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The Predictive Machine Learning Model Towards Effect of Human Resources Management Practices and Job Performances Among Academic Librarians in Malaysia

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ABSTRACT

Job performance is a vital component of organizational success, directly impacting productivity, efficiency, and overall workplace effectiveness. For academic librarians, job performance is especially crucial in delivering high-quality library services, supporting academic programs, and fostering a conducive learning environment. However, there is a lack of literature on job performance in the context of academic librarianship in Malaysia. By conducting a thorough literature review and utilizing empirical research, this study aims to provide insights into the factors influencing job performance and strategies to enhance the job performance of academic librarians. In addition, the target population was the entire librarian's public university libraries in Malaysia with 20 public university libraries involved. Primary data for 287 respondents of academic library was analysing using multiple linear regression analysis (MLR). The software used for analysing is Statistical Package for the Social Sciences (SPSS). In a conclusion, the findings of this study found many factors contribute to job performance of academic library. This study provides recommendations to ultimately improving job performance among academic librarians in Malaysia.

1. Introduction

Malaysia's government is working to improve the nation's literacy rate, with a target of reaching 95.71% in 2021. Libraries play a crucial role in promoting national literacy efforts and quality education by providing access to knowledge, facilitating research, encouraging literacy, creating a favorable learning atmosphere, and advocating for continuous learning among students and educators [1]. Libraries also support inclusivity and diversity, providing free and open access to information regardless of age, race, gender, or socioeconomic status. They serve as hubs for research,

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offering access to scholarly journals and databases, and fostering literacy through reading habits and information literacy skills. Libraries can create an environment that welcomes all individuals, including those with disabilities, by designing buildings to be accessible public spaces. In today's age of information overload, librarians play a vital role in incorporating digital technologies and teaching students how to make sense of information [2]. They are known for their customer-service skills, helping students find resources and navigate library digital tools. However, librarians may not always be recognized as academic partners and may be undervalued by some administrators and faculty members. Libraries in Malaysia play a vital role in promoting national literacy, inclusivity, and diversity, while also being essential assets to the library itself. By adapting to changing needs and implementing new technologies, libraries can contribute to a more inclusive and competitive society [3].

In Malaysia, job performance among academic librarians is generally declining, with a study showing that 20 (57.1%) of library professionals have average job performance in university libraries in Varanasi, 14.3% have low job performance, and 28.6% have high job performance. HRM practices play a crucial role in improving job performance, but research on the connection between HRM practices and job performance in the context of academic librarianship in Malaysia is lacking [4]. A study by [5] found that libraries in Pakistan were underperforming due to lack of control over scheduling of workhours, which could affect worker behaviour and performance. Additionally, negative consequences from student dissatisfaction significantly influence university brand image.

Academic librarians face unique job demands and challenges that require specialized human resource management practices that are not well understood or recognized. Challenges such as inadequate funding, lack of support, and insufficient training opportunities can negatively impact their job performance [6]. The Covid-19 pandemic has further complicated these challenges, with librarians facing increased workloads, decreased social interaction, and difficulties in adapting to new technologies. Prior research on human resource management practices and job performance has tended to focus on public libraries or non-academic public sector organizations, making it unclear to what extent these findings can be applied to academic libraries in Malaysia [7]. Other factors such as individual motivation, job satisfaction, and organizational culture also play a role in shaping job performance outcomes [8]. There is a need for longitudinal studies to examine the relationships between human resource management practices and job performance over time, as short-term studies may not capture the full impact of these practices in academic libraries Malaysia [9].

This study aims to explore the relationship between human resources management practices and job performance among academic librarians in Malaysia. The research will involve a survey of 20 public university libraries in Malaysia, examining their perceptions of HRM practices such as selection, recruitment, performance evaluation, and training and development among librarians. The study will contribute to improving academic studies and gaining new knowledge in the library management and human resources management field [10].

The relationship between HRM practices and job performance in various industries, including academic librarianship, has been the subject of numerous international studies. Studies have shown a positive correlation between employee performance and appraisal, and a substantial link between training and employee performance [11]. Effective HRMPs and continuous professional development (CPD) programs are needed to address these challenges and improve job performance [12].

However, the previous researcher still uses inferential statistical modeling to analyze regarding the effect of academic librarian job performance. Many researchers for carrying out the inferential analysis have been approach. Familiar methods such as descriptive analysis, normality test, correlation analysis is defined in terms of a finite number of parameters that are estimated from the

data [13]. A part of that, linear regression is one of the models is suitable for prediction that used in this study.

The performance of regression analysis results depends on the form of the data generating process and how it relates to the regression approach being used. Since the data generating process is generally good or no missing values, the process or results regression analysis on making assumptions will be acceptable. These assumptions are sometimes testable if a sufficient quantity of data is available. Regression models for prediction are often useful even when the assumptions are moderately violated, although they may not perform optimally. However, this may happen in many applications, especially with small effects or questions of causality based on observational data.

Multiple linear regression as a linear model should fulfill the assumptions before proceeding with the analysis. The assumptions are made as constant variance, normality distributed and multicollinearity. Thereafter, analysis will be applied by finding the significant variables, mean square error, root mean square error, mean absolute error and mean absolute percentage error. The significant variables are important to identify the effects to provide an information job performance prediction. Moreover, multiple linear regression is the best model on mean square error (MSE) to produce the best prediction toward the effect of job performance in Malaysia.

2. Relevant Literature and Research Approach

In Malaysia, academic librarians play a critical role in supporting research, teaching, and learning within higher education institutions. Their job performance is influenced by various factors that impact their effectiveness and contributions to organizational goals. This review explores key elements affecting job performance among academic librarians, training and development, performance appraisal and selection and recruitment [14].

2.1 Training and Development

Developing oneself and receiving training are essential to improving academic librarians' work performance. Address the different demands of their academic communities, librarians must continuously learn as information landscapes and technology breakthroughs change the nature of library services. This study of the literature looks at the value of training and development initiatives, how they affect librarian performance, and industry best practices [15].

Programmed for training and development are essential for giving academic librarians the abilities and information need to succeed in their positions. In order to improve librarians' competencies in information literacy instruction, research support, digital resource management, and emerging technologies, these programmed include a variety of activities such as workshops, seminars, certifications, and on-the-job training [5].

By giving academic librarians, the abilities to address changing customer needs and technical obstacles, training and development programmed are crucial to improving their performance on the job. Academic Libraries can cultivate a culture of perpetual learning and innovation by allocating resources towards strategic goals-aligned and librarian-responsive training activities [2].

2.2 Performance Appraisal

One important instrument for assessing and improving academic librarians' work performance is performance appraisal. It offers insightful criticism on librarians' accomplishments, points out areas in need of development, and synchronizes individual output with corporate objectives [16]. The main

components of performance appraisal systems are examined in this research review along with their effects on academic librarians' work performance.

Academic libraries use performance appraisal for a variety of reasons. It gives librarians an organized framework for getting feedback on how they perform at work, setting goals for their own professional growth, and strengthening their contributions to the missions of their institutions [17]. Efficient tools for evaluating employee performance not only evaluate past performance but also help librarians advance their careers in the future [18].

Performance appraisal is a critical component of managing and enhancing the job performance of academic librarians. By adopting effective appraisal systems that emphasize goal alignment, feedback mechanisms, professional development, fairness, and transparency, libraries can foster a culture of continuous improvement and support librarian excellence [19]. Future research should explore innovative approaches to performance appraisal tailored to the evolving roles and responsibilities of academic librarians in digital and globalized higher education environments [20].

2.3 Selection and Recruitment

The identification and attraction of competent individuals who can make valuable contributions to the objectives and mission of academic libraries depends heavily on the selection and recruitment processes [21]. Within universities, academic librarians are essential to the support of teaching, learning, and research activities. The significance of efficient recruiting and selection procedures, their effect on librarian job performance, and methods for streamlining these procedures in academic library environments are all included in this review of the literature [22].

Selection and recruitment processes are foundational in building a skilled and motivated workforce of academic librarians [2]. Effective hiring practices ensure that libraries attract candidates who possess the requisite knowledge, skills, and attributes to thrive in their roles. Moreover, strategic recruitment efforts contribute to diversity, equity, and inclusion within library teams, fostering innovation and excellence [23].

In academic libraries, recruitment and selection processes play a significant role in determining how well librarians perform in their roles. Libraries may recruit and retain exceptional librarians who make major contributions to the success of the institution and the academic performance of students by putting in place efficient procedures that place a high value on alignment with institutional goals, transparency, diversity, and chances for professional advancement [24].

3. Methodology

3.1 Materials

The unit of analysis refers to the level of integration of data obtained during the data analysis process. There are four types of units of analysis, which are individuals, groups, organizations, and social artefacts and social interactions [25]. The unit of analysis in this study is the individual, which are academic librarian in 20 public university libraries in Malaysia. The study focuses on the human resources management practices and job performances among librarians in these academic university libraries (IPTA), Malaysia. The target respondents will be librarian's employee works in public academic university libraries in Malaysia as in Table 1.

This research design aims to connect conceptual research problems to relevant academic research, integrating the researcher's ideas and providing a rational foundation for data collection, processing, and evaluation. A quantitative approach will be employed to identify variables related to human resources management practices and job performance of librarians. The study population

consists of employees in 20 public university libraries in Malaysia, using a questionnaire survey to gather statistically useful information from librarians.

Table 1
Sample size of academic libraries in Malaysia

Bil	University	Academic Librarian	Response	Percentage
1	UTHM	17	14	82%
2	UTM	30	30	100%
3	UMT	18	11	61%
4	UPSI	15	7	46%
5	UMPSA	13	7	53%
6	UMK	7	3	42%
7	UNISZA	12	6	50%
8	UPM	35	19	54%
9	IUM	39	32	82%
10	UUM	25	15	60%
11	UiTM	43	24	55%
12	UM	28	21	75%
13	UKM	35	29	82%
14	USM	31	16	51%
15	UMS	20	10	50%
16	UNIMAS	6	5	83%
17	USIM	17	11	64%
18	UTeM	17	10	58%
19	UPNM	8	3	37.5%
20	UNIMAP	14	14	100%
Total		430	287	100%

The questionnaire will be distributed to librarians in public universities, allowing for large amounts of information to be collected in a minimal period and being cost-effective. Primary data will be collected through Google Form, and the data will be analyzed using the IBM Statistical Package for Social Sciences (SPSS). SPSS offers a range of statistical techniques, including descriptive statistics, correlation analysis, regression analysis, factor analysis, and others. Its user-friendly interface makes it easy for researchers to input data, perform statistical analyses, and interpret results.

In this study on the impact of HRMPs on job performance in libraries, SPSS can be used to analyze the data collected through questionnaires or surveys. The software can compute descriptive statistics, such as means, standard deviations, and frequencies, and conduct inferential statistics, such as ANOVA, to test for significant differences between groups or variables. Overall, SPSS provides researchers with a powerful tool to identify patterns, trends, and relationships between variables in their research.

3.2 Multiple Linear Regression

Regression analysis was developed by Sir Francis Galton in the 19th century. Galton studied the relation between heights of parents and children and he noted that the heights of children of both tall and short parents were appeared to “revert” or “regress” to the mean group. He considered this tendency to be a regression to “mediocrity”. He developed a mathematical description of this regression tendency. The term regression describes statistical relations between variables [26].

Most statistical tests rely upon certain assumptions about the variables used in the analysis. Prior to developing a regression model, it is necessary to ensure that the model meets the assumptions [27]. The following are the assumptions underlying the multiple linear regression model [28]:

- i. The population mean of y within the level of patient's population was defined by the x 's follows a linear and additive pattern.
- ii. The y observations were assumed to be statistically independent.
- iii. The standard deviation of y within particular x -strata was constant over all values of x .
- iv. The distribution of y within x -strata was normal.

Assumptions of multiple linear regression as (i), (ii), (iii) and (iv) as stated above should be fulfilled before using the data for analysis. This study applied three assumptions: constant variance, normality and multicollinearity. When these assumptions meet, the results will be trustworthy. Few articles reported that they rely on the tested assumptions of the statistical test to draw their conclusions [29].

The errors have constant variance, with the residuals scattered randomly around zero. For instance, the residuals increase or decrease with the fitted values in a pattern, the errors may not have constant variance.

To ensure that the data are normally distributed, the residual analysis was utilised. The plot used to check is residual versus predicted value. Additionally, there are additional plots that can be used to determine the normality of data, including the quartile-quartile plot (QQ-plot) or the probability-probability plot (PP-plot). If the plot does not show any pattern or shape such as U-shape or S-shape, and instead appears randomly scattered, the data are normally distributed.

Multicollinearity diagnostic should be done to the data to avoid dependency among independent variables. The test used is variation inflation factor (VIF). A serious multicollinearity problem exists if the VIF more than 10. If the value of VIF is below than 10, then the multicollinearity checking is satisfied [30]. Multiple linear regression has several predictor variables such as first order with two predictor variables and first order with more than two variables. The multiple linear regression model can be stated as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \varepsilon \quad (1)$$

where:

$\beta_0, \beta_1, \dots, \beta_j$ are constants

X_{j1}, \dots, X_{ij} are unknown parameter/ independent variable

$i = 1, \dots, n$.

In matrix terms, the following matrices should be defined:

$$Y = X\beta + \varepsilon \quad (2)$$

$$Y = \begin{bmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_n \end{bmatrix} \quad X = \begin{bmatrix} 1 & X_{11} & X_{12} \\ 1 & X_{21} & X_{22} \\ \vdots & \vdots & \vdots \\ \cdot & \cdot & \cdot \\ 1 & X_{n1} & X_{n2} \end{bmatrix}$$

$$Y = \begin{bmatrix} \beta_0 \\ \beta_1 \\ \vdots \\ \beta_n \end{bmatrix} \quad \varepsilon = \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_n \end{bmatrix}$$

where Y is a vector of responses, β is a vector of constants, X is matrix parameters and ε is a vector of independent normal random variables.

Analysis of variance contained three sums of square and mean square which are sums of regression (SSR), sums of error (SSE) and sums of total (SST). The sums of squares for the analysis of variance in matrix terms are [31]:

$$SSR = bX'Y - \left(\frac{1}{n}\right)Y'JY \tag{3}$$

$$SSE = (Y - Xb)' (Y - Xb) \tag{4}$$

$$SST = Y'Y - \left(\frac{1}{n}\right)Y'JY \tag{5}$$

where J is a nxn matrix.

Furthermore, the degree of freedom for sum of squares was different. The degrees of freedom for SSR were $p-1$ which means p was the amount of predictor variables or amount of parameter. SSE has $n-p$ degrees of freedom associated with, where n represented the number or the respondents in the study. Finally, SST as usual has $n-1$ degrees of freedom associated with [32].

The equation analysis of variance (ANOVA) as well as mean square regression (MSR) and mean square error (MSE). MSE is a risk function, corresponding to the expected value of the square error loss or quadratic loss. MSE measures the average of the squares of the "errors." The error is the amount by which the value implied by the estimator differs from the quantity to be estimated [33]. The difference occurs because of randomness or because the estimator doesn't account for information that could produce the more accurate estimation. The table 2 shows a summary of analysis of variance (ANOVA). The following are the equations:

$$MSR = \frac{SSR}{p-1} \tag{6}$$

$$MSE = \frac{SSE}{n-p} \tag{7}$$

Table 2
 Summary of ANOVA

Source of Variation	SS	Df	MS
Regression	$SSR = b X'Y - (1/n)Y'JY$	$p- 1$	$MSR = SSR / p-1$
Error	$SSE = (Y- Xb)' (Y- Xb)$	$n- p$	$MSE = SSE / n-p$
Total	$SST = Y'Y -(1/n) Y'JY$	$n- 1$	

4. Results

4.1 Assumption of Prediction Machine Learning Model

4.1.1 Normality of distribution

In order to detect the assumption and ascertain whether the shape or trend follows the normal distribution, the normality test in this study employed a Q-Q plot by the academic librarian's work performance variable (dependent variable). Q-Q plot result displays the normalcy of the predictors as a straight line. Additionally, the Q-Q plot demonstrated the predictors in both positive and

negative conditions. Both numbers satisfied the normality. The findings are displayed in Figure 1 and 2.

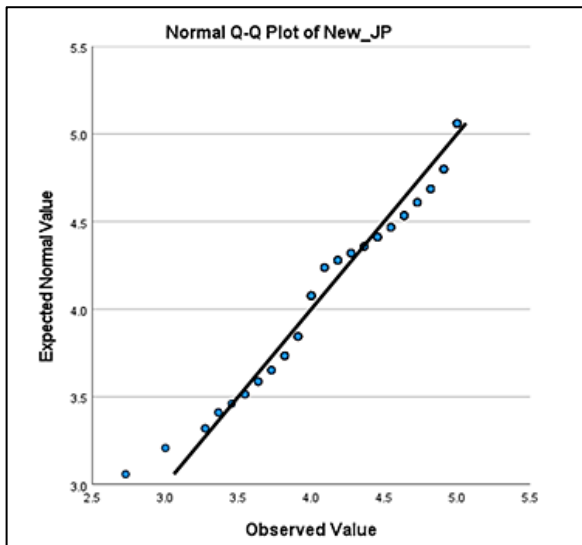


Fig. 1. Q-Q plot normality

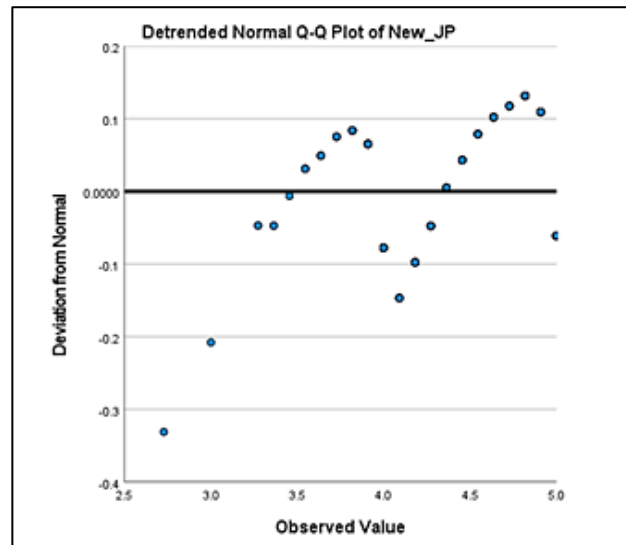


Fig. 2. Positive and negative Q-Q plot

4.1.2 The variance of residuals

SPSS software was utilised to compute the residual variance. To determine the residual's condition variance, a scatter plot was employed. It appears that there is no pattern to the dots on Figure 3, which suggests that the error terms have a zero mean. It may be inferred from this figure that the error terms' variance is constant. This assumption is met. Figure 3 and Table 3 display the outcome.

4.1.3 Multicollinearity checking

Table 4 shows that all tolerance values are less than 0.99, all VIF values are less than 10, and the eigen values are decreasing from the highest value to the lowest value. The condition index has a value of 23.751, which is below 1000. This demonstrated that the multicollinearity condition was met and that there were no significant correlations between any of the independent variables.

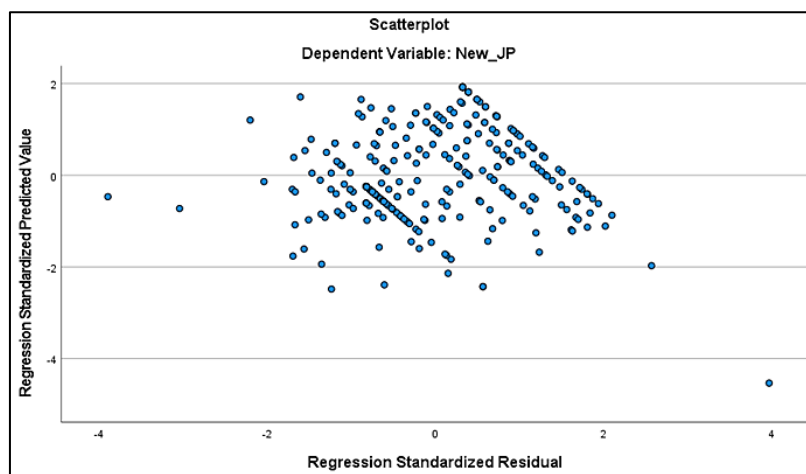


Fig. 3. Scatter plot of variance of residuals

Table 3

Residual statistic

Residuals statistics					
	Minimum	Maximum	Mean	Std. deviation	N
Predicted Value	3.233	4.870	4.378	0.256	287
Residual	-1.533	1.585	0.000	0.391	287
Std. Predicted Value	-4.459	1.916	0.000	1.000	287
Std. Residual	-3.903	4.304	0.000	0.995	287

Table 4

Coefficients of tolerance values and eigen values and explanation variances for data

	Tolerance	VIF	Eigen value	Condition index
Constant			3.974	1.000
Training and development	0.568	1.762	0.010	19.604
Performances appraisal	0.614	1.630	0.008	22.114
Selection and recruitment	0.634	1.577	0.007	23.751

4.2 Multiple Linear Regression

Multiple linear regression is one common model used by researcher, especially in human resources. This model is used to study and analysis three predictor variables and also to predict the high effect pf HRMP towards librarian’s job performances. After the analysis was done, only two predictor variables were significant. The variables that were significance are training and development and selection and recruitment. The significant variables were measured by p - value which is less than 0.05 as in Table 5.

Table 5

Summary of parameter estimation multiple linear regression model

Independent variables	Beta (β)	Significant value
(Constant)	2.099	*0.001
Training and development	0.233	*0.001
Performances appraisal	0.082	0.138
Selection and recruitment	0.239	*0.001

*Significant at 0.05

All the significant variables influence the librarian’s job performances effects. The estimated multiple linear regression model for factors of librarian’s job performances model is as follow:

$$\hat{Y} = 2.099 + 0.233 \text{ training and development} + 0.239 \text{ selection and recruitment}$$

4.3 Analysis of Variance (ANOVA)

The purpose of analysis of variance (ANOVA) is to assess significant values and obtain information about the mean within a regression model. The error term with mean square is 0.154. The null hypothesis is strongly refuted by the F test statistic's p-value, which is less than 0.05, or 0.001. The multiple linear regression ANOVA result is displayed in Table 6.

Table 6
ANOVA for multiple linear regression

Sources	Sum of squares	Df	Mean square	F-value	P-value
Regression	18.871	3	6.290	40.723	0.001
Residual	43.713	283	0.154		
Total	62.584	286			

5. Conclusions

This study investigated the relationship between human resource management (HRM) practices and the job performance of academic librarians in public university libraries in Malaysia. The research focused on three key HRM practices: training and development, performance appraisal, and selection and recruitment, aiming to provide insights for enhancing the effectiveness of HRM strategies in this specific context.

The findings underscored the significant impact of strategic HRM practices on job performance among academic librarians. Firstly, effective training and development programs were found to be positively associated with job performance, highlighting the importance of ongoing skill enhancement and professional growth opportunities within academic library settings.

Secondly, well-designed performance appraisal systems showed a significant relationship with job performance. This suggests that structured evaluation processes contribute to clearer expectations, performance feedback, and career development paths, thereby enhancing motivation and productivity among academic librarians.

Thirdly, robust selection and recruitment practices were also found to influence job performance positively. This emphasizes the critical role of effective hiring processes in attracting and retaining talented individuals who align with the organizational goals and culture of academic libraries.

The study employed a quantitative approach with a sample size of 287 academic librarians from 20 public university libraries in Malaysia, using a 5-point Likert scale questionnaire for data collection. Reliability analysis indicated strong internal consistency among both the dependent variable (job performance) and independent variables (HRM practices).

In conclusion, the research contributes valuable insights for library administrators and policymakers in shaping HRM strategies tailored to the needs of academic librarians. By emphasizing the implementation of effective HRM practices such as training and development, performance appraisal, and selection and recruitment, academic libraries can foster a conducive work environment that supports continuous professional growth and enhances overall job performance among their librarians. Future studies could explore additional factors influencing job performance or investigate the long-term impacts of HRM interventions on organizational outcomes within academic libraries.

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