5.1 Major Research Findings
5.2 Research Recommendations
5.3 Testing of hypothesis
   5.3.1 Null Hypothesis
   5.3.2 Alternative Hypothesis
   5.3.3 Level of significance
   5.3.4 Degree of Freedom
   5.3.5 Chi-square ($\chi^2$) Test
   5.3.6 Testing of Hypothesis - 1
   5.3.7 Testing of Hypothesis - 2
   5.3.8 Testing of Hypothesis - 3
5.4 Further areas of research
5.5 Conclusion of the study
5.1 Major Research Findings

Findings are the inferences based on the data analysis, researcher’s knowledge and critical thinking. Some of the significant findings of the present study are:

1. Investigator finds that link to e-resources (e-books, e-journals) is the highest provided service by the 52 (93%) engineering college libraries under the study as a digital / online service under digital reference service, while institutional repository is lowest provided service by 14 (25%) engineering college libraries as digital / online service.

2. The study reveals that e-mail reference service is provided by maximum 45 (80%) libraries as e-mail based service under digital reference services, while ask-a-librarian service is provided by minimum 31 (55%) libraries.

3. It is found that question point reference service is provided by maximum 32 (57%) engineering college libraries under study, while minimum 24 (43%) college libraries have no comments, which seems that these libraries might be at the developmental stage.

4. Investigator finds that under real time reference service, instant messaging service is maximum provided by 24 (43%) engineering college libraries as digital reference service, while chatter botter is minimum provided service by only 2 (04%) engineering college libraries under study.

5. The study clearly points that under web form services; Frequently Asked Questions (FAQs) service is provided by maximum 22 (39%) engineering college libraries, while web form service is provided by minimum 11 (20%) libraries. Also there are no comments from 23 (41%) college libraries.

6. Investigator finds that under web based reference services, user feedback from services is provided by maximum 27 (48%) engineering college libraries, while minimum provided service under this category is web contact centre by 13 (23%) college libraries.

7. The survey shows that under web 2.0 services category, social media service (WhatsApp, Skype) is provided by maximum 14 (25%) engineering college libraries, while twitter service is provided by minimum 05 (09%) college libraries as digital reference service.
8. Investigator further finds that internet via website is the medium chosen by maximum 46 (82%) engineering college libraries to provide digital reference service, while only 03 (05%) libraries have used other medium to provide digital reference service and in other category it is not further specified.

9. The study reveals that digital reference service subscribed at highest is full text by 48 (86%) engineering college libraries under the study, while at lowest is other by 01 (02%) college libraries.

10. While studying criteria for selecting digital reference service the user demand has been given preference by maximum 47 (84%) engineering college libraries, while others have been given preference by minimum 08 (14%) libraries.

11. Investigator finds that source for selection of digital reference service; maximum priority is given to recommendations of faculties, researchers, and students by 49 (88%) libraries, while minimum priority is given to free online trial by 20 (36%) libraries under study.

12. The survey shows that while evaluating digital reference service for subscription, maximum preference is given to user needs by 46 (82%) engineering college libraries and minimum preference is given to trial before use by 31 (55%) college libraries.

13. Investigation clearly points that faculty is the high extent user of digital reference services denoted by 31 (55%) engineering college libraries under study, while researchers use minimum digital reference service denoted by 12 (21%) libraries.

14. While studying which digital reference service is used maximum, investigator finds that link to e-resources, including e-books, e-journals, is used at maximum shown by 21 (38%) engineering college libraries, while ASCE is used at minimum shown by 04 (07%) college libraries.

15. The study shows that out of 56 engineering college libraries under study, 41 (73%) libraries have not appointed any staff for providing digital reference services, while 15 (27%) libraries have appointed staff for providing digital reference services. This is quite disappointing.

16. Investigator finds that problems faced by the librarians in providing digital reference services, 36 (64%) libraries have replied the monetary problem and 20 (36%) libraries have indicated technical problem.
17. Survey clearly indicates that out of 56 engineering college libraries, 29 (52%) libraries arrange staff training, while 27 (48%) libraries do not arrange staff training for providing digital reference services.

18. Investigator finds that out of 56 engineering college libraries under study, 35 (62%) college libraries have provision of budget for digital reference services, while 16 (29%) libraries do not have provision of budget for digital reference services and 05 (09%) libraries do not have responded.

19. The study indicates that 39 (70%) college libraries under study states that providing digital reference services is not cost beneficiary, while 17 (30%) college libraries state that it is cost beneficiary.

It clearly shows that providing digital reference service is cost expensive in terms of finance.

20. Survey shows that 35 (62%) college libraries provide user education for using digital reference service, while 21 (38%) college libraries do not provide user education for using digital reference service.

21. While studying usage of digital reference service under online / digital services category, investigator finds that link to e-resources (e-books, e-journals, and e-thesis) is maximum average 91% used by users, while collaboration with national / international network is minimum average 13% used service.

22. Study clearly indicates that average 82% researchers know the online / digital service, but only average 46% use the same. While average 69% faculties know this service, but only average 46% use it and average 67% students know this service, but only average 39% use this service. The usage trend indicates that usage of online / digital services is less.

23. Investigator finds that under e-mail based digital reference service; ask – a – librarian service is maximum used by average 74% users, while e-mail reference is minimum used service by average 68% users.

24. Under e-mail based digital reference service, user trend shows that average 92% researchers know this service, but only average 75% use it, while average 93% faculties know this service, but average 76% use it and average 93% students know this service, but average 63% use this service.

25. Investigator finds that question point reference service is used less at average 10% by users.
26. User trend shows that question point reference service is known to average 75% researchers, but only average 17% use it, while average 43% faculties know this service, but only average 7% use it and average 43% students know this, but average 6% use it.

27. Under real time reference services, Instant Messaging service is used at high extent by average 73% users, while chatter botter is less used service at average 02% by users of engineering college libraries.

28. User trend of real time reference services shows that average 64% researchers know these services, but average 22% use these, while average 45% faculties know these services, but average 15% use them and average 45% students know these services, but average 20% use these services.

29. Investigations show that under web form services, maximum used service is Frequently Asked Questions (FAQs) by average 71% users and web form service is minimum used by average 10% users.

30. Study shows that user trend of web form services indicates that average 75% researchers know these services, but only average 46% use these, while average 54% faculties know these services, but average 38% use these services and average 60% student know these services, but average 38% use these services.

31. Survey clearly shows that out of web based reference services, search engine reference service is used maximum by average 38% users, while bulletin boards is less used service by average 7% users.

32. Survey further shows that user trend of web based reference services indicate that average 65% researchers know these services, but only average 23% use these, while average 30% faculties know these services, but average 11% use it and average 38% students know these services, but average 14% use these services.

33. Investigator finds that under web 2.0 services, social media service is maximum utilized by average 55% users, while other services are used minimum by average 6% users.

34. User trend of web 2.0 services indicates that average 53% researchers know these services, but only average 23% use it, while average 31% faculties know these services and 17% use it, simultaneously average 38% students know these services, but use only 20%.
35. While studying experience of using digital reference services, study shows that maximum 131 (39%) users are using these services from 2 to 4 years, while minimum 20 (06%) users have experience of using digital reference services more than four years.

36. While studying frequency of using digital reference services, it is observed that maximum 269 (80.06%) users of engineering college libraries under study use these services once in a month, while minimum 12 (3.57%) users use these services daily.

It shows that digital reference services are not used at high extent by users.

37. While studying time spent on using digital reference services, maximum 280 (83.33%) users spent less than one hour a week, while minimum 05 (1.49%) users spent more than six hours per week.

It again shows that digital reference services are not used at high extent by users of engineering college libraries under study.

38. Study clearly indicates that most frequently used digital reference service is e-resources (e-books, e-journals) used by maximum 183 (50.69%) users, while minimum 10 (2.77%) users use ASME, 10 (2.77%) use Springer and 10 (2.77%) use science direct.

39. While studying place from where digital reference services are used, it indicates that maximum 249 (41.64%) users use these services in library, while minimum 07 (1.17%) users use from other places.

It is quite amazing that digital reference services are used in library more, but on the other land it proves the traditional mentality of users and necessity of library.

40. Study shows purpose of using digital reference services is maximum for education by 303 (60.48%) users and minimum for other purpose by 02 (0.40%) users.

41. While studying problems faced by users while using digital reference services, it is found that maximum 196 (39.2%) users have noted slow access speed, while minimum 08 (1.6%) users have noted other problems.

42. While studying way to use digital reference services, maximum 210 (58.99%) users have said that by asking library staff, while minimum 14 (3.93%) users use it by other way.
43. While studying authenticity of digital reference services, study indicates that maximum 310 (92.26%) users have said YES and it is authentic, while minimum 26 (7.74%) users have said NO, it is not authentic service.

44. Survey clearly indicates that maximum 267 (79.46%) users are fully satisfied with digital reference services provided by engineering college libraries under study and minimum 6 (1.79%) users are less satisfied with digital reference services.

It clearly shows that library users are satisfied with digital reference services provided by engineering college libraries.

45. Investigator finds that maximum 267 (79.46%) users get the needed information from digital reference services, while minimum 12 (3.57%) users don’t get needed information from digital reference services.

46. Study clearly indicates that maximum 275 (81.85%) users have responded that they get high support from library staff for using digital reference services, while minimum 11 (3.27%) users have said that they get less support from library staff.

47. Survey shows that maximum 232 (39.52%) users find digital reference services more expensive as compared to traditional documents, while minimum 66 (11.24%) users find it effective as compared to traditional documents.

48. Investigator finds that maximum 273 (37.92%) users get information regarding digital reference services from library / college website, while minimum 6 (0.83%) users get it from other source.

49. Study clearly shows that maximum 244 (60.70%) users find that using digital reference service is difficult, while minimum 1 (0.25%) user find any other option while using DRS.

50. Study shows that maximum 09 researchers, 112 faculties, 136 students and total 257 (76.49%) users find digital reference service time consuming while minimum 01 faculty, 01 student and total 02 (0.60%) users find it any other.

51. Survey indicates that maximum 239 (71.13%) users say that digital reference service is costly, while minimum 7 (2.08%) users note any other option.
5.2 Research Recommendations

Recommendations are solutions suggested by the researcher, based on the findings, analysis and suggestions made by the respondents.

1. Separate Staff should be appointed in library by the engineering colleges for providing digital reference services.
2. To overcome monetary problem, government or various funding agencies should give subsidy or grant to engineering college libraries for providing digital reference service.
3. To overcome technical problems while providing digital reference services, engineering colleges should appoint technical person.
4. Staff training should be arranged frequently for providing effective digital reference services.
5. Measures should be taken to provide cost beneficiary digital reference services.
6. Engineering college libraries should take steps for marketing of digital reference services to increase its usage.
7. For increasing usage of digital reference services, engineering college libraries should arrange user orientation program frequently.
8. Measures should be taken to increase usage frequency of digital reference services.
9. Review should be taken to know why digital reference services are not used at high extent by users and appropriate remedial measures should be taken.
10. Measures should be taken to upgrade access speed while using digital reference service.
11. Question point reference service is less used; libraries should concentrate on this and should take measure to increase usage.
12. There is need for uniform pattern of providing digital reference services.
13. International agencies like IFLA, ALA, RUSA compose, modify and publish guidelines for digital reference services, but at national level there should be such agencies.
14. Libraries may develop collaborative consortia for providing digital reference services.
15. To overcome financial constraints, libraries should try to generate revenue on their own by commercializing their services.

16. Many libraries don’t have their own websites. They should develop their own website which will help them to provide various digital reference services.

17. If it is not possible to appoint separate technical staff for library, at least training should be provided to library staff at regular intervals to overcome technical problems.

18. User trend of various digital reference services shows that users know the services but usage is less. Measures should be taken by the libraries to increase use of digital reference services.
5.3 Testing of Hypothesis

The Process of verifying the validity or appropriateness of the hypothesis is known as testing of hypothesis. A hypothesis is tested by analyzing the relevant data and applying statistical techniques.

5.3.1 Null Hypothesis

A hypothesis which predicts that there is no correlation between the specific variables is called null hypothesis. Null hypothesis is used for statistical testing of research hypothesis. The null hypothesis is denoted by $H_0$.

5.3.2 Alternative Hypothesis

The statement which is true if the null hypothesis is false i.e. a possible or the acceptable alternative to the null hypothesis is known as alternative hypothesis. The alternative hypothesis is denoted by $H_1$.

5.3.3 Level of significance

The probability of rejecting $H_0$ is the level of significance of the test. In general, 0.05 (on the queries in 5 chances out of 100 which are likely to reject) and 0.01 are the commonly accepted values of the levels of the significance.

5.3.4 Degree of Freedom

The criteria to select the rows in the chi square table are known as degrees of freedom. The columns in chi square table indicate level of significance and rows indicate degree of freedom. The degree of freedom is selected with the help of formula.

5.3.5 Chi-square ($\chi^2$) Test

Chi-square test is one of the simplest and general known tests of hypothesis. The Chi square test consists of two phases. One is calculating chi square values and second is testing the hypothesis. (Kumbhar, Rajendra, 2014: p. 313-323) It is applicable to a very large number as well as small number of problems in general practice under the following headings:

- As test of goodness of fit and independence of attributes.
- As a test of homogeneity of independence estimates of the population variance.
- As a test of hypothetical value of the population variance $\sigma^2$.
- To test the homogeneity of independent estimates of the population correlation coefficient.
5.3.6 Testing of Hypothesis - 1 Library users are satisfied with the digital reference services provided by the college libraries.

Testing of Hypothesis-1: (Chi square test of goodness of fit)

Null Hypothesis \( H_0 \): The satisfaction level of library users with the digital reference services provided by the college libraries is uniform.

Alternative Hypothesis \( H_1 \): The satisfaction level of library users with the digital reference services provided by the college libraries is not equal i.e. Library users are satisfied with the digital reference services provided by the college libraries.

Under the Null Hypothesis \( H_0 \):

By the word ‘satisfied’ we consider full satisfaction by the use of digital reference services. Total number of researchers, faculties and students is 336 so the expected frequency is calculated as:

Expected Frequency \( E = \Sigma x / x = 336 / 2 = 168 \).

Calculation of Chi-square \( (\chi^2) \):

<table>
<thead>
<tr>
<th>Satisfied With DRS</th>
<th>Observed Frequency (O)</th>
<th>Expected frequency (E)</th>
<th>(O-E)</th>
<th>(O-E)(^2)</th>
<th>(O-E)(^2) / E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>267</td>
<td>168</td>
<td>99</td>
<td>9801</td>
<td>58.34</td>
</tr>
<tr>
<td>No</td>
<td>69</td>
<td>168</td>
<td>-99</td>
<td>9801</td>
<td>58.34</td>
</tr>
<tr>
<td>Total</td>
<td>336</td>
<td>336</td>
<td></td>
<td></td>
<td>116.6785714</td>
</tr>
</tbody>
</table>

The calculated value of \( \chi^2 = \Sigma [(O - E)^2 / E] \equiv 116.68 \)

We have degree of freedom = \( (n - 1) = 2 - 1 = 1 \).

Level of significance = 5%.

The tabulated value of \( \chi^2 \) for 1 degree of freedom at 5% level of significance is 3.841.

Since the calculated value of \( \chi^2 \) i.e. \( \chi^2 \) \( \text{cal} = 116.68 \) is more than the tabulated value of \( \chi^2 \) \( \text{Tab} = 3.841 \).

Hence the null hypotheses \( H_0 \) is rejected at 5% level of significance and degree of freedom 1, and alternative hypothesis \( H_1 \) is accepted and it is concluded that library users are satisfied with the digital reference services provided by the college libraries.
5.3.7 Testing of Hypothesis - 2

Providing digital reference services are expensive in terms of finance.

Testing of Hypothesis-2: (Chi square test of goodness of fit)

**Null Hypothesis H\(_0\):** The finance for the digital reference services provided by the college libraries is uniform.

**Alternative Hypothesis H\(_1\):** The finance for the digital reference services provided by the college libraries is not uniform, i.e. providing digital reference services are expensive in terms of finance.

**Under the Null Hypothesis H\(_0\):**

Expected Frequency E = \(\Sigma x/x = 56/2 = 28\).

Calculation of Chi-square (\(\chi^2\)):

<table>
<thead>
<tr>
<th>DRS is Expensive</th>
<th>Observed Frequency (O)</th>
<th>Expected frequency (E)</th>
<th>(O-E)</th>
<th>(O-E)(^2)</th>
<th>(O-E)(^2)/E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>39</td>
<td>28</td>
<td>11</td>
<td>121</td>
<td>4.3214</td>
</tr>
<tr>
<td>No</td>
<td>17</td>
<td>28</td>
<td>-11</td>
<td>121</td>
<td>4.3214</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>56</strong></td>
<td><strong>56</strong></td>
<td></td>
<td></td>
<td><strong>8.6429</strong></td>
</tr>
</tbody>
</table>

The calculated value of \(\chi^2 = \Sigma [(0 - E)^2 / E] \approx 8.6429\)

We have degree of freedom = (n - 1) = 2 - 1 = 1.

Level of significance = 5%.

The tabulated value of \(\chi^2\) for 1 degree of freedom at 5 \% level of significance is 3.841.

Since the calculated value of \(\chi^2\) i.e. \(\chi^2\) cal = 8.6429 is more than the tabulated value of \(\chi^2\)\(_{\text{Tab}}\) = 3.841.

Hence the null hypotheses Ho is rejected at 5\% level of significance and degree of freedom 1, and alternative hypothesis H\(_1\) is accepted and it is concluded that providing digital reference services are expensive in terms of finance.
5.3.8 Testing of Hypothesis - 3

Digital reference services are not used at high extent by users of engineering college libraries.

**Testing of Hypothesis-3: (Chi square test of goodness of fit)**

**Null Hypothesis H₀:** use of digital reference services by users of engineering college libraries is uniform or equal.

**Alternative Hypothesis H₁:** use of digital reference services by users of engineering college libraries is not uniform, i.e. digital reference services are not used at high extent by users of engineering college libraries.

**Under the Null Hypothesis H₀:**

By the word ‘high extent’ we consider *daily* use of digital reference services. Total number of researchers, faculties and students is 336, so the expected frequency is calculated as:

Expected Frequency \( E = \sum x/x = 336/2 = 168 \)

Calculation of Chi-square \( (\chi^2) \):

<table>
<thead>
<tr>
<th>Use of DRS (Daily)</th>
<th>Observed Frequency (O)</th>
<th>Expected frequency (E)</th>
<th>(O-E)</th>
<th>(O-E)²</th>
<th>(O-E)² / E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>12</td>
<td>168</td>
<td>-156</td>
<td>24336</td>
<td>144.86</td>
</tr>
<tr>
<td>No</td>
<td>324</td>
<td>168</td>
<td>156</td>
<td>24336</td>
<td>144.86</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>336</strong></td>
<td><strong>336</strong></td>
<td></td>
<td></td>
<td><strong>289.71</strong></td>
</tr>
</tbody>
</table>

The calculated value of \( \chi^2 = \Sigma[(0 - E)^2 / E] = 289.71 \).

We have degree of freedom = \((n - 1) = 2 - 1 = 1\).

Level of significance = 5%.

The tabulated value of \( \chi^2 \) for 1 degree of freedom at 5 % level of significance is 3.841. Since the calculated value of \( \chi^2 \) i.e. \( \chi^2 \text{ cal} = 289.71 \) is more than the tabulated value of \( \chi^2 \text{ Tab} = 3.841 \).

Hence the null hypotheses Ho is rejected at 5% level of significance and degree of freedom 1, and alternative hypothesis H₁ is accepted and it is concluded that digital reference services are not used at high extent by users of engineering college libraries.
5.4 Further areas of research

The present study has been conducted to know the current level of digital reference services in engineering college libraries affiliated to University of Pune. Similar type of studies can also be conducted on the following topics:

- Evaluation of digital reference services in arts, commerce and science college libraries.
- Evaluation of digital reference services in University libraries.
- Evaluation of other services in engineering college libraries.
- User survey of engineering college libraries regarding less usage of digital reference services.
- Use of digital reference services in management studies institutes, medical sciences institutes, etc.

5.5 Conclusion of the study

114 engineering colleges are affiliated to Savitribai Phule Pune University (formerly University of Pune). It is observed that out of 114 engineering college libraries, 99 college libraries are providing some kind of digital reference services. Link to e-resources, e-mail reference service, question point reference service, instant messaging service, Frequently Asked Questions (FAQs) service, user feedback from service, social media service, etc. are the maximum provided services by engineering college libraries. While institutional repository, ask-a-librarian, chatter botter, web form services, web contact center, twitter service, etc. are the minimum provided services by engineering college libraries. While selecting and evaluating digital reference services, highest priority is given to user demands and needs by engineering college libraries.

Link to e-resources, ask-a-librarian, instant messaging service, Frequently Asked Questions (FAQs) service, search engine reference service, social media service, etc. are the maximum used services by users of engineering college libraries. While collaboration with national / international networks, e-mail reference, question point reference service, chatter botter, web form service, bulletin boards, etc. are the minimum used services by users. User trend of various services shows that users know these services but usage by them is less. Efforts should be taken by engineering college libraries to increase the use of digital reference services.
It is surprising that digital reference services are used in library more, but it also insists traditional mentality of users and necessity of library. It is quite disappointing that maximum libraries do not appoint separate staff for providing digital reference services. Many libraries face monetary problem and state that providing digital reference services is expensive in terms of finance. Inspite of all this, users of engineering college libraries are satisfied with digital reference services provided by their libraries.