

## Components Analysis Examination for Identifying Stronger Variables Related to Users' Satisfaction in Research Data Management Systems of Subject-Related Libraries in Colombo District, Sri Lanka

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**Abstract:** *Back ground of the study:* Research data can be identified in various formats. Research data management is a process for managing research data. Component analysis is a method for reducing many variables into a few. Most of studies have discussed factors affecting to user satisfaction-related information resources and services and. IT infrastructure. The study is based on the identification of a correlation between stronger variables and stronger components.

**Purposes of the study:** The objectives of the study were to identify stronger components related to research data management systems and identify stronger variables in components related to research data management systems. To identify users' satisfaction levels with research data management systems.

**Methodology:** The study used six subject-related libraries in Colombo district, Sri Lanka. The sample size was 368, and a printed, structured questionnaire was distributed to registered library users. But 293 registered users responded (79%). The time horizon was cross-sectional. The approach is an inductive approach. The survey uses a quantitative method. Realism has defined philosophy. A statistical package for social science software is used. SPSS.

**Results:** The study identified four stronger components and variables related to those components. The results revealed that the components and the variables have significant relationships, and the identified stronger components have been correlated.

**Implication** Further study results suggest that the analyzed variables have an impact on user satisfaction and can be used to explore research data management services.

**Keywords:** Research data, Satisfaction, Components, Data Management.

### 1. Introduction

Any information that has been gathered, discovered, produced, or developed to validate original study findings is referred to as research data. Research data can be structured or displayed in ways that facilitate communication, interpretation, and processing. Data is available in a variety of formats, both digital and physical (University of South Australia, 2023). Research data management refers to the process of organizing and storing information that results from an investigation in the most efficient manner feasible. It organizes data obtained over the course of the study endeavor by developing similar norms. It is also in

charge of data exchange, access, conservation, and safe disposal, making it an essential component of various sorts of resource management.(Research.com ,2023).

### 1.2 Component analysis

Factor analysis is a statistical technique that expands a large number of factors into a smaller number of components through eliminating all of their similarities. It is also known as data reduction (TIMBC,2023).

### 1.3 Research Objectives

1. To identify stronger Components related to research data management systems
2. To identify stronger variables in Components related to research data management systems.
3. To identify users' satisfaction levels of. research data management systems.

### 1.4 Research Questions

1. What are the stronger Components related to research data management systems?
2. What are the stronger Component and variables related to research data management systems?
3. What is the users' satisfaction level of stronger Component and variables in using RDMS?

### 1.5 Research Hypothesis

**1.H<sub>0</sub>:** There is no significant relationship between the gender of the respondents and users' satisfaction with the available research data.

**H<sub>1</sub>:** There is a significant difference relationship between the gender of the respondents and users' satisfaction with the available research data.

**2.H<sub>0</sub>:** There is no significant difference in the relationship between the age of the respondents and satisfaction with the available research data.

**H<sub>1</sub>:** There is a significant difference relationship between the gender of the respondents and satisfaction with the available research data

### 1.6 Significant of the Study

The study will be focused on factors affecting RDMS when users use the library for their research needs. The identified factors will be valuable tools for identifying the level of user satisfaction. The study identified stronger variables related to users' satisfaction with research management systems. The identified dependent and independent variables will be measured through the survey. The primary three aspects of the study will be determined. Users' technical skills, IT literacy, and use of the available IT infrastructure are identified. The considerations will center on certain defense variables. The landscape of data storage and analytics options is becoming more complicated as research demands it.

### 1.7 Literature Review

Most of existing literature have discussed about descriptive analysis of factors related to users' satisfaction. Special Libraries have faced more challenges in purchasing information resources and resource management. The study of Khan et al. (2022) has implemented a survey for libraries that confront significant service challenges. Some challenges are linked to information resource management, including direct information availability for immediate decision-making. The Internet of Things (IoT) is a recent technological shift that library personnel should be aware of because it can potentially enhance information resource management. The research aims to highlight the willingness to adopt IoT technology in libraries. The study highlights the various success factors supporting the adoption of IoT services. It is

concluded that robust management practices and effective utilization of technological resources must back IoT-augmented services in academic libraries. Many libraries have made substantial modifications to their structure in terms of technology and design to satisfy the demands of patrons. Another reason is the academic library environment, Joo & Schmidt. (2021) have investigated the perceptions of academic librarians on research data services (RDS) in academic library environments. The study found that in delivering RDS, academic librarians assumed that consultation services would be more helpful to users than technical services. As a result, skills linked with consultation services, such as instructional skills and data management planning, were deemed more valuable by participants. According to the findings, academic libraries must pursue collaborative opportunities with other campus units to create and deliver RDS, particularly technological services.

The study of on factors affecting to users' willingness to participate in the smart services of academic libraries by Yuan.J and Yang.N( 2023) discussed the construct a conceptual model with 17 hypotheses based on the Uses and Gratifications theory, Social Cognition Theory, Innovation Diffusion Theory, and Information Systems Success Model, the paper analyzes the variables influencing college users' willingness to participate in library smart services. Through the use of questionnaire survey data and the structural equation modeling technique, the conceptual model was empirically tested. Using a random selection technique, the questionnaire was delivered online to instructors and college students in various Chinese provinces. Users' information needs, innovation awareness, platform performance, user contentment, library advertising and guidance, and extrinsic incentives all have a direct and positive impact on users' willingness to engage in academic libraries' smart services. Information quality, service quality, service platform performance, and service value

### 1.8 Research Design

There are 1,500 registered users across all six libraries., According to Krejcie and Morgan Table (1970), the calculation sample was 306 (confidence level, 95%). 20% was added as a margin of error. As a result, the calculation sample was 368. The Table 3.1 describes the Target Population. The study used six libraries. According to the Directory of Libraries (2015), Around 120 Special Libraries are in Sri Lanka. In the Colombo district, approximately 95 libraries were established. However, most subject-specific libraries have branch libraries outside of the Colombo district of Sri Lanka, and most libraries include only subject-related material rather than research collections. As a result, the study has chosen six research-related institute-registered library users as responders. Only six libraries in the Colombo District have Research Data Management systems.

The approach is an Inductive approach. The study has found the User satisfaction level of subject-specific library users when users use available research data management Systems. Realism has defined philosophy. The probability sampling method was applied for the data collection, and the technique was stratified sampling methods. Stratified sampling gives higher population coverage. Therefore, the study is used with some homogeneous groups of registered library users. The registered library users are directors, assistant directors, research officers, lab assistants, medical laboratory technologists, scientific professionals, lecturers, and students. The studied data was analyzed using the Statistical Package for the Social Sciences (SPSS) software for quantitative data analysis. A printed Questionnaire was distributed among 368 subjects in related registered library users in six related Libraries. However, 293 (79%) respondents were answered out of 368. Quantitative: The questionnaire was created with quantitative data and Qualitative data. The Method was the Survey method, and the Methodology was the mixed method. A cross-sectional study was used for the Study

## 2. Data analysis

### 2.1 Gender of the Respondents

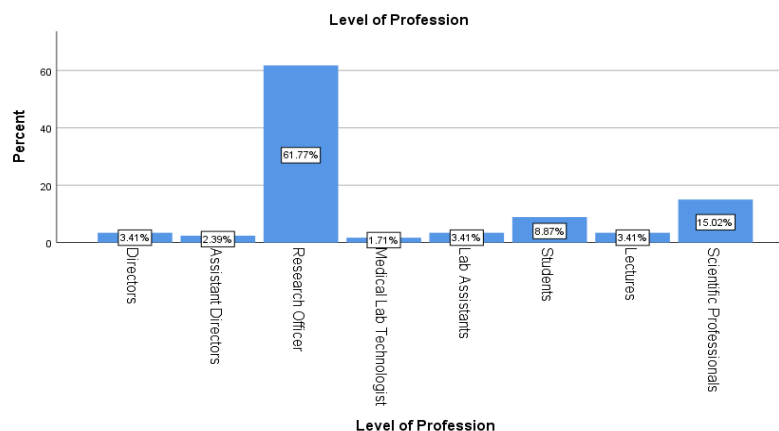
Most of the existing literature has discussed demographic factors such as age, gender, and profession or category of Education. Therefore, the study is focused on four main demographic factors. The mean of the responses, the analysis of gender is highlighted in Table 1.1. Male answers comprise 40.6% of the total, while females are 59.4%. Therefore, the total response rate can be considered as 293 out of 368 (79%).

**Table 1.1 Gender of the Respondents**

Gender of respondents					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	119	40.6	40.6	40.6
	Female	174	59.4	59.4	100.0
	Total	293	100.0	100.0	

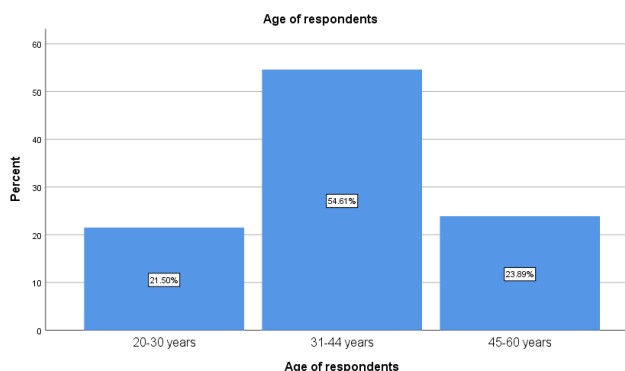
### 2.2 Distribution of levels of profession

According to Figure 1.1, the distribution of respondents by professions such as Scientific professionals, Directors, Assistant directors, Research officers, Lab assistants, Medical lab technicians, and Students. The majority of professionals are research officers (61.77%).



**Figure 1.1 Distribution of levels of profession**

Figure 1.2 shows the Frequency distribution of the age of respondents.



**Figure 1.2 Distribution of levels of profession**

## 2.4 Total Variation Explained of User Satisfaction Level

The following table 1.1 shows the Eigenvalues associated with each factor before and after extraction and rotation. Before extraction, SPSS has identified 12 components within the data set. The Eigenvalues associated with each element represent the variation explained by the particular component, and SPSS also displays the Eigenvalues in terms of the percentage of variance explained. Below Table, the total variation is described in initial eigenvalues and extracted sums of squared loadings for analysis and interpretation purposes. The presence of eigenvalues more significant than one is necessary to determine how many components or factors are expressed by a specific set of variables. According to the Table below, the values for the first component are  $4.247 > 1$ . The second component is  $1.207 > 1$ , the third is  $1.097 > 1$ , and the fourth is  $1.008 > 1$ . As a result, the nine variables listed above represent 30 components. Also, the extracted sum of squared holdings of variance shows that the first factor accounts for 21.501% of the variance features from the stated data, followed by the second factor (10.718%) and the third factor (8.318%). The above three components effectively represent all the components highlighted by the stated 30 variables. When considering ten components, the eigenvalues have a total variation of 60%. The other six components of Eigenvalues express only 40%. Finally, the results could be concluded as four components of the Eigenvalues expression being more significant than the ten components of the Table.

**Table 1.2 Total Variance Explained**

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	.247	35.390	35.390	4.247	35.390	35.390	.970	24.748	24.748
2	1.207	10.061	45.451	1.207	10.061	45.451	2.102	17.518	42.265
3	1.097	9.139	54.589	1.097	9.139	54.589	1.429	11.911	54.177
4	1.008	8.397	62.987	1.008	8.397	62.987	1.057	8.810	62.987
5	.930	7.748	70.735						
6	.785	6.543	77.278						
7	.641	5.341	82.619						
8	.614	5.115	87.735						
9	.514	4.284	92.019						
10	.397	3.307	95.325						
11	.330	2.748	98.074						
12	.231	1.926	100.000						
Extraction Method: Principal Component Analysis.									

## 2.5 Commonalities

The following item in the output is a table of commonalities, which shows how much of the variance (i.e., the communality value, which should be greater than 0.5 to be considered for further analysis) is due to commonalities. Otherwise, these variables would be excluded from subsequent factor analysis procedures. The retrieved factors have accounted for the variation in the variables. According to Table 4.5, the following 12 components of the extraction value are more significant than 0.5, which is considered for analysis. As a first component of library opening hours, the extraction value is 0.604. The value for the second satisfaction level of research data extraction is 0.601. The extraction value's third component of satisfaction with workshop and training facilities is 0.537. The fourth component is the satisfaction of bibliography data. The extraction value is 0.668. The next one is the satisfaction of the indexing system;

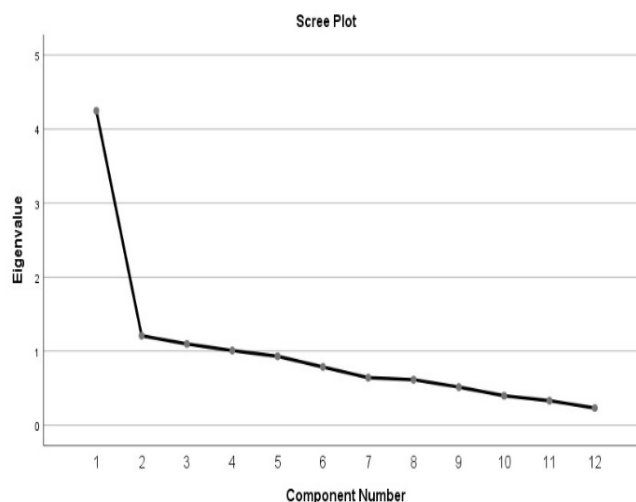
the extraction value is 0.726. Therefore, when all other extraction values are more significant than 0.5, they are valid and can be considered for further analysis.

**Table 1.3. Total Variance Explained**

Communalities			
	Initial		Extraction
Satisfaction of Library opening hours		1.000	.604
Satisfaction of available research data		1.000	.601
Satisfaction of workshop and training facilities		1.000	.537
Satisfaction of Bibliography data		1.000	.668
Satisfaction of Indexing system		1.000	.726
Satisfaction of eBooks facilities		1.000	.585
Satisfaction of available research publications		1.000	.680
Satisfaction of available Abstract books		1.000	.681
Order of available updated journals		1.000	.639
Available official research publications		1.000	.476
Abstract Books for Study		1.000	.764
Available Bookshelf arrangements		1.000	.600
Extraction Method: Principal Component Analysis.			

#### 1.4 The Screen Plot of Factor Analysis

The eigenvalues are graphed against each of the components in the scree plot. The graph can be used to decide how many features to keep. When the curve begins to flatten, it is where there is interest). According to the Figure 1.1, It can be seen that the curve begins to flatten 2 to 4. Therefore, factor 6 onwards has an eigenvalue of less than 1. As a result, only four elements have been retained.



**Figure 1.3 The Screen Plot of Factor Analysis**

#### 2.3 Component Matrix

The loadings (extracted values of each item under four variables) of the 12 variables on the four extracted factors are shown in Table 4.6. There are four extracted variables from the 12 items, dividing them into four variables based on the most relevant items, which have identical replies in component 1 can be called as F1 extracted factor loadings are 0.766, 0.764, 0.759, 0.732, 0.666, 0.575, 0.518, 0.524, 0.528 and



simultaneously, element two can be identified as F2. The reflected component loadings are 0.626, 0.552. In F3, extracted factor loadings are 0.568, 0.539. In F4, reflected components loadings are 0.780. The table's gap (empty spaces) demonstrates loadings smaller than 0.5. This makes reading the table easier. Any loadings less than 0.5 were suppressed.

**Table 1.4 Component Matrix**

Component Matrix				
	Component			
	1	2	3	4
Satisfaction of Bibliography data	.766			
Satisfaction of Indexing system	.764			
Satisfaction of available research publications	.759			
Satisfaction of eBooks facilities	.732			
Satisfaction of Library opening hours	.666			
Satisfaction of workshop and training facilities	.575			
Available official research publications	.518			
Satisfaction of available Abstract books	.524	.626		
Satisfaction of available research data	.528	.552		
Order of available updated journals	.533		.568	
Available Bookshelf arrangements			.539	
Abstract Books for Study				.780
Extraction Method: Principal Component Analysis.				
a. four components extracted.				

## 2.4 Rotated Component Matrix

The rotated component matrix can be said to contain the correlations between items and components or factors. The rotated factor loading is as follows:

**Table 1.5 Rotated Component Matrix**

Rotated Component Matrix				
	Component			
	1	2	3	4
Satisfaction of Indexing system	.791			
Satisfaction of Library opening hours	.751			
Satisfaction of available research publications	.739			
Satisfaction of eBooks facilities	.673			
Satisfaction of available Abstract books	.591			
Satisfaction of available research data		.736		
Satisfaction of workshop and training facilities		.685		
Satisfaction of Bibliography data	.554	.599		
Available Bookshelf arrangements			.742	
Ordering of available updated journals		.537	.555	

Available official research publications				
Abstract Books for Study				.871
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.				
a. Rotation converged in 10 iterations.				

## 2.5 The following Table is identified after the rotation of the component Matrix

The first factor can be named F1. F1 is displayed with 12 variables. The variables are related to the user satisfaction level of research data management systems. The first component includes bibliography data satisfaction; the Matrix's rotated component is 0.791. The second component is satisfaction with library opening hours. The third component is satisfaction with available research publications. The rotated component of the matrix is 0.739. The fourth component of the matrix is satisfaction with e-book facilities. The rotated component of the matrix is 0.673. The fifth is contentment with the available abstract books. The rotated component of the matrix is 0.591. Another factor is the satisfaction of the bibliography data. The rotated component of the matrix is 0.599. The gap between other variables (empty spaces) can be identified as less than 0.5. When it comes to F2, there are three rotated component matrices. F2 is considered the third rotating component of the matrix. The first one is satisfaction with the available research data. The table of 4.7 is indicated as six. The rotated component of the matrix is 0.736. Number 7 is another indicated factor. The rotated component of the matrix is 0.685. The following number is ten. The component is satisfaction with the ordering of available, updated journals. The rotated component of the matrix is 0.5. There is only one component in F3 that is available through shelf arrangements. The matrix's rotated component is 0.742. F4 is also one of the components. That is an abstract book for study. The rotated component of the matrix is 0.871.

**Table 1.6 Rotated Component Matrix**

Components	F1	F2	F3	F4
Satisfaction of Indexing system	0.791			
Satisfaction of Library opening hours	0.751			
Satisfaction of available research publications	0.739			
Satisfaction of eBooks facilities	0.673			
Satisfaction of available Abstract books	0.591			
Satisfaction of available research data		0.736		
Satisfaction of workshop and training facilities		0.685		
Satisfaction of Bibliography data	0.599			
Available Bookshelf arrangements			0.742	
Ordering of available updated journals		0.555		
Abstract Books for Study				0.871

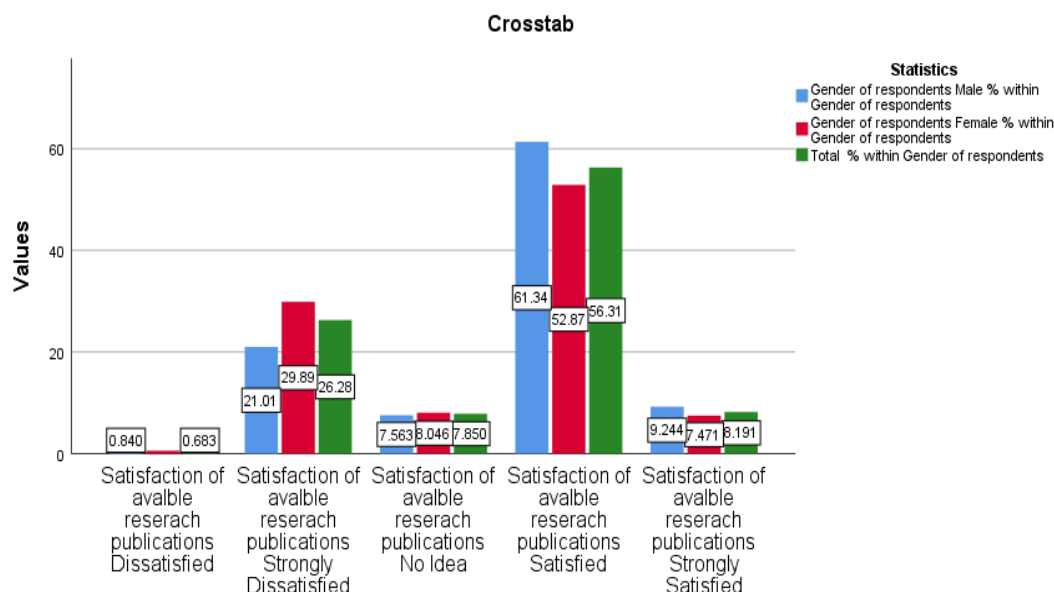
## 3. Descriptive analysis of stronger variables in F1 Component

Descriptive analysis data is obtained by using bar charts or tables related to the visualized results. Here, the data were identified as the stronger variables by using bar charts and tables with SPSS techniques to describe user satisfaction levels. There are four components identified, and the following variables are described in relation to these components, which indicate users' satisfaction levels.

### 3.1 F1 Component analysis-satisfaction of available research data



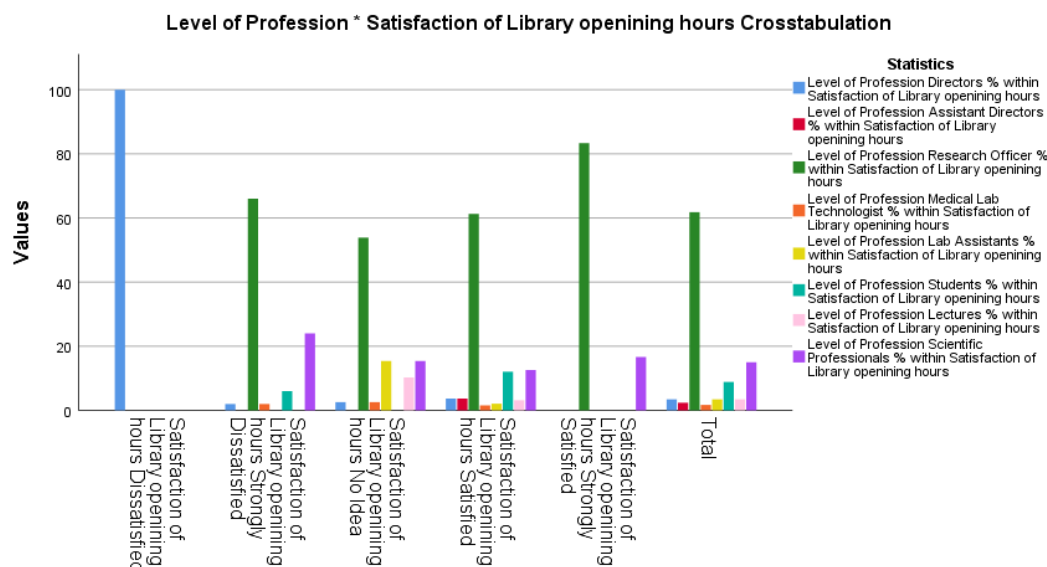
According to Figure 4.1, most male users satisfied the available research data more than female users. As Figure 4.1 shows, 56.31% of the total gender of the respondents were satisfied.



**Figure 1.4 satisfaction of available research**

### 3.2 F1 Component analysis-satisfaction of library opening hours

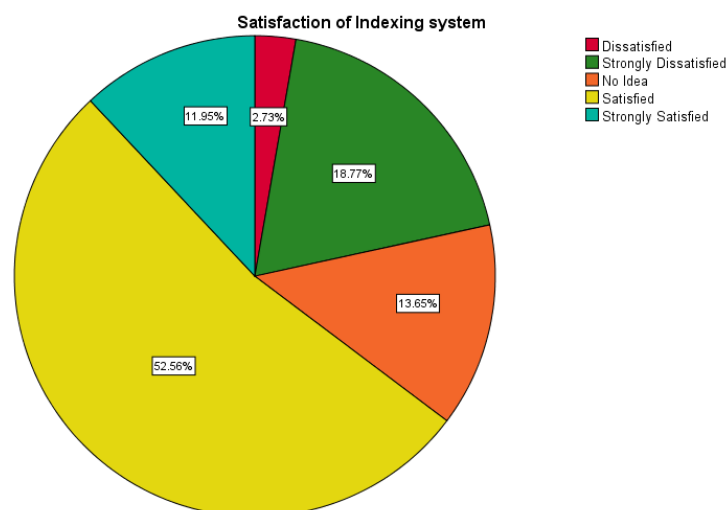
Following Cluster Bar Chart 4.2, describe the satisfaction level of library opening hours among library users. Most directors are dissatisfied with library opening hours, but the majority of research officers are satisfied with library opening hours. Totally, 60% of research officers were satisfied with library opening hours.



**Figure 1.5 satisfaction of Library opening hours**

### 3.3 F1 Component analysis-satisfaction of Indexing system

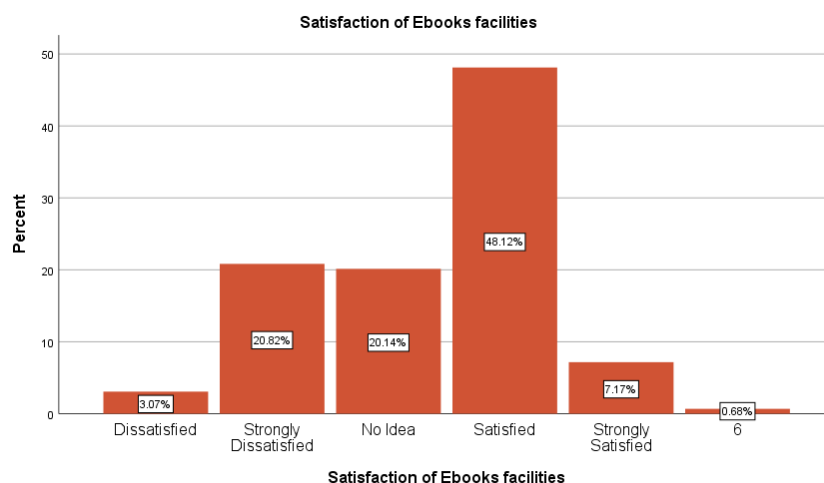
According to following figure 4.3 illustrate satisfaction level of available indexing system of subject related libraries. 52.56% satisfied available indexing systems.



**Figure 1.6 satisfaction of Library Indexing systems**

### 3.4 F1 Component analysis-satisfaction of E books facilities

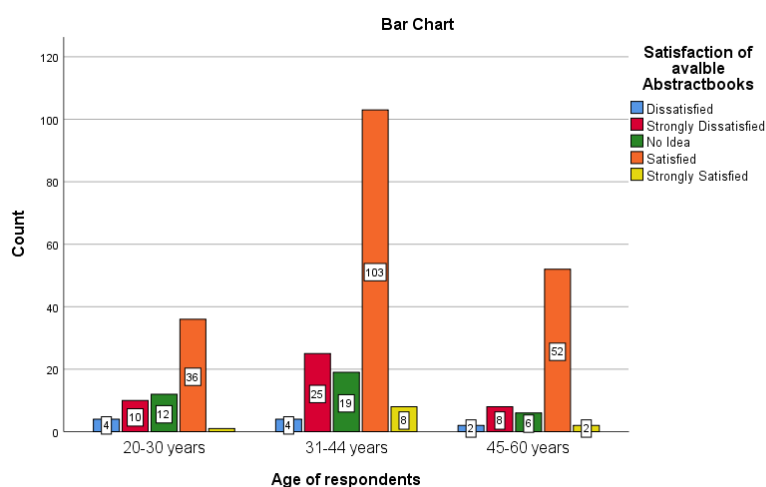
The following bar chart figure (4.4) describes the e-book facilities of subject-related libraries. 48.12% of respondents were satisfied with the available eBook collection. 20.14% of respondents have no specific idea about the eBook facilities of the relevant libraries.



**Figure 1.7 satisfaction of Library eBooks facilities of libraries**

### 3.5 F1 Component analysis-satisfaction of Abstract Books facilities

The following bar chart (Figure 4.5) describes the satisfaction level of abstract books. Under the age of 31–44, most users satisfied with the available abstract books



**Figure 1.8 satisfactions of Abstract Books facilities**

#### 4. Descriptive analysis of stronger variables in F2 Component

According to Table 1.6 F2 The available research data, training, and workshop facilities belong to the F2 component.

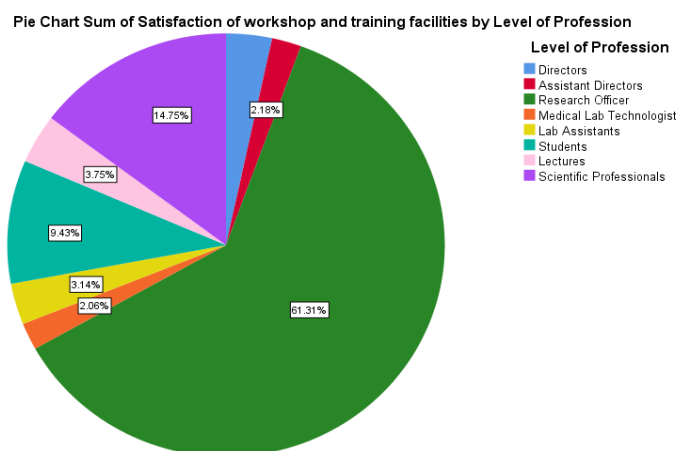
##### 4.1 F2 Descriptive analysis of stronger variables in F2 Component- Satisfaction of available research publications

**Table 1.7 descriptive of satisfaction level in research Publication**

Satisfaction of available research publications					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Dissatisfied	2	.7	.7	.7
	Strongly Dissatisfied	77	26.3	26.3	27.0
	No Idea	23	7.8	7.8	34.8
	Satisfied	165	56.3	56.3	91.1
	Strongly Satisfied	24	8.2	8.2	99.3
	Total	293	100.0	100.0	

#### Satisfaction of Workshop and Training facilities

According to Figure 1.9, which shows the satisfaction of workshop and training facilities, most research officers were satisfied with the available workshop and training facilities (61.31%). 14.75% of scientific officers also satisfied workshop and training facilities.



**Figure 1.9 Satisfaction of Workshop and Training facilities**

**1.  $H_0$ :** There is no significant relationship between the gender of the respondents and satisfaction with the available research data.

**$H_1$ :** There is a significant relationship between the gender of the respondents and satisfaction with the available research data.

#### Chi-square test of research data by representing gender

According to the Table 1.7 , The Pearson Chi-Square value of the table is 2.192. the two sided significant level is 0.700. But the expected value should be less than 0.5. Therefore, the results of the chi-square test indicated that there is no statistically significant relationship between the gender of the respondents and usage of available research data.

**Table 1.8 Chi-square test of research data by representing gender**

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	<b>2.192<sup>a</sup></b>	4	<b>.700</b>
Likelihood Ratio	2.229	4	.694
Linear-by-Linear Association	1.408	1	.235
N of Valid Cases	293		
a. 3 cells (30.0%) have expected count less than 5. The minimum expected count is .81.			

**2.  $H_0$ :** There is no significant difference in the relationship between the age of the respondents and satisfaction with the available research data.

**$H_1$ :** There is no significant difference in the relationship between the age of the respondents and satisfaction with the available research data.

**Table 1.8 Chi-square test of research data by representing age**

According to the Table 1.8, The Pearson Chi-Square value of the table is 15.562. The two sided significant level is 0.049. The expected value should be less than 0.5. Therefore, the results of the chi-square test indicated that there is a statistically significant difference relationship between the age of the respondents and usage of available research data.

**Table 1.9 Chi-square test of research data by representing age**

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	<b>15.562<sup>a</sup></b>	8	<b>.049</b>
Likelihood Ratio	16.303	8	.038
Linear-by-Linear Association	.734	1	.391
N of Valid Cases	293		
a. 6 cells (40.0%) have expected count less than 5. The minimum expected count is .43.			

### 1.13 Conclusion

The study has identified stronger components. There are four components that have a strong relationship with users' satisfaction with research data management systems. When considering the **extraction sums** of squared loadings, the values are greater than one. The cumulative values are also very high. Other components have low quality scores. These four components have variables. The values of the after-rotated component matrix reveal strong variables. The rotated component matrix values are greater than 0.5. That means the variables have a strong relationship with the four components mentioned. The components have a strong relationship with users' satisfaction related to the research data management system. According to the hypothesis testing, between age and satisfaction level of research data have no significant difference. Further, the study emphasizes the statistically significant difference between age and users' satisfaction with the available research data.

Based on these results, subject-related libraries can enhance research services by developing an indexing system, expanding research publications, developing abstract book publications, and developing bibliography data. Bookshelf arrangement, ordering, and updating research journals It can be enhanced by research data management services. It will impact users' satisfaction levels with research data management services. The study recommends some future areas, such as identifying stronger indicators related to users' satisfaction with reference services, digital content management systems, and database management systems.

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