

# ADOPTION OF ICT BY THE UNIVERSITY LIBRARIES IN WEST BENGAL: AN ANALYTICAL STUDY USING ROGER'S INNOVATION DIFFUSION THEORY

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## *Abstract:* purpose

This paper try to explore the extend of ICT adoption among the university libraries in west Bengal, and to identify the key factors in adoption of ICT . another perspective of this study is to application of innovation diffusion theory(IDT) to the diffusion of ICT in the university libraries .

## Methodology/Design/Approach

For this study survey method is administered with structure questionnaire, conducted among the professional staff of the university libraries as well as face to face interview were conducted for gathering data. From data gathered the research has analysed the potential influences on the adoption of ICT, including the attributes of innovation in university libraries .This is based on the attributes of an innovation in Rogers' theory of diffusion of innovation.

## Findings:

The research findings are summarised after the analysis of data which is collected from questionnaire related to the objective of the study, and interview method

during the interviews, including research propositions related to the first research question, i.e. "can Rogers' diffusion of innovation model be applied to the diffusion of ICT in University libraries", and findings from staff interviews related to the second research question – "What are major attributes that have affected ICT adoption in the case study library?" Research limitations/implications – Some attributes based on Rogers' theory were positive, while a few others were not clearly perceived by practitioners, and this needs to be addressed by more careful distinctions being made between the categories in any future research.

Originality/value – This research provides knowledge in developing ICT services for librarians, students, and researchers, and anyone else interested in this issue. Additionally, it can serve as a model of using the theory of diffusion

***Index Terms* – ICT, Innovation, Diffusion Theory, Communication technology, University Libraries.**

## I. INTRODUCTION

II. Fastest development of Information and communication Technologies (ICTs) have changed the scenario of traditional concept of libraries . Modern University Libraries are more powerful, Dynamic and can reach their users without the restrictions of geographical boundaries. In this age of Internet libraries fast moving to digital mode and can be accessed universally. With the help of new communication technology libraries remodelling their services to borderless world and become lifeblood of the community.[9]

Use of ICTs in libraries has become great advantage for its users as they open up opportunities for information exchange. Users can access wide variety of information resources such as text, sound, image etc. According to their needs under one umbrella. Therefore application of ICTs provides considerable impact on the way in which libraries relate to their user communities and become an essential part of evolving information society. [1]

Replace more traditional forms library use and information access . some libraries seem to be using the modern technology for traditional functions such as library orientation and catalogue, and other seem to be exploring ways in which the web and the internet can be used to provide a new and different service. This is the story of an innovation as seen through the experience of selected staff from one university to another.[6]

Through this study, this research seeks to extend our understanding of how ICTs are being used by University libraries , and to assess key factors in adoption of the ICTs. It also explores the application of a particular theory to the diffusion of ICTs in University Libraries .

## 1. Definition of ICT

Information and communication technology (ICT) is an umbrella term under this arena information technology, telecommunication technology, software, middleware, storage, and audio-visual systems, which enable users to access, store, transmit, and manipulate information.

In Wikipedia the term ICT is also used to refer to the convergence of audio-visual and telephone network with computer networks through a single cabling or link system. There are large economic incentives (huge cost savings due to elimination of the telephone network with the computer network system using a single unified system of cabling, signal distribution and management

However, definition, as "the concepts, methods and applications involved in ICT are constantly evolving on an almost daily basis."<sup>[3]</sup> The broadness of ICT covers any product that will store, retrieve, manipulate, transmit or receive information electronically in a digital form, e.g. personal computers, digital television, email, robots. For clarity, Zuppo provided an ICT hierarchy where all levels of the hierarchy "contain some degree of commonality in that they are related to technologies that facilitate the transfer of information and various types of electronically mediated communications" [13]

## 2 ICT in University Libraries

I. Computer has brought in a new impact to the library and information usage. In libraries, information technology has assisted library professionals to provide value added quality information service and give more remote access to the inter-nationally available information resources.[3] Today's highly sophisticated information technology to facilitate the storage of huge amounts of data or information in a very compact space. that most of the libraries were U "lack sufficient hardware, software facilities and do not have adequate internet nodes and bandwidth". The campus LANs were not fully extended to exploit the benefits of digital information environment. Ahmad and Fatima (2009)[5] found that researchers use a variety of ICT products and services for research and further remarked that ICT products help "to find information, access information more easily". It was recommended that training be organized to increase the use of ICT-based products and services.)[7] stated that The University Libraries must increase the numbers of computer available to enable the users to digitize rare collections such as older and out of print editions

### II. 3. Diffusion of innovation is discussed more detail below ,

Rogers' theory: the diffusion of innovation Figure 1 and the following discussion can only summarise the various facets of Rogers that are relevant to this research. It is a fascinating and highly flexible approach to understanding the diffusion of innovation, and it has been applied in areas as different as agriculture and library science. For those seeking a fuller description of Rogers' framework, the best source of information is Rogers himself, and especially Chapter 6 of his book (Rogers, 2003). **Diffusion is defined as "the process by which an innovation is communicated through certain channels over time among the members of a social system"** (Rogers, 2003, p. 11). Rogers presents a model of the diffusion process that determines the rate of innovation adoption. As Figure 1 shows, there are five sets of factors that affect the rate of innovation adoption. The important aspect is the rate of adoption of innovations, which sits in the centre of the model. The rate of adoption refers to the fact that certain individuals adopt innovations more quickly than others. Adoption growth usually begins relative slowly, suddenly "takes off" for a period of time, then eventually levels off. Rogers (2003) explained that this is because a small number of opinion leaders are the first to adopt, and that are later copied by a large wave of followers, which accounts for the dramatic growth. Eventually, when the innovation becomes widely diffused or is replaced with a superior innovation, adoption growth levels off.[12]

When looking at university libraries, this research has analysed the potential influences on the adoption of ict that include attributes of innovation in university libraries. This is based on the attributes of an innovation in Rogers model (fig. 1). Those attributes are relevant to ICT adoption in University libraries, and they are also appropriate for collecting information related to ICT adoption.

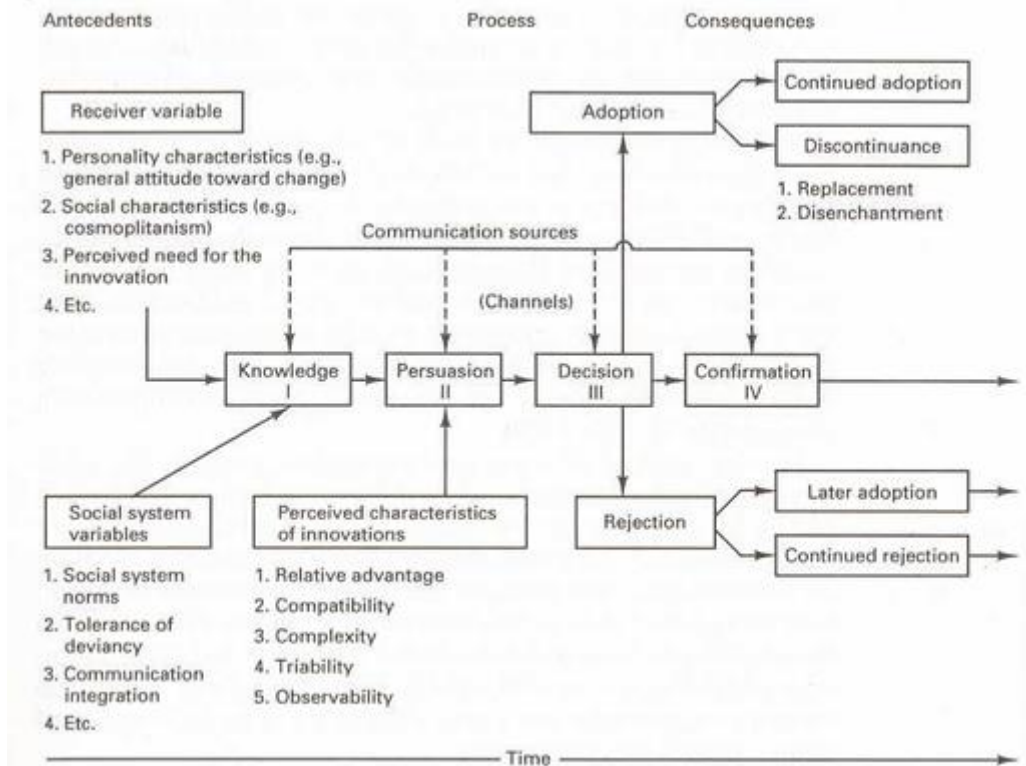


Figure 1. A general research framework of the diffusion process

Source: Rogers' Diffusion of innovation, 2003

Why has Rogers been chosen as the lens through which to view the ICT adoption in University Library? Again, Tran (2004) has explained this fully elsewhere, and here the author summarises the reasons for choosing Rogers as the preferred model. Most important is the fact that the DoI model is extremely robust and up to date (the latest edition was published in 2003). In terms of its currency, Rogers has made sure that his theory, first published in 1962, has evolved and kept up with new insights and developments over the years. This constant evolution has given it a robustness that is unusual in many other models frequently employed in information systems research. Second, and equally significant from a library perspective, since the work of Chatman, DoI has been viewed as applicable to organisations as well as to technologies. In "Diffusion theory: a review and test of a conceptual model in information diffusion", Chatman (1986) defined the content of innovation as information. According to Chatman, innovation can include more than just technology, and this is the important idea she developed in her 1986 research. The traditional way of looking at an innovation was in light of a tangible thing (software package) or a practice (use of microcomputers in libraries) which was viewed as new by members of a social milieu. However, it is conceivable that information which has not been part of one's awareness can also be classified as new, can and thus be considered an innovation (Chatman, 1986, p. 379). Chatman's approach is a significant advance on the use of Rogers in this research for two reasons. First, the traditional diffusion of innovation theory is confirmed as being applicable to technology in libraries. Second, the meaning of innovation extended to information means that one can use the theory for more than just technology. In this research the author is interested in two developments: (1) use of the internet as an information tool in libraries – this relates to the traditional aspect of the theory; and (2) community information on the internet – this relates to the second aspect of the theory devised and tested by Chatman. In other words, this research uses Rogers as a framework for testing both principal aspects of this research problem. Additionally, the meaning of innovation has three parts: community information and a particular form of technology, i.e. the internet, in a specific type of organisation, i.e. the library. Following Chatman's breakthrough extension of the model, DoI has been used successfully in a wide range of information environments. It has been employed in many countries as a means of evaluating a range of services provided by such organisations; university libraries is a natural extension of its wide-ranging application in the library environment.[7]

#### 4. Research Design

This study utilized the qualitative as well as quantitative research process. Here attempts to describe such things as characteristics, hardware, software, computerized services and attitude of libraries and librarians towards ICT. A structured questionnaire based on innovation diffusion theory of Rogers' were distributed as well as interviewed .

## 5. Population

The population for this study comprised of the University library (Central library and departmental library) of West Bengal, the library which was established at least ten years ago, name of the library and number of respondent are in the (bracket) as follows: 1. University of Calcutta central library, (36) 2. Jadavpur university library, (39) 3. Rabindrabharati university library, (16) 4. presidency university library, (15) 5. st.xaviers university library, (12) 6. Kalyani University library, (14) 7. North Bengal University library, (10) 8. Burdwan University library (17) 9. Viswabharati University Library (36) 10. Vidyasagar University Library, (9) all the professional staff of the library is considered for study.

## 6. Sample Design

In order to achieve desired representation, stratified random sampling will be used. This is because the accessible population is not homogenous in terms of the role they play in fostering ICT adoption. The two strata namely the librarians and library assistants will be formed from the accessible population. This is almost a census study all the librarian and professional staff has been considered from selected universities.

## 7. Data Collection Tools

The questionnaire method was adopted for collection of data for this study, supplemented by interviews of Librarians to gather additional information. A draft questionnaire was designed based on discussions with professional colleagues and related research studies.

Two sets of structured questionnaires were prepared; one questionnaire to the University Librarian or Librarian in Charge and another to the library professionals in the central and departmental libraries in the universities selected for the study.

## 8. Reserach propositions and findings:

This part presents the research propositions related to the first research question-“ Can Rogers diffusion of innovation model be applied to the diffusion of ICT in University libraries?”: Findings from questionnaire and interviews related to the second research question – What are the major attributes that have affected ICT adoption in University Libraries? ; In order to determine the impact of each ICT variable on innovation a set of propositions was tested, These propositions were based closely on Rogers definitions of the key variables, Substituting “ICT” for “Innovation”. (Rogers, 2003, pp. 11-35). That is ICT can be considered as an innovation as well as a new method of providing information service through the library. As with any innovation, the more the variable fits with propositions the more successful it is likely to be. (Clayton, 1997). In other words, it is proposed that successful implementation of ICT in University libraries increases by the extent to which it fulfills criteria in four of the variables (Relative advantage, Compatibility, Trialability and observability), does not fulfill the criteria of fifth variable (Complexity) relative advantage.

The findings section has been summarised from staff discussion during the interviews.

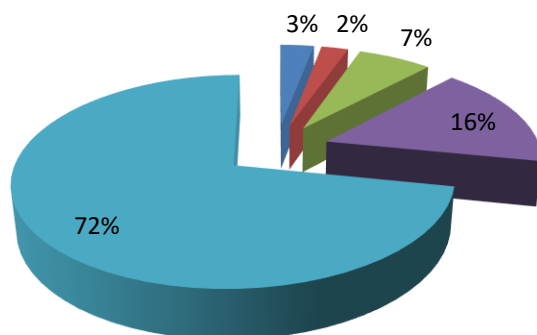
Total number of Librarian and library professional are 206 in number, questionnaire was distributed among the 204 library professional out of 204 respondents 167 respondents submit their questionnaire, so percentage of respondent are near about 82% .

Table showing response of the respondents about Relative advantage

| Variable   | Strongly disagree | Disagree | Neutral | Agree | Strongly Agree |
|--|-------------------|----------|---------|-------|----------------|
| Using ict enable to access information easily and quickly  | 5                 | 4        | 11      | 27    | 120            |
| Using ict enhances effectiveness in accessing most relevant information  | 9                 | 7        | 12      | 35    | 104            |
| Using ict allows to access more information services than would otherwise possible   | 4                 | 6        | 10      | 30    | 117            |
| Using ict to access information increases productivity ( e.g. find information about services with in shortest time frame. | 6                 | 9        | 15      | 20    | 117            |
| Over all It is found ict is useful to access relevant information.   | 8                 | 2        | 16      | 14    | 127            |

## Relative Advantage

■ Strongly disagree ■ Disagree ■ Neutral ■ Agree ■ Strongly Agree

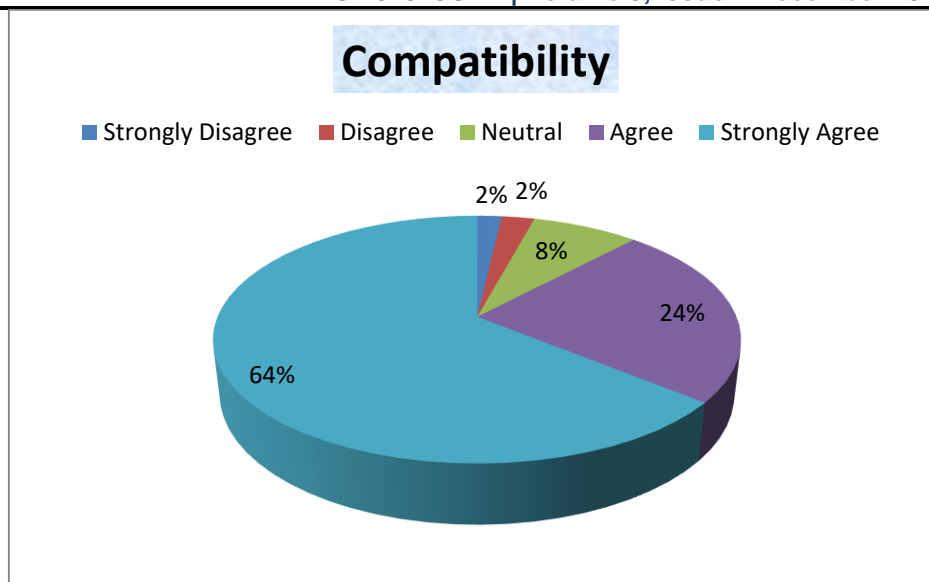


Pie diagram showing Relative advantage about ICT adoption, 88% respondent are agree and strongly agree about relative advantage about ICT, they believe that ICT is better than traditional methods of providing information service

P1- Relative Advantage- The degree to which University library likely to be implement ICT successfully will be increased by the extent to which it offers relative advantage.( This relates to the degree that it is perceived as better than traditional methods of providing information service to the users.) In the interview s library staff indicated that in their view , maximum respondents agreed that ICT in the library offered a number of distinct advantages over traditional information services. These advantage s include : It offer 24/7 services in providing information to users at any time , any where ,any places: It provide growing range of materials for a variety of purposes because it includes almost every thing of interest to user community. It helpps the multiple users at same time, through ICT information can search easily expediciously and effectively. Staff provide better on screen search tools that enable users to find information quickly and efficiently, staff can introduce more content more easily on the library website. From these views expressed by the library staff. It is clear that all the library staff believe that ICT has relative advantage than the traditional method s of providing information services to the user community.

Table showing data about Compatibility

| Variable  | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|-------------------|----------|---------|-------|----------------|
| I feel comfortable using ict both technically and socially. (As means of communication) | 3                 | 4        | 13      | 40    | 107            |
| ICT service is flexible to interact with users and information                          | 5                 | 10       | 15      | 50    | 87             |
| Use of ict service is more interesting than the traditional one.                        | 2                 | 3        | 25      | 60    | 77             |
| Using ICT increases the productivity ( man power)                                       | 1                 | 2        | 15      | 42    | 107            |
| ICT use is cost effective than traditional one  | 2                 | 3        | 22      | 20    | 120            |



Pie diagram showing Compatibility about ICT: diagram showing 88% of the respondent are compatible on ICT

P2 Compatibility: the degree to which ICT is likely to be implemented successfully will be increased by the extent to which it offers compatibility, (This relates to the degree to which the ICT is perceived as being consistent with the existing values, past experiences, and need of potential staff and users.)

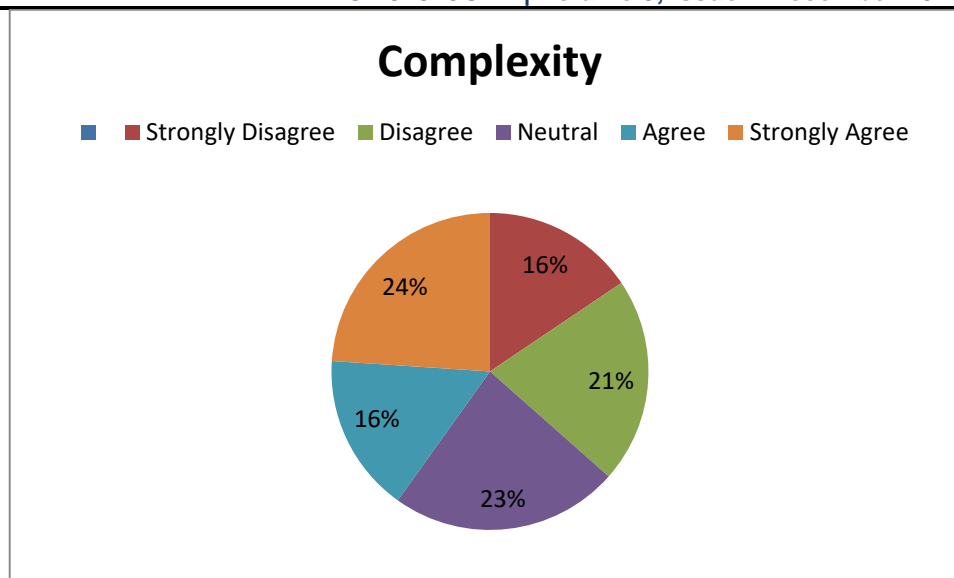
Library staff offered a range of comments that suggest a high level of perceived compatibility between their abilities and needs and the ICT. ICT is well matched to librarians skill and abilities.

The ICT is compatible with staffs needs as well as users needs; Staff are comfortable in doing their jobs in relation to ICT. They are comfortable in processing information and willing to use new technologies related to ICT adoption. Staff have high expectation in serving users need through ICT

In University libraries it seems that compatibility has not been an issue, and that it is positive feature of this ICT. It is compatible with staff expertise, so that staff feel comfortable when asked questions about ICT application in libraries, all the respondents are agree that the ICT is important in helping them to their work, the compatibility of ICT is therefore positively related to its rate of adoption.

Table showing data about Complexity

| Variable  | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|-------------------|----------|---------|-------|----------------|
| Use of ict is more difficult than traditional one.                | 26                | 35       | 39      | 27    | 40             |
| Ict adoption needs big fund                                       | 19                | 31       | 45      | 45    | 27             |
| ICT adoption required adequate trained staff                      | 21                | 40       | 50      | 35    | 21             |
| ICT users need depth knowledge in search technique of information | 32                | 27       | 39      | 30    | 39             |
| It is difficult to keep up to date about new technology interface | 23                | 32       | 25      | 37    | 50             |



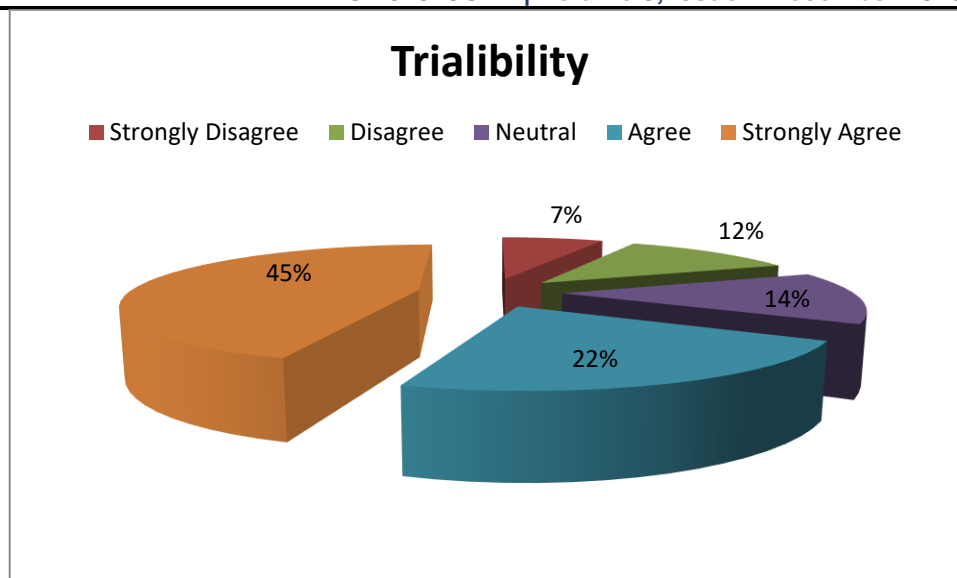
Pie diagram showing respondent are almost equally distributed , library staff are confused about complexity of ICT 43% staff are agree and strongly agree about complexity, 34% staff are strongly disagree and agree about complexity, 23% are neutral

P3. Complexity: the degree to which ICT is likely to be implemented successfully will be decreased by the extents of its complexity.( This relates to the degree to which ICT perceived as difficult to understand and use)

It can be seen that the relative advantage and compatibility of the library staff are high and that they can be said to contribute to the successful implementation of the ICT according to the staff involved. But the complexity of the ICT presents both positive and negative features. University library have raised following issues regarding the complexity of ICT, complexity include incompatible hardware, various confusing software application, updated the technology, required largr amount of fund , ability to use the interface, complexity in technological problem. All of these points indicate a high level of complexity and sometimes frustration on the part of staff in the selected libraries, It is not possible at this point to quantify the degree to which this may have negatively affected ICT adoption at university libraries.

Table showing data about Trialibility

| variable  | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|-------------------|----------|---------|-------|----------------|
| New idea that are divisible are adopted more quickly than that are not divisible                                  | 12                | 20       | 23      | 37    | 75             |
| An innovation that is trialable represents less uncertainty to the individual who is considering it for adoption. | 7                 | 25       | 29      | 40    | 67             |
| Partial implementation of ict in selected section ensure its effectiveness.                                       | 16                | 18       | 33      | 38    | 62             |
| Partially implementation of ICT delay the proposed work   | 9                 | 30       | 25      | 33    | 70             |
| Trial the new idea minimize the risk of financial loss  | 11                | 19       | 33      | 42    | 62             |



Pie diagram showing trialability: 67% of respondent are agree and strongly agree about Trialability

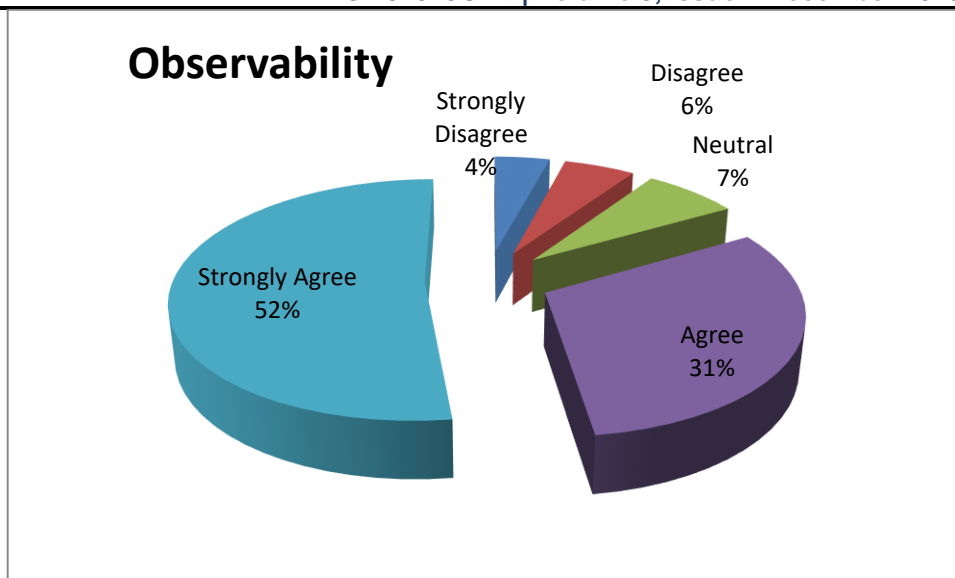
P4. Trialability: The degree to which ICT is likely to be implemented successfully will be increased by the extent to which it offers trialability ( This relates to the degree to which ICT may be experimented with on a limited basis.) Based on the interviews at university libraries and Rogers concept of trialability(Rogers,2003,p. 258), the process of trialability in relation to the ICT adoption in University libraries can be summarised in four steps. These step shows that University libraries was introducing trialability at the decision making stage. As rogers states “ one way to copewith the inherent uncertainty about an innovations consequences is to try out the new idea on a partial basis” (Rogers,2003,p.177), Further, “ this small scale trial is often part of the decision to adopt”(Rogers,2003,p.177), Step1: The staff learned new technology and skills building to provide ICT service to users. While the staff were learning new technologies and skills (step. 1) they were also building information service s electronically in stages in order to serv users communitys requirements.[11]

Step 3 : If step 1& 2 worked well the staff could expand ICT services and improve these services over time. Step 2& 3 could be considered as trying out ICT implementation and adjusting it to improve reliability. Trialability is “the degree to which an innovation may be experimented with on a limited basis” ( Rogers, 2003, p.258), Step 4 if the above three steps resulted in greater efficiency in staff productivity, then they would increases their involvement in the ICT over time in order to retain this greater efficiency in staff productivity .

Table shows data about Observability

| Variable  | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|-------------------|----------|---------|-------|----------------|
| ICT users have more scope to gather knowledge of their field than those who do not have | 7                 | 9        | 12      | 52    | 87             |
| Using Ict to keep the knowledge up to date is very easy                                 | 5                 | 13       | 19      | 48    | 82             |
| Information access through ICT minimize the cost  | 12                | 9        | 22      | 55    | 68             |
| Using ICT increases the level of productivity   | 17                | 18       | 31      | 41    | 60             |
| ICT save the time of the users  | 13                | 21       | 22      | 35    | 76             |





Pie diagram showing % of respondent .

From the above diagram it is clear that about 83% of the respondent are agree and strongly agree about observability

P5 . Observability: The degree to which ICT is likely to be implemented successfully will be increased by the extent to which it offers observability. ( This relates to the degree to which the results of ICT adoption are visible to others). The key staff were excited when talking about the ICT adoption in terms of its observability, and this attribute appeared easy for them to understand. Most of the staff are agreed that ICT adoption consisted of two observable components: 1. Technology that enable development and use of e resources and 2. E resources that are available on the network.

In relation to the first point , University library staff noted a number of changes in the library as a result of introducing the ICT : More computer provided to staff, new software programs they need to learn and use such as Netscape composer, Internet explorer, LMS software etc. These were “visible technologies” in university libraries for both the development staff and users,

#### 9. Conclusion:

This is a part of my research work, the results of this study indicate positively on research proposition, first research question was that Rogers’ diffusion of innovation framework is an appropriate vehicle for assessing the adoption of ICT as innovation in University libraries in West Bengal. It allows a robust series of factors to be considered and evaluated as a means of indicating likely success and failures in continuing ICT development. More specifically , in relation to the various sets of factors expressed in the preceding propositions, it has emerged that some seem rather more significant than others in determining the successful adoption of ICT. Specifically the following factors appear to have exerted a positive influence on ICT adoption in University libraries:

Relative Advantage, Compatibility, Trialability, Observability; extent of change agents’ promotion efforts: social system; and types of innovation decision. In this qualitative investigation it has not been possible to quantify or rank these factors in terms of impact, but the first five would seem to be most significant in the eyes of university library staff. The last two factors seem less important. In contrast complexity seems to have been a definite drawback, and there is clear room here for more detailed investigation through other cases of complexity in ICT adoption. To what extent can complexity be minimised , and how does complexity impact on client reaction to ICT use?. These are questions that warrant further study.

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