

# Elicitation Techniques and Success of Software

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**Abstract** - Success or failure of any system is determined by the end users. Usability of systems for the end user decides whether software will be success or not. Usability is totally dependent on the user's requirements and these requirements are gathered from the users by elicitation techniques. The elicitation techniques are base of any system development and different methods are in use to gather requirement from users to enhance the quality of the software, which in turn make it a success in software engineering. That's why requirement gathering process is very important in software development and it needs great attention of the developer.

In this paper, we will compare methodologies of elicitation techniques of software engineering and human computer interaction, causes of system failure from end user point of view.

**Keywords:** requirements, elicitation, techniques, approaches, stakeholder, source requirements, human computer interaction, software engineering.

To understand problem of the system and software engineers and HCI designers should work together to evolve user requirements. As the elicitation is a difficult process [6] therefore software engineers should study it very technically.

Success of software depends on different factors like

- 1) How much software fulfills user requirement.
- 2) How well software satisfies the user tasks flow.
- 3) How well user requirements meet response of software.
- 4) How quickly a task for software response.
- 5) How simple is the software for the use for the user.

HCI designers can build best software by involving user of system. HCI helps to make software easy for user and error free [7]. Importance of HCI can be seen from its usability point of view in any software.

## 1 INTRODUCTION AND HISTORY

### 1.1 User Requirement and Success of the System

Success means user satisfaction and it is the main factor for the comparison of the software quality. Elicitation techniques are in practice for gathering user requirement in software engineering. Requirements elicitation is most critical and important activity in the RE process. In SDLC the right requirements is supposed to be vital but difficult part of software development projects. Hofmann and Lehner study of requirement engineering (RE) results show that success of any project is dependent on RE practices.

Elicitation techniques is the root level of gathering information from the user in software engineering (SE) diverse people of different knowledge should work for system development for better understanding and for requirements of problem. It is obvious from failure of different software elicitation must be effective. As designs and behavior vary from one organization to other organization and from one human to another, therefore problem in understanding requirement arises. In recent years human computer interaction (HCI) is being in use for designing the software's, including design for web [1], design for games [2], interaction safety critical system [3], HCI design pattern are helping UI to get improved productivity and efficient design processes. To get a well-organized and useful software [4] one should clearly understand problem area and analyze which technique can be used to solve such problem [5].

- 1) Usability from user point of view identifies that required tasks are accomplished in software or not.
- 2) Usability from developer point of view calculates success or failure of software.
- 3) Usability from the view of management determines the software required performance level for the user.

This way, HCI can view efforts cost, success or failure of the software.

### 1.2 Problem Statement

HCI focus in developing easy software for the users to make software a success. That's why SE studies the elicitation technique from SE point of view as well as user perspective. Problems in system development are result of communication difficulties.

As IT is developing rapidly software industry should make user friendly software, in this way they can achieve good position in market otherwise it will be complete failure and you will be out of the industry.

### 1.3 Objectives

HCI is study of practice of usability [8]. Objective of this work is to identify

1. Elicitation technique
2. E.T Advantages & disadvantages

3. E.T in S.W engineering
4. ET in HCI
5. Difference between SE And HCI
6. Proposing framework for HCI usability metrics

In this way we can set standards for usability thus improving the methods for measuring usability.

#### 1.4 Scope and Limitations

As today's world has become very fast and innovative, management need to look deeply about its product quality and customer needs. Developers should know about market trends plus they must aware about the fact that in today's market the only constant thing in market requirement is the change and this changes give satisfaction to the customer. To get this target they need to know well user needs in the new product and a product should be user friendly so that a user can use it as he wants and this is also the goal of HCI. This is the reason that usability is the core term in HCI. Proposed paper will be about providing some guideline for usability measure that can help for future work. I'll look for different education web domains and will identify their impact on already defined usability guidelines and standards according the users requirements. There are lots of different web domains exists where usability measures are very important to count on; in proposed paper analysis will be done by taking 4 different web domains for comparison about their impact.

## 2 ELICITATION TECHNIQUES IN SOFTWARE ENGINEERING

### 2.1 Causes of the Failure

In this research paper we will see success and failure of the system from the user's point of view. If systems are not user friendly then the systems will be great failure. Why a system cannot be a user friendly .It totally depends on the first step of the system development that is from requirement gathering. Requirement System can fail because of [9] five reasons.

1. Not properly managed resources and people.
2. Process is not systematic.
3. Documentation is not complete or appropriate or not correct.
4. Lack of proper knowledge or understanding between people.
5. Lack of proper communication between people.

According to the above reasons incomplete documentation and lack of communication leads to failure of a system. According to Macaulay [10] communication is the main reason in designing a successful system.

### 2.2 Elicitation Difficulties

According to literature study the main elicitation difficulties are divided into three areas[11][12].

1. Articulation: The way in which information is expressed [13].
2. Misunderstanding: divided interpretations on the same piece of information.
3. Conflict: multiple points of views.

These communication aspects influence each other and leads to poor requirement gathering.

System developers should develop user friendly programs. Different researches have shown that user friendly systems are getting market while others are vanishing by the time.

### 2.3 Users Satisfaction Requirements

According to the Customer Satisfaction Researches Report 2013 by The American Customer Satisfaction Index (ACSI).Each year, 70,000 customers are surveyed by ACSI about the products and services they use the most in UnitedStates. According to this report sale of Apple company products increase due to the user friendly behavior [14].According to a Novatech survey innocent computers are beaten by users to take their frustration out on their machines.[15]

When user feels helpless while using software they become frustrated and that's why they beat the machines. The research by the National Opinion Poll and the software company Symantec, found that half of computer users had become angry at some time. Almost a third of people had physically attacked a computer, 67% experienced frustration andanger and more than 70% swore at their machines[16].Therefore users' satisfaction is very important while making a system.

### 2.4 Reasons of Popularity

According to the above report it is clear that satisfaction is because of user friendly programs only those companies are gaining market which are considering user requirement and user minds the way a user think is very important while designing a product. The study of user mind starts from very initial state of software engineering that is from requirement elicitation.

### 2.5 Elicitation Techniques(ET)

Basically uncovering user needs from the stakeholder is known as elicitation. It is the process for the requirement gathering. The RE process is a set of activities for the collaboration,communication,prioritization relevant to the user.

### 2.6 ET and the application Domain

Application domain is the actually that real world in which the system will ultimately reside. When one is beginning the process of requirement elicitation one should examine the application domain [17].The application domain environment should be explored thoroughly by examining all its aspect politically, socially and other constraints related to the system. The related problems of existing work and related processes should be explained according to the goals and issues of the business.

### 2.7 Understanding the Requirements Sources

Requirements exist in variety of formats [18]. In software development projects there are a number of sources for requirements. Stakeholder, Users and subject matter experts are the main source of information about the problems and user needs. Other sources are existing systems and its processes. Manuals, forms, and reports of existing documentation can provide useful information of current system as well as requirements for the new system.

### 2.8 RE Stakeholders

The people who are affected in some way by the development and implementation of the system are the stakeholder of the system and they must be consulted while software development. Stakeholder of the system consists of individuals and groups of people that can be inside or outside of the organization. The customer, project sponsor, is the apparent stakeholder of the system. In some cases however the actual users of the system may be the most important.

Relevant stakeholders: The stakeholders that are affected by some part of the system operations are known as stakeholders if affected. In RE first steps is to analyze the entire relevant stakeholder and involve them in RE activity.

### 2.9 Methodology for the Application of Elicitation

While elicitation a problem it is found that an individual requirements elicitation technique cannot be suitable for all projects. It is a critical procedure to choose a elicitation technique for a project [19]. A variety of techniques can be used for variety of reasons in particular project [20]. It may be

- (a) Analyst best practice technique.
- (b) Analyst's favorite elicitation technique.
- (c) Elicitation technique choice is solely analyst choice, he choose such techniques which he thinks can be the best suited technique for the problem.

### 2.10 Process of Elicitation Starts

Elicitation begins when sources of requirements and the specific stakeholders have been identified by using the selected elicitation techniques. In this process scope for the system is establish needs of the stakeholder are established and the future needs should also be determined. The factors of the major objectives of the systems which satisfy the key problems of the business are also determined. Requirements elicitation process is strongly related to the objective of the project, organization, and environment [21].

Actually project start with mission statement which is informal and in complete high-level mission statement for the project [22]. To make RE a success a number of process models have been proposed for it [23]. These models leads to a generic roadmap of the process with flexibility to

comfort the basic contextual differences of different projects..

### 2.11 Requirements Elicitation Techniques in SE

From last two decades research and practice within RE in SDLC for software systems has been directed towards improving elicitation through the development of various techniques, approaches, and tools. These methods are adapted from social sciences a few have been developed for eliciting software requirements [24].

TYPE Definition	Strengths and weaknesses
Interviews Interviews are essentially human based social activities, they are inherently informal and their effectiveness depends greatly on the quality of interaction between the participants [25]	It is also a common problem with unstructured interviews to focus in too much detail on some areas, and not enough in others [26]. This type of interview is best applied for exploration when there is a limited understanding of the domain, or as a precursor to more focused and detailed structured interviews.
Questionnaires They provide an efficient way to collect information from multiple stakeholders quickly [27].	Questionnaires lack the opportunity to develop further on a topic, or expand on new ideas. In the same way they provide no mechanism for the participants to request clarification or correct misunderstandings
Task Analysis Task analysis employs a top-down approach where high-level tasks are decomposed into subtasks and eventually detailed sequences until all actions and events are described [28]	Task analysis provides information on the interactions of both the user and the system with respect to the tasks as well as a contextual description of the activities that take place.
Domain Analysis These types of investigations are particularly important when the project involves the replacement or enhancement of an existing legacy system	Problem Frames in particular provide a method for detailed problems examination in order to identify patterns that could provide links to potential solutions [29].
Introspection The technique of introspection requires the analyst to develop requirements based on what he or she believes the users and other	Introspection is only really effective when the analyst is not only very familiar with the domain and goals of the system, but also expert in the business processes

stakeholders want and need from the system	performed by the users
Repertory Grids Repertory grids involve asking stakeholders to develop attributes and assign values to a set of domain entities [30].	Repertory grids are somewhat limited in their ability to express specific characteristics of complex requirements
Card Sorting Card sorting requires the stakeholders to sort a series of cards containing the names of domain entities into groups according to their own understanding.	In this technique cards are used to assign responsibilities to users and components of the system [31]. Because entities represent such a high level of system abstraction, the information obtained from this technique is limited in its detail
Laddering When using laddering stakeholders are asked a series of short prompting questions, known as probes, and required to arrange the resultant answers into an organized structure [32].	Like card sorting, laddering is mainly used as a way to clarify requirements and categorize domain entities.
Group Work Group work such as collaborative meetings is a very common and often default technique for requirements elicitation.	Key factors in the success of group work are the makeup of participants and the cohesion within the group.
Brainstorming Brainstorming is a process where participants from different stakeholder groups engage in informal discussion to rapidly generate as many ideas as possible without focusing on any one in particular [33].	One of the advantages in using brainstorming is that it promotes freethinking and expression, and allows the discovery of new and innovative solutions to existing problems.
JAD JAD involves all the available stakeholders investigating through general discussion both the problems to	The focus of this type of meeting tends to often be on the needs and desires of the business and users rather than technical issues.

be solved, and the available solutions to those problems. With all parties represented, decisions can be made rapidly and issues resolved quickly [34]	
Requirements Workshops Requirements workshop is a generic term given to a number of different types of group meetings where the emphasis is on developing and discovering requirements for a software system [35].	Different types of stakeholders from various areas of the business, Co-operative Requirements Capture (CRC) where like JAD there is a defined set of activities and the development community is especially involved.
Ethnography Ethnography being the study of people in their natural setting involves the analyst actively or passively participating in the normal activities of the users over an extended period of time whilst collecting information on the operations being performed [36].	In practice, ethnography is particularly effective when the need for a new system is a result of existing problems with processes and procedures, and in identifying social patterns and complex relationships between human stakeholders.
Observation As the name suggests the analyst observes the actual execution of existing processes by the users without direct interference.	The effectiveness of observation and other ethnographic techniques can vary as users have a tendency to adjust the way they perform tasks when knowingly being watched.
Protocol Analysis: Protocol analysis is where participants perform an activity or task whilst talking it through aloud, describing the actions being conducted and the thought process behind them.	This technique can provide the analyst with specific information on and rationale for the processes the target system must support.
Apprenticing In this technique the analyst is taught the operations and business processes by observing, asking questions, and physically doing, rather than being informed of them, as is	The analyst becomes actively involved in the real life activities of the business.

the case with protocol analysis	
Prototyping It is common that prototypes are used in conjunction with other elicitation techniques such as interviews and JAD.	This technique is extremely helpful when developing new systems for entirely new applications.
Goal Based Approaches The fundamental premise of goal modeling and goal based approaches is that high-level goals that represent objectives for the system are decomposed into sub goals and then further refined in such a way that individual requirements are elicited.	In practice these approaches have been particularly useful in situations where only the high-level needs for the system are well known, and there exists a general lack of understanding about the specific details of the problems to be solved and their possible solutions.

Table 1:2.1: Elicitation Techniques in SE

### 3 ELICITATION TECHNIQUES IN HUMAN COMPUTER INTERACTION

#### 3.1 Human Computer Interaction(HCI)

In the past elicitation techniques were as above in the table 2.1 but today the above mentioned causes of failure and success are leading software engineers to new world of HCI. First we should know about the HCI[37].

Human-Computer Interaction is the study of interaction between human and computer and one of the key aspects of the study is usability. As Usability determines the quality of the software therefore it is very important in SE. If it applied correctly, then it reduces cost and increases the level of quality. From given definition of HCI we can divide it into three parts: Human (as user), computer and interaction.

3.1.1 User: "User", terms define a single user, or a group of users. Different users from different mental model have different ways to learn and remember things.

3.1.2 Computer: Computer here we mean appliances which use information technology which includes range from desktop and large scale computers to digital microwave oven.

3.1.3 Interaction: As humans and machines entirely different from each other but HCI tries to ensure that they both can interact successfully with each other. To get usable system you need to use the knowledge you are familiar about humans and computers, and seek suggestion from expected users throughout the design process.

The goal of HCI is to produce safe, usable systems, and reliable functional systems.

#### 3.2 HCI and SE are Entirely Different Fields

##### HCI Integration in SE

Usability is the subset of HCI and our main focus. It is undeniable that there were attempts where HCI has been suggested to be included into the SDLC visibly such as the requirements phase [38, 39] or at the design phase. However, as it has been previously mentioned before,

##### Barriers in Combining Difference between HCI and SE

HCI is entirely different field from SE. There were several barriers in combining these two Fields

	HCI	SE
Differences in requirements representation.	HCI focuses on the visual aspect when it comes to requirements interpretation.	SE is text based.
Differences in terminologies.	Scenario in HCI means story telling or narration.	Scenario in SE means how the system will be used and interacts among each other
Differences in testing.	Tests at every software development life cycle stages.	SE has its own independent stage for testing.

Table 3.1 Barriers in Combining Difference between HCI and SE

Therefore we can say that HCI is different from SE.

3.2.1 Why HCI is better than SE programming. The software crisis intensified interest in programming as a human activity. It heightened the need for more research in HCI and programmers based on Human psychology factor. Programming became recognized as an area of psychology involving problem solving and symbol manipulation in HCI.

#### 3.3 Elicitation techniques in HCI

How can we make successful software programs by using HCI is a very important question. Elicitation techniques are similar to software engineering techniques but the way of observing techniques is entirely different. SE Techniques are also part of HCI Techniques

##### 3.3.1 Following Techniques and Approaches for Requirements Elicitation are in use of HCI

1. Interviews
2. Questionnaires
3. Task Analysis
4. Domain Analysis
5. Introspection
6. Repertory Grids
7. Card Sorting
8. Laddering

9. Group Work
10. Brainstorming
11. Joint Application Development
12. Requirements Workshops
13. Ethnography
14. Observation
15. Protocol Analysis
16. Apprenticing
17. Prototyping
18. Goal Based Approaches
19. Scenarios
20. Viewpoints

### 3.3.2 New Techniques Introduced in HCI

Following new techniques are in use of HCI are [40]

#### 1. Cognitive Walkthroughs:

To determine the level of usability for a website, one or more usability experts “walk” through a set of the most typical user tasks supported by the website, one-step-at-a-time.

#### 2. Contextual Task Analysis

A contextual task analysis, or contextual inquiry, is a user research method that applies ethnographic observation and one-on-one interviewing to understand the task procedures that users follow to reach their goals.

3. Facilitated Brainstorming Most people have heard of brainstorming, and probably been involved in some type of brainstorming exercise; however, facilitated brainstorming is much different than simply gathering in a small group and sharing ideas.

#### 4. Heuristic Evaluation

A Heuristic Evaluation, or Usability Audit, is an evaluation of an interface by one or more Human Factors experts.

#### 5. Participatory Design

Participatory design exercises engage stakeholders and end users in the process of solving a design problem.

#### 6 Usability Testing

Usability testing is the best way to understand how real users experience your website or application. Unlike interviews or focus groups that attempt to get users to accurately self-report their own behavior or preferences, a well-designed user test measures actual performance on mission-critical tasks.

#### 7. Quality Assurance Testing

From our perspective, quality assurance is a subset of the overall usability goal—after all, a website isn’t usable if it isn’t working.

#### 8. HCI Design Approaches

This may be applied to user interface designs to develop user-friendly, efficient, and intuitive user experiences for humans [49].

### 3.4 How HCI Elicitation is Different from SE Elicitation

How HCI Elicitation is different from SE Elicitation?

	HCI	SE
Data	HCI is user-centric. , not data-centric. It involves users in the entire process as much as possible and it focuses on the visual aspect as well [41].	SE is not user centric, only data centric.
Differences in terminologies.	Highly interdisciplinary draws on knowledge from a multitude of areas: art, psychology, technical writing, computer science, etc. [42].	It does not involve other disciplines.
Differences in testing.	Highly iterative involves as much testing and revision as possible, especially before final implementation [43].	SE has its own independent stage for testing.

Table:3.4:Elicitation Techniques in SE

### 3.5 Usability

Usability [44]is a measure of the interactive user experience associated with a user interface, such a website or software application in HCI. A user-friendly interface design is easy-to-learn, supports users’ tasks and goals efficiently and effectively, and is satisfying and engaging to use.

An interface’s level of usability can be measured by inviting intended users of the system to participate in a usability testing session. During a usability test session, a user is given a series of tasks to complete by using the system in question, without any assistance from the researcher. The researcher records user behaviors, emotional reactions, and the user’s performance as the he attempts to accomplish each task. The researcher takes note of any moments of confusion or frustration that the user experienced while trying to complete a task, and also tracks whether or not the user was able to satisfactorily complete each task. Analysis of data from several users provides

User Experience Engineers a means of recommending how and where to re-design the interface in order to improve its level of usability and thus, the user experience in general.

### 3.6 Success of the Software and Usability Metrics in HCI

Success of software is entirely dependent on the maximum usability of the software. To measure the usability of a system different methods like GOMS (Goals, Operators, Methods, and Selection rules) is a kind of specialized human information processor model for human-computer interaction observation [47]. Following these initial steps, additional models for analysis evolved and are heavily used in the engineering-oriented usability community)is use to discover problems in the use of a system, preferably before it is released for the user. Unfortunately, it is more expensive to measure usability [48]

Usability metrics let you do following important things:

- Keep track of the Progress between releases according the objective of users obtained by elicitation technique.
- It helps to look your competitive position in market with respect to your competitors and the objective which is gained by elicitation.
- It helps in making a Stop/Go decision for you before launching the product.
- Create some extra design plans for executives and design managers. For example you can create some extra special feature for development projects like how many customers support calls are generated this year[49].

ISO standard defines usability as the “extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction” [49]. From this standard defined by ISO we classify usability measure into three subsections;

1. Effectiveness.
2. Efficiency.
3. Satisfaction.

### 3.7 Usability in SE

SE systems are designed with a focus on business goals, fancy features, and the technological capabilities of hardware or software tools. All of these approaches to system design omit the most important part of the process – the end user.

### 3.8 Usability in HCI

Usability is the process of designing a tool, such as a website’s or application’s user interface, from the perspective of how it will be understood and used by a

human user. Rather than requiring users to adapt their attitudes and behaviors in order to learn and use a system, a system can be designed to support its intended users’ existing beliefs, attitudes, and behaviors as they relate to the tasks that the system is being designed to support. The result of employing UCD to a system design is a product that offers a more efficient, satisfying, and user-friendly experience for the user, which is likely to increase sales and customer loyalty.

### 3.9 Relation between Users Requirement and Usability

User Experience Design (UXD) entails conducting user research exercises with intended users of a system. User research reveals users’ needs and preferences through user observations, one-on-one interviews, and creative activities that encourage users to express their emotions, motivations, and underlying concepts and beliefs about the steps involved in task procedures. By understanding the human emotions, motivations, and beliefs that surround a task, a user interface can be designed to accommodate and support user behaviors in a way that users will experience as natural and satisfying.

### 3.10 Success Factors in HCI and Usability

HCI Success factors are totally dependent on requirement elicitation as they measure the usability. Usability standards can be categorized entirely on the requirement elicitation as it mainly concerned with:

1. Use of the product (efficiency, effectiveness and satisfaction in a particular context of use).
2. User interface and interaction.
3. Product development process.
4. Organization capability that how to apply user centered design.

### 4 Research Motivation and Website Literature Review

## 4.CONCLUSION

HCI core term is usability and it totally dependent on the user requirements .All flow of the system should meets user requirements. Success of the system in HCI is how to improve the usability of the interactive systems. Measuring quality of the system is the core part of the system which in turn leads the organizations success. The goals of HCI are to produce safe and usable systems as well functional systems. In other words goal of HCI is to produce computer systems with high quality software. From ISO standard we classify usability measure into three subsections; effectiveness, efficiency and satisfaction.

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