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CLEERhub.org Adoption by EAFIT University Engineering Faculty Members: A Longitudinal Study

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CLEERHUB.ORG ADOPTION BY EAFIT UNIVERSITY ENGINEERING FACULTY MEMBERS: A LONGITUDINAL STUDY

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I would like to dedicate this thesis to my wife and the love of my life, Mayari, without her this journey would have been unbearable. To my parents, Miguel and Cecilia, who have always believed in my dreams and permanently provided me their support. To my sister, Carolina, who has always been my joy and motivation, and last but not least, Lilo, always devoted and truthful, you complete our lives.

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GLOSSARY

CLEERhub.org: National Science Foundation cyberinfrastructure project hosted by Purdue University Hub Platform, derivation of the original HUBzero cyberinfrastructure.

Communities of Practice: Human conglomerate where the "learning component is central" (Wenger, White, & Smith, 2009, p. 3).

Cyberinfrastructure: Technological facilitator for "distribution of the work required across the available resources, including humans" (Underwood, Smith, Luckin, & Fitzpatrick, 2008, p. 4).

Diffusion of Innovations Theory: Refers to the attempt to understand how potential adopters can receive or embrace change, how long it takes the idea to spread out, and whether the innovation is accepted, remodeled, reinvented or even rejected (Rogers, 2003).

Diffusion: The process in which an innovation is transferred over a social group by means of a communication channel (Rogers, 2003).

Hub: "Dynamic web site with many built in open source packages" (Malik, et al., 2011, p. 668) running within an open-source operative system with web server capabilities, composed also by a database for storing purposes.

HUBzero: Open-source cyberinfrastructure-based platform generated and hosted by Purdue University's Hub Technology for scientific collaboration, research and education (McLennan & Kennell, 2010).

Innovation: Any object, practice or idea that could be perceived as new by the implicated community or social system (Rogers, 2003)

Technology Acceptance Model: Subcategory of the original Diffusion of Innovations Theory from Rogers, able to understand, predict and analyze intentions and behaviors of human organizations dealing with technological innovations processes (Venkatesh & Davis, 2000)

Web 2.0: Web sites that have used more advanced technological practices compared to the original static web site design. It could also be referred as the way on how people utilize internet resources with collaboration and interaction purposes.

LIST OF ABBREVIATIONS

ADKAR: Awareness, Desire, Knowledge, Ability and Reinforcement.

CI: Cyberinfrastructure.

CLEERhub: Hub for the Collaboratory for Engineering Education Research.

CoP: Communities of Practice.

DoIT: Diffusion of Innovations Theory.

EAFIT: (Spanish) “Escuela de Administración y Finanzas e Instituto Tecnológico”. School of Administration, Finances and Technical Institute.

IRB: Institutional Review Board.

IT: Information Technology.

PCI: Perceived Characteristics of Innovation.

TAM: Technology acceptance model.

ABSTRACT

Mendez Mena, Diego M., M.S., Purdue University, May 2013. CLEERhub.org Adoption by EAFIT University Engineering Faculty Members: A Longitudinal Study. Major Professor: Alejandra J. Magana, Ph.D.

The main purpose of this study is to identify and comprehend faculty members' perception of attributes of the diffusion of the technological innovation CLEERhub.org at EAFIT University, College of Engineering, in Medellin, Colombia. Moreover, this work attempts to understand causes and motivators that might lead to innovation adoption or rejection. The Diffusion of Innovations Theory serves as the framework to develop an appropriate assessing instrument that allows accurate measuring of user opinions towards the practice of CLEERhub.org in their educational research work in Engineering. In order to correctly assess user perception of the embracement process of such technological/cyberinfrastructure innovation, the concept of Online Communities of Practice is taken also into account. Results, obtained in two collection rounds, indicate that one year after the introduction of CLEERhub the EAFIT engineering community is still located in the initial knowledge stage of the diffusion process.

CHAPTER 1. INTRODUCTION

1.1 Background and Significance

In the last decade scientific communities have identified effective ways of local and remote collaboration, and to this end, communications and information technologies have been considered the major facilitator. Web 2.0 technologies can be utilized to develop engaging learning communities where efforts are made towards the main goal of understanding (Ge, 2011). Recent technological developments are also brought to scientific and learning communities by systems and platforms called cyberinfrastructure. The continuous and vertiginous cyberinfrastructure growth has been a key player in the expansion of many scientific and educational technological platforms that have taken scientific and educational fields to a whole new collaboration level.

An example of such community in the learning and educational research domain is the Collaboratory for Engineering Education Research (CLEERhub.org), derived from Purdue University's HUBzero cyberinfrastructure. CLEERhub.org has the ability to empower scientific involvement with the engineering community by sharing valuable educational resources. In order to maintain and expand the content and the quality of the mentioned resources it was important to make them available to a wider community. The wider community can then decide if the resources and services provided by this community and respective cyberinfrastructure can be leveraged to support research and

education efforts of potential future users. However, to successfully identify its success, it is required to understand how potential users may receive or embrace change, how long it will take to the idea to spread out, and whether the innovation is accepted, remodeled, re-invented or even rejected.

Throughout the years, measuring techniques and tools have improved in order to build reliability and consistency to be able to comprehend the spread of innovations. However, straight application of existent theory related to the study of new knowledge or skills embracement by society is not considered as the best approach (Ellis-Chadwick, Doherty, & Hart, 2002) since technology innovations take place in a dynamic (Prescott, 1995) and more extended environment (Lyytinen & Damsgaard, 1998). Therefore, user embracement of information systems and/or cyberinfrastructure platforms will have to be studied by adapting the original theory to completely understand its outcomes.

The following concept map will deliver an overview of modern theories and models available to explain human behavior and reaction to introduced innovations and its mutual relationship:

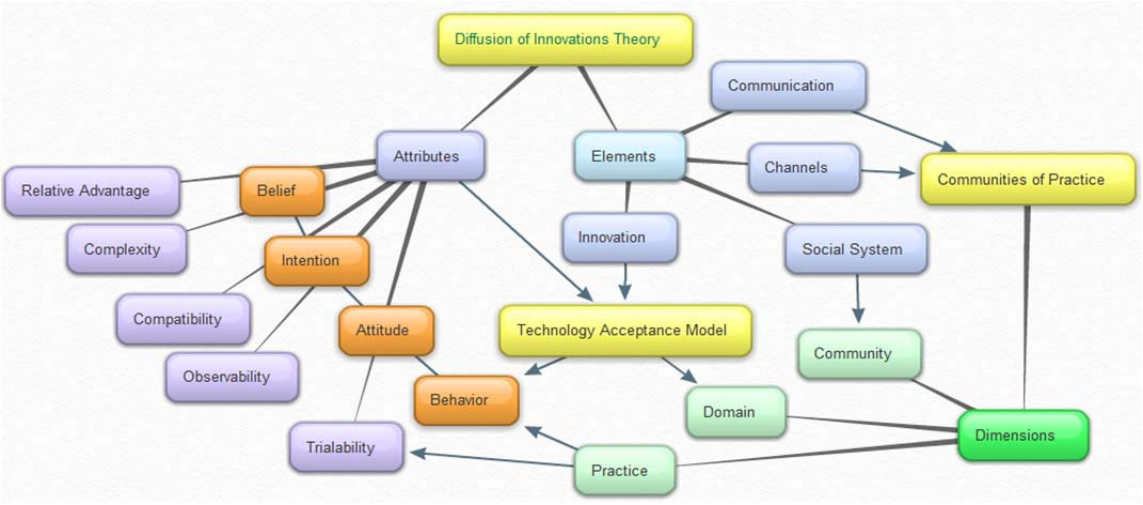

Figure 1.1 Concept map of theories and models related to innovation embracement

1.2 Cyberinfrastructure and Hubs

Scientific communities have developed in the past few years modern ways to cooperate, and one of the most interesting approaches are internet-based collaboration hubs defined as “technological innovations whose aim is to bring about a radical transformation in research” (Procter, et al., April 2006, p. 1675). Such innovations are brought by platforms also called scientific cyberinfrastructure or e-science (Procter, et al., April 2006). Cyberinfrastructure is considered to be the basis for “dynamic” clusters of individuals, organizations, and resources that are empowered by flexibility, security and collaboration, “such as computational tools and services” (Zimmerman & Finholt, 2007, p. 239). Cyberinfrastructure or CI is a technological facilitator for “distribution of the work required across the available resources, including humans” (Underwood, Smith, Luckin, & Fitzpatrick, 2008, p. 4). The main goal of CI is to enable the scientific and educational community, conducted by significant “research technologies” (Sheehan, 2008, p. 62), to produce “collaborative, engaging and realistic science activities” for a large-scale and asynchronous environment (Underwood, Smith, Luckin, & Fitzpatrick, 2008, p. 4).

Five critical technologies are embedded in the core of cyberinfrastructure:

1. “High-performance computer resources: computer clusters or supercomputers.
2. CI Applications and tools: applications that supports research.
3. Data storage and management resources: for file storage and archiving.
4. Advanced network infrastructure resources: networks that support massive data transfers in and off-campus.

5. Resources for collaboration within virtual communities: remote operation of research assets, videoconference." (Sheehan, 2008, p. 52)

1.3 The Purdue Hub Platform

Cyberinfrastructure development has played a major role in the expansion of many scientific and educational technological platforms with different purposes and goals. Purdue HUBs are technological platforms generated by HUBzero (McLennan & Kennell, 2010), which is a cyberinfrastructure-based conglomerate generated and hosted by Purdue University's Hub Technology Group "in partnership with the NSF-sponsored Network for Computational Nanotechnology (NCN) to support the first HUB, nanoHUB.org" (Malik, et al., 2011, p. 668).

HUB can be defined as a "dynamic web site with many built in open source packages" (Malik, et al., 2011, p. 668) running within an open-source operative system with web server capabilities, composed also by a database for storing purposes, or it can be looked just as simply as a "web-based collaboration environment" (Malik, et al., 2011, p. 668). All of Purdue HUBs "support collaborative development and dissemination of scientific models, running in an infrastructure that leverages a cloud of computing resources" (McLennan & Kennell, 2010, p. 49).

1.4 Collaboratory for Engineering Education Research (CLEERhub)

CLEERhub.org is a NSF research project with the objective to construct an "online community of practice" whose target are researchers in the field of engineering education with the goal to "foster interaction, collaboration, knowledge sharing and

creating" (Perova, Brophy, & Streveler, 2012, p. 2). The Collaboratory for Engineering Education Research (CLEERhub.org) derived from Purdue University's HUBzero cyberinfrastructure, consists of "an open source environment originally designed to support research communities' ability to share resources" (Perova, Brophy, & Streveler, 2012, p. 2).

Many authors have recognized CLEERhub.org as a "web-based collaboration environment" (Malik, et al., 2011, p. 668) with a user-friendly interface and characteristics that have been considered appropriate for engineering education research purposes (Streveler, Magana, Smith, & Douglas, 2010). The Collaboratory for Engineering Education Research (CLEERhub.org) provides to the engineering education research community the opportunity to share "an organized collection of tools and resources" (Streveler, Magana, Smith, & Douglas, 2010, p. 2) to foster discovery and learning for its users and collaborators (Streveler, Magana, Smith, & Douglas, 2010).

According to Malik et al. (2011), CLEERhub provides engineering education researchers with:

1. "A knowledge base with an embedded feedback mechanism.
2. A learning environment.
3. A collaboration space" (Malik, et al., 2011, p. 669).

Also CLEERhub offers the following features for the education research community:

- "Online presentations, workshops, seminars and webinars.
- New resources uploading.
- Ratings and citations.

- Content tagging.
- Wikis and blogs.
- User groups for private collaboration.
- User support area.
- Usage metrics.
- News and events.
- Feedback mechanisms" (Malik, et al., 2011, p. 668).

All listed components make out of CLEERhub.org a richer environment that raises significantly the cooperation throughout the community.

Web 2.0 technologies, such as CLEERhub.org, have demonstrated their support for cooperative and project-based knowledge development. Collaboration and co-development contribute to the continuous enhancement of the production of information (Perova, Brophy, & Streveler, 2012). The embracement of the use of modern social media provisions the proper environment to cultivate educational engagement, enthusiasm and support to the creation of new learning societies (Malik, et al., 2011). Even though CLEERhub.org, or any Hub platform, could possibly replace traditional educational approaches, its diffusion can certainly provide a valuable educational experience while pursuing the main objective to improve and distribute the achievement of knowledge (Malik, et al., 2011).

1.5 Local Context at EAFIT University and the Role of Proyecto 50

EAFIT University was founded on 1960 by local Businessmen to serve the community area of Medellin in Colombia. Today, EAFIT University is composed of five

different colleges: Management, Engineering, Sciences & Humanities, Law, and Economy & Finances. At the present time, EAFIT offers undergraduate, masters, and doctoral programs at Medellin, Bogota, Pereira and Llanogrande campuses (Universidad EAFIT, 2012).

EAFIT's "Proyecto 50" is a proposal for educational innovation with the purpose to leverage educational capabilities by modernizing their "instructional, learning and research processes" (Universidad EAFIT, 2011, p. 2). The incorporation of Information Technologies for collaboration is considered as a main component for developing strategies that are meant to fulfill their main objectives (Universidad EAFIT, 2011). EAFIT's Proyecto 50 key objectives are:

- "To develop innovative pedagogical strategies.
- To create a knowledge network.
- To build a learning community of permanent renovation." (Universidad EAFIT, 2011, p. 3)

CLEERhub.org has been found as a suitable solution to EAFIT's purpose to use Information Technologies for faculty professional development, specifically in the field of Engineering Education Research. CLEERhub attributes and resources might support faculty improvement efforts towards the fulfillment of the main goal of Proyecto 50 and EAFIT University development. The existing agreement between EAFIT and Purdue University expedites CLEERhub involvement in the current enterprise.

1.6 Statement of Purpose

EAFIT's purpose to develop faculty growth through Information Technologies mainly depends of the active interaction of its members with technological innovations. Active interaction can only be reached by fully embracement and adoption of innovation components and practices. The study then focuses on theories and models to provide the utensils to manage and understand how novelties are spread, accepted or rejected by members of a given community.

Many authors agree that the process in which innovations are spread is "one of the most important processes in cultural evolution" (Richerson, Mulder, & Vila, 1996). The difficulties encountered while inventing or developing new knowledge are intriguing. "Societies trade ideas and techniques, as well as disease organisms, genes, and commodities" (Richerson, Mulder, & Vila, 1996).

The main purpose of this project is to understand and to measure potential users' perception of the characteristics of a given technological innovation, in this case CLEERhub.org, in a social system such as EAFIT University. To this end, we will center our study in theories of acceptance and diffusion of innovations.

1.7 Research Question

The described precedents and the imperative need to spread a more interactive and globalized collaborative platform for engineering education research lead to the following research questions:

How CLEERhub attributes of the diffusion of innovation model are perceived over time by college instructors for supporting collaborative engineering education research at EAFIT University?

What are the challenges, difficulties, and motivators encountered in the diffusion of innovation process that lead to the adoption or rejection of the use of CLEERhub?

1.8 Scope

Technology Diffusion of Innovations Theory research mainly focuses on how users' perceptions influence in their decision towards a potential adoption (Moore & Benbasat, 1991). It is important to highlight that the insights to be measured are the "perceptions of using the innovation rather than the perceptions of the innovation itself" (Moore & Benbasat, 1991, p. 194) to provide a proven consistency in the research (Moore & Benbasat, 1991). All of the features of the investigation instrument can be redefined (from the original Diffusion of Innovations Theory) "in terms of the potential adopters' use, trial or observation," further on named as the Perceived Characteristics of Innovating or PCI (Moore & Benbasat, 1991, p. 196). Consequently, the instrument of this study is based on those characteristics with the proper modifications to achieve significant results.

It is essential to understand the difference between organizational and individual adoption, and their correlation in the search of the causes for embracing or rejecting innovations since it has been under-investigated (Jeyaraj, Rottman, & Lacity, 2006). Moreover, it is necessary for the assessing tool to take into account reliable predictors

(for individuals and organizations) of the adoption process as well as eminent biases determined by Rogers (2003) and Jeyaraj et al. (2006) stated in following sections of this work.

1.9 Limitations

The present study presents the following limitations:

- The author does not have control over the assignment and exposure of the innovation to the study subjects.
- All survey responses were provided in Spanish and then translated to English.
- The voluntariness of the subjects in the study is extremely valuable, given the assessment tool created, for this purpose and posterior analysis.
- Any user interaction with the author was not done in person; internet communications tools will be used for this purpose.
- The nature of the study does not allow delivering anonymous responses to the assessment tool.

1.10 Delimitations

The research on this project has been delimitated to the following:

- The study is only intended to understand users' perceptions of CLEERhub usage at EAFIT University School of Engineering.
- The results of this study are based on the comparison of the responses obtained in the first round of data collection against the ones obtained in the second round to determine a possible user behavioral modification within a one-year period.

1.11 Summary

In this chapter the author has presented an overview of cyberinfrastructure including their importance and their development by Purdue University Hub platform, including CLEERhub.org. A general overview has also been presented of EAFIT University School of Engineering and “Proyecto 50” and its relation with technological innovations. Moreover, the scope, research questions, limitations and delimitations of the present study have been exposed.

CHAPTER 2. REVIEW OF LITERATURE

In the following section the author provides relevant information of current theories and models that will assist to understand the Diffusion of Innovations Theory, its elements (innovation, communication channels, time, and social system) and variations. The concept of the Technology Acceptance Model (TAM) is also going to be delivered; TAM specializes on predictions of human behavior towards the diffusion of technological systems.

Research works on cyberinfrastructure and its embracement by the scientific community are mentioned as well. The specialization of these technological platforms needs a deeper examination on how they diffuse throughout the public.

In order to provide insightful analysis of how the innovations are adopted or rejected by the community, the concept of Communities of Practice delivers substantial investigative tools to achieve the goals of the study.

2.1 Diffusion of Innovations

The process in which an innovation is transferred over a social group by means of a communication channel is called Diffusion. An innovation can be considered as any object, practice or idea that could be perceived as new by the implicated community or social system (Rogers, 2003). Rogers' Diffusion of Innovation model refers to the

attempt to understand how potential adopters can receive or embrace change, how long it takes the idea to spread out, and whether the innovation is accepted, remodeled, re-invented or even rejected. The adoption is made by "decision-makers, who have resources and the decision rights to change behaviors, or control resources associated with development practices" (Mustonen-Ollila & Lyytinen, 2003, p. 276).

Research on how individuals react to new ideas, processes or concepts began in Europe in the early 1900's. Diffusion of innovation modern ideas and research was developed in the 1950's and 1960's in order to explain how individuals accept change and how to make it happen in a smoother and even in a faster way. Since then, many studies have been done from different point of views and fields, such as anthropology, sociology, education, public health, communication, marketing, geography, etc. The diffusion of innovation model has been used as a theoretical framework of numerous studies with significant results. The effective use of the model requires the study and application of their components.

The diffusion of a new idea, according to Rogers, has four elements that can be expressed and related to the main concept of the diffusion procedure, for instance, defining the diffusion process as "(1) an *innovation* (2) that is *communicated* through certain *channels* (3) over *time* (4) among the members of a *social system*" (Rogers, 2003, p. 11).

The diffusion process is measured primarily on time units, which in most of the occasions is more visible and tangible. For instance, some of the innovations could take only a few months and others could last over decades to be approved or even rejected. The process of the diffusion of an innovation measured through time always produces an

s-shaped curve that depicts four categories of individuals who are part of the process. The categories are: (1) innovators (2) early majority, where the curve starts to take off, (3) late majority, where most of the individuals have accepted the innovation, and (4) laggards, where the curve reaches its limit. This categorization can help to identify the characteristics of individuals on each stage of the diffusion process, and to determine the potential causes that make individuals embrace or reject a new idea or innovation (Rogers, 2003). However, there are some other constituents and characteristics to be addressed in order to understand the adoption rate of an innovative process. Rogers described in his theory the "adopting units", which can be expressed as the main factors that can influence or affect potential adopters in the diffusion of innovation process. The adopting units are: "(1) innovation factors, (2) individual factors, (3) tasks factors, (4) environmental factors, and (5) organizational factors" (Mustonen-Ollila & Lyytinen, 2003, p. 278). These characteristics bring upon a more specialized view of the perception of the diffusion and the rate of adoption, that Rogers calls attributes. The perception of the diffusion and the rate of adoption can be characterized by attributes as individuals interact with innovations. These attributes are classified by Rogers (2003, p. 15-16) as the following:

- "Relative Advantage": Refers to the degree in which the innovation is observed as better than its predecessor.
- "Compatibility": Is the degree of consistence with the adopters needs based on values or previous experiences.
- "Complexity or Ease of Use": Measures how difficult is to comprehend and to use.

- “Trialability”: Is the degree in which the innovation can be experimented on a limited environment before its complete use.
- “Observability”: Can be stated as a measure of visibility to other members inside the social system.

Also, many authors have deepened even more into this classification. For instance, when referring to the diffusion of technological innovations, Mustonen-Ollila and Lyytinen categorized the innovation process based on their “scope, purpose and content” as follows:

- “Project management and control procedures”
- “Description methods”
- “Development tools”
- “Baseline technology innovations”

As presented, these categories align their bases as “technological” or “administrative” innovations (Mustonen-Ollila & Lyytinen, 2003, p. 276).

Mustonen-Ollila and Lyytinen also analyzed the diffusion of innovation theory evolution and divided it into four generations to better understand its aftermath in order to deduct a research model. These generations are listed by time and by its most relevant constraints (Mustonen-Ollila & Lyytinen, 2003, p. 276):

1. From the late 1940s to the mid-1960s, faced “hardware constraints”.
2. From the mid-1960s to the early 1980s, categorized by “software constraints”.
3. From early 1980s to the beginning of 1990s, produced by “user relationships constraints”; and
4. From the beginning of 1990s, driven by “organizational constraints”.

In order to perform a successful study of diffusion of an innovation, researchers must be aware of two main stages of the diffusion process when referring to individuals. The first one is called *The Innovation-Development Process* which states the origin of the innovation (e.g. recognized a problem or need, research, development, etc.). The second one is called *The Innovation-Decision Process,* which defines the stages where an individual passes from the initial knowledge to making a decision to accept or reject an innovation, and its confirmation (Rogers, 2003). The main activities of the process are "initiation and implementation" separated by the embracing choice (Mustonen-Ollila & Lyytinen, 2003, p. 278). Correspondingly, Rogers (2003, p. 171-189) divides the entire Diffusion of Innovation process in five stages:

1. The knowledge stage, where the innovation is disclosed and the individual gets initial understanding.
2. The persuasion stage, in which the individual starts to take a position toward the innovation.
3. The decision stage, where the individual perform activities that would lead to confirm or reject the innovation.
4. The implementation stage, where innovation-related activities are performed preceded by a behavioral change.
5. The confirmation stage, in which the individual looks to reinforce the decision already made, that can actually change if conflicts appear.

This partition of the diffusion process can help understand and quantify individual and organization behavior towards an innovation. However, there are many authors that do not totally agree with Rogers' theory when it tries to explain technological diffusion

processes. Numerous technology diffusion processes are not consistent nor have well-defined limits (Lyytinen & Damsgaard, 1998). Lyytinen and Damsgaard have found six conjectures that critique Rogers' model. First of all, when discussing Rogers' innovation model, the project under study from whose conjectures were derived, had identifiable "separate, distinguishable and objective features" (1998, p. 5). In second place, technology was transferred from an "independent innovator" to the adopter through an "ether or diffusion arena" (1998, p. 5). Third, the decision made by an adopter was considered an "isolated" choice that was molded by "push and pull" reasons (1998, p. 5). In fourth place, the pronouncement about accepting or rejecting an innovation pursued a "rational calculus" based on observation of the technological characteristics available through communication networks (1998, p. 5). Fifth, the diffusion process was evolutionary, determined by "pull and push forces" that can be recognized by "changes in the adoption rate" (1998, p. 5). Finally, the authors indicated that the time scale was not very long and that the history of previous diffusion processes was not important (Lyytinen & Damsgaard, 1998). All of these aspects need to be taken into account to address the process and its consequences correctly since the technology diffusion of innovation process usually takes place in a more dynamic and radical environment, limited by organizational political boundaries (Lyytinen & Damsgaard, 1998).

2.1.1 Use of Cyberinfrastructure as a Diffusion of Innovations Process

In order to determine the different ways a technological innovation, such as CLEERhub, is embraced by a social system, a new approach is necessary (Malik, et al., 2011). According to Rogers this type of innovation consists of knowledge, persuasion,

decision, and implementation stages in order to be completely adopted, in some cases rejected or modified to the varying requirements of the users, and then presented again to the community (Dron, 2007).

Cyberinfrastructure platforms try to fulfill a purpose using technology innovations to foster education, research, scientific collaboration, and more. One of the more interesting ways to apply this kind of novelty is for educational purposes, where the technology exists but the results are way off of the desired ones. There are some researches who indicate that one of the biggest obstacles when trying to apply innovations for academic purposes is the unwillingness of faculty to use technology. Data shows that despite the fact that 80% of public 4-year colleges have available academic management tools based on technology or information systems, only 20% of faculty actually use them in their coursework (Bennett & Bennett, 2003). The pedagogical doubts and the "amount of time and effort" necessary to actually develop a significant learning experience for students, makes the issue a priority to be addressed by project stakeholders (Bennett & Bennett, 2003). The study will try to explain the facts behind the outcomes of the present technological diffusion.

It is important also to state the shortcomings and biases that could possibly appear when trying to study or implement an innovation. In first place, the "pro-innovation bias" (Rogers, 2003, p. 106) implies that not all innovations should be quickly adopted by all of the members of a social system. In second place, the "individual-blame bias" (Rogers, 2003, p. 118) is a tendency to blame an individual for not adopting the innovation instead of the social system where the individual is an active part. In third place, the "recall problem" (Rogers, 2003, p. 126) leads to inaccurate data when individuals have

experienced the diffusion process a long time ago. And last but not least, the "issue of equality" (Rogers, 2003, p. 130) where it is important to consider the socioeconomic and cultural gaps existent inside a social system and may influence the diffusion process (Rogers, 2003). Cultural differences have also important consequences to the technology adoption process, and they should be analyzed (Olaniran, 2011).

2.1.2 Technology Acceptance Model (TAM)

User embracement of cyberinfrastructure is fundamental, and the Technology Acceptance Model (TAM), a subcategory of the original Diffusion of Innovations model from Rogers, can help to understand, predict and analyze intentions and behaviors of the human organization where it takes place (Venkatesh & Davis, 2000). Hence, the study of human interaction, behavior, and acceptance has many edges to be addressed. The study of the technological adoption process, in which the project is going to be based, has some other implications that make it different from others. According to Xun Ge, what she calls "emerging technologies" (2011, p. 507) empower people to be more insightful and ingenious (Ge, 2011). Therefore, we need to make a different approach, where people gather in communities with the purpose to fulfill their need for technological knowledge and innovation.

2.2 Communities of Practice

Wenger, White and Smith (2009, p. 3) defined "communities of practice" as a conglomerate where the "learning component is central" (2009, p. 3). A community of practice (CoP) is the place where open participation sponsors the community knowledge

and endorses the individual understanding (Ge, 2011) (Law, Ge, & Eseryel, 2011). However, it has been identified that just providing the tools to interrelate “does not necessarily mean that members of a group will use those features” (Malik, et al., 2011, p. 680).

The behavior of individuals, and their active participation for a prosperous community, is shaped by five causes according to McLeroy et al.: “(1) Intrapersonal, (2) Interpersonal processes, (3) Institutional factors, (4) Community factors, and (5) Public Policy” (McLeroy, Bibeau, Steckler, & Glanz, 1988, p. 355), basics for Roger’s diffusion of innovation model compliance and correct understanding.

In order to define the system in which a Community of Practice releases a space for community learning, Wenger et al. in their book “Digital Habitats” (2009) have determined three basic dimensions:

- Domain, “a set of issues, challenges and passions through which members recognize each other as learning partners” (p. 5).
- Practice, which can be look as engaging on a “fairly complex set of learning activities” (p. 7).
- Community, which can be defined as a trusted “commitment to domain and practice” (p. 8) which includes “diversity”, “engagement” (p. 8), “peripheral participation” (p. 9), and “leadership” (p. 10).

2.2.1 Online Communities of Practice

A cyberinfrastructure platform could be considered as an online collaboration tool used by individuals with a specific purpose to fulfill. That leads us to the demarcation of

online community of practice, which can be viewed as a more effective community of practice (CoP) (Johnson, 2001), due to its time and location independence (Sherer, Shea, & Kristensen, 2003). Virtual communities of practice are characterized by its "ease of access" (Ruberg, Cummings, Piecka, Ruckman, & Seward, 2011, p. 617). Moreover, they are conformed "around a shared interest in a particular topic" (Ruberg, Cummings, Piecka, Ruckman, & Seward, 2011, p. 603). The technologies available in Web 2.0 can be utilized to develop an engaging virtual learning community where "everyone is involved in a collective effort of understanding" (Ge, 2011, p. 508). A successful online CoP also may also avoid obstacles such as underutilization and low return on investment.

An important aspect of an effective online CoP, so it can be successfully diffused, is its ability to provide a dynamic participation of all of its members so it can build reciprocal knowledge in the community (Hsu & Ching, 2011)Summary

The literature reviewed in this chapter provides valuable information to define and clarify concepts of the Diffusion of Innovation Theory and its variations. The concept of Communities of Practice will provide analytical tools to better understand the diffusion process.

Given the information found in this chapter the study will focus now on the applicability of Rogers' theory. The next section will eventually deliver valuable information to create and adapt an assessment tool that permits close measure of the entire embracing process.

CHAPTER 3. THEORETICAL FRAMEWORK

3.1 Diffusion of Innovations Theory

In the last 60 years, theoretical and empirical studies have been developed and published in order to understand, analyze, measure, and clarify the innovation process by embracing the Diffusion of Innovations Theory. Moore and Benbasat (1991) agreed that the best methodology to construct a Diffusion of Innovations instrument is to efficiently apply the theory so "validity and reliability" could be found in its outcome (Moore & Benbasat, 1991, p. 192).

Jeyaraj et al. (2006) came up with ten "prescriptions" to deliver a suitable assessment tool when trying to explain and explore technology Diffusion of Innovation. These points are categorized by its analysis as predictors, linkages and biases, which are listed as follows:

"Predictors

1. Continue to use the best predictors of individual IT adoption: Top Management Support, Computer Experience, Perceived Usefulness, Behavioral Intention, and User Support.
2. Continue to examine promising predictors of individual IT adoption, including System Quality, Professionalism of the IS Unit, User Training, Computer Self-

Efficacy, Outcome Expectations (performance), Outcome Expectations (personal), Perceived Behavioral Control, and Problem Importance.

3. Continue to use the best predictors of organizational IT adoption: Top Management Support, External Pressure, Organizational Size and External Information Sources.
4. Continue to examine promising predictors of organizational IT adoption, including Environmental Instability, Top Management Characteristics, System Quality, User Training, Experience, Quality Orientation, Administrative Intensity, Career Ladder, Managerial Training, Middle Management Support, and Customer Support.

   Linkages

5. Use individual characteristics in organizational adoption studies to assess the characteristics of individuals within organizations that facilitate IT adoption, including Champions, Management, and Users.
6. Use environmental characteristics in individual adoption research.
7. Increase the study of Rate of Adoption as a dependent variable in individual adoption research.

   Biases

8. Increase the study of Outcomes as a dependent variable in both individual and organizational adoption research to overcome the pro-innovation bias.
9. Increase the study of Actual System Use as a dependent variable in both individual and organizational adoption research to overcome the self-reporting bias.

10. Increase the study of non-adopters to overcome the adopter bias in individual adoption studies" (Jeyaraj, Rottman, & Lacity, 2006, p. 2).

Jeyaraj et al. study also confirms that Rogers' theory is appropriate to evaluate individual and organization adoption triggers (Jeyaraj, Rottman, & Lacity, 2006). Based on previous work, Hsu et al. (2007) elaborated a research model of technology Diffusion of Innovations that is constituted by the most appropriate "constructs" or attributes (from Rogers theory) which fit very well in the present work. Figure 2.1 explains it better (Hsu, Lu, & Hsu, 2007, p. 716).

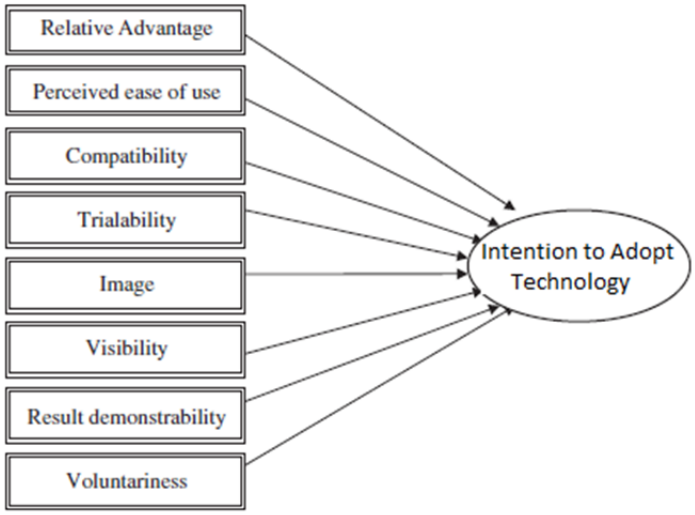

Figure 3.1 Adapted Research model (Hsu, Lu, & Hsu, 2007).

Longitudinal studies have demonstrated to be more effective when trying to identify the diffusion process, since they could explain the moments when decisions about embracing take place "involving a perspective with several adoption environments and factors" (Mustonen-Ollila & Lyytinen, 2003, p. 278).

3.2 Diffusion, Cyberinfrastructure and Communities of Practice

As previously discussed in this section, technology innovations cannot be assessed by the straight and original Rogers' Theory of Diffusion of Innovations; some modifications are needed in order to accurately understand the diffusion process. If the objective of this work is to analyze and understand the innovation embracing process in cyberinfrastructure as part of a community of practice (CoP), then an even more specialized examination tool is necessary.

In order to corroborate the success in the adoption of a cyberinfrastructure as part of a CoP, two main components need to be addressed: *impact and effectiveness* (Hacker & Magana, 2011). "Impact of cyberinfrastructure" (Hacker & Magana, 2011, p. 3) refers to the amount of individuals in the CoP who actually experiment, evaluate, and make a habit out of the technological platform and in a coarse way shows its influence. "Effectiveness of cyberinfrastructure" denotes the "manifestation over time" of the "impact" that a certain cyberinfrastructure has made on the community that truly modifies "education and research productivity" (Hacker & Magana, 2011, p. 4). Both components may be quantified using Rogers five stages of technology adoption, stated on section 3.1, by assessing the "impact" and prudently correlating it to the "effectiveness" by the end of the mentioned phases. Some quantitative metrics used by Hacker and Magana (2011) in their study over cyberinfrastructure diffusion in each of the stages are: "the number of visitors to a website, the number of times a software tool was downloaded or used, the amount of data uploaded and downloaded, and user satisfaction surveys" (Hacker & Magana, 2011, p. 5). Similarly, qualitative metrics are obtained by open-

ended questions in surveys, focus groups sessions and interviews of individuals involved in the diffusion process.

The main purpose of this project is to understand and to measure the rate of adoption of a technological innovation in a social system (dependent variable), focusing on the attributes of innovations stated before, such as complexity, compatibility, trialability, etc. (independent variables).

3.3 Summary

This chapter provides an insight of the Diffusion of Innovations Theory, as well as its pros and cons when applied to technological innovations.

CHAPTER 4. METHODS

4.1 Rationale and Significance

Diffusion of Innovations Theory coined by Rogers (2003) has demonstrated to be a reliable and accurate when appreciating characteristics of the perceptions of potential users towards an innovation. However, Rogers' theory has also fallen short when dealing with technological innovations due to a more dynamic an unstable envelopment where such innovations take place and Rogers (2003) has not directly addressed (Lyytinen & Damsgaard, 1998).

Hsu et al. (2007) have developed an assessing tool on perceptions of attributes for subjects dealing with technological innovations addressing many of the shortcomings of Rogers' theory. Hsu et al. (2007) used a multiple-choice and Likert-scaled survey that deals with users' perceptions of innovation attributes in order to determine their influence in the diffusion process. Such work has obtained interesting results while presenting valuable "predictors of adoption intention" (Hsu, Lu, & Hsu, 2007, p. 722). Hacker and Magana's work (2011) provides also a valued outline that helps to determine users' behavior on each one of the Diffusion of Innovations stages not only for technology but also for cyberinfrastructure embracement.

Given previous experiences and conditions, the author has determined that a survey-based longitudinal study has the potential to determine accurately the perceptions and influences that determine the adoption or rejection of CLEERhub diffusion.

4.2 Participants

The participants were selected from a population of faculty members in the field of Engineering Education from EAFIT University Medellin Campus, ninety one faculty members were considered as the sample universe, in theory. The following table gives a clear idea of the participants:

Table 4.1 Faculty Members from EAFIT University School of Engineering

Participants	Gender	Research Field	CLEERhub Experience
	Male n=74		Yes n=0
Faculty		Engineering n=91	
	Female n=17		No n=91

However, out of the entire faculty population only forty of them were invited to participate in the introductory workshop and following collaboration events, including department heads and the Dean of the School of Engineering (Zea, Magana, Lalinde, Toro, & Bueno, 2013). Thus, in practice, the sample universe will be considered as forty.

4.3 Data Collection Methods

At first, the study is going to be quantitative in order to measure users' perceptions and the stages of the process of adoption of scientific collaborating tools

existing at CLEERhub.org. However, the second part of the assessing instrument contains open-ended questions for personal experiences and comments on the innovation process that need coding, classification and a qualitative analysis.

The design is classified as quasi-experimental because the treatment cannot be assigned randomly and the groups are already conformed. The sampling was performed every twelve months in a period of one year, during this time two rounds of data were collected. A longitudinal study was carried out in order to track the habits of the participants (Ellis-Chadwick, Doherty, & Hart, 2002). Survey questions are modifications of the ones found in the work of Hsu et al. (2007) and in the content of Hacker &Magana (2011). The survey was based in the attributes described by Rogers, which are the following: relative advantage, compatibility, complexity, trialability, observability or visibility (Hsu, Lu, & Hsu, 2007).

4.3.1 Institutional Review Board (IRB)

Since one major component of this study is human interaction through surveys an IRB application has been submitted by December 2012 and approved on January 15th, 2013with IRB protocol number 1212013065 (Appendix A).

It is important to mention that due to the nature of the study, survey responses could not be taken as anonymous. However, personal information will be treated as confidential, and the results presented in this study will not publish any kind of records that could be related to the subjects of the study.

4.3.2 Survey

On each of the two collection rounds the following survey questions were provided to the participants with minor modifications depending on the collecting round:

Table 4.2 Survey Question and Sources

Number	Question	Type	Source and Variable
	Informative		
1	What is your CLEERhub username?	Open	N/A
	Which of the following best describes your perception about CLEERhub? a. Before the knowing about CLEERhub, I felt interested in the use of collaboration tools for engineering education, even though the environment is not mature. b. I decide to use CLEERhub in the basis of my intuition or imagination. The use of this platform will be useful. c. I hesitate to use CLEERhub wondering if it will become popular. I will not use this tool till I am sure of the completeness of the function. d. I hesitate to use CLEERhub wondering if it will become popular. I will not use this tool till I am sure of the completeness of the function. e. I will not use CLEERhub even if it becomes popular. However, if the tool incorporates some other functionality I will think about it.	Multiple Choice	Hsu et al. (2007) User Categorization
Attribute Perception			
1	I am knowledgeable of the purpose and resources that CLEERhub offers to its users.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Relative Advantage

Table 4.2 Continued.

2	My superiors expect me to use CLEERhub.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Voluntariness
3	I intend to keep using CLEERhub voluntarily.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Voluntariness
4	Using CLEERhub enhances my performance in my research in engineering education.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Relative Advantage
5	Using CLEERhub increases my productivity in engineering education or engineering education research.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Relative Advantage
6	I find the use of CLEERhub advantageous in my research in engineering education.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Relative Advantage
7	Using CLEERhub fits well in the way I work.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Compatibility
8	Using CLEERhub is related to my daily activities.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Compatibility
9	Using CLEERhub improves my visibility within my research community or organization.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Image
10	People in my organization or community who use CLEERhub have a high profile.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Image
11	Learning to use CLEERhub is easy for me.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Ease of Use

Table 4.2 Continued.

12	My using of CLEERhub requires a lot of mental effort.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Ease of Use
13	Using CLEERhub is often frustrating.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Ease of Use
14	My interaction with CLEERhub is clear and understandable.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Ease of Use
15	Uploading and downloading information from CLEERhub is easy for me.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Ease of Use
16	I believe I could communicate to others the consequences (advantages, scope and constraints) of using CLEERhub.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Demonstrability
17	I am aware of the consequences of the use of CLEERhub.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Demonstrability
18	I can form a favorable opinion about the use of this technology.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Compatibility
19	I would recommend the use of CLEERhub to other colleagues.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Compatibility
20	The results of using CLEERhub are apparent (clear) to me.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Demonstrability
21	Before using CLEERhub I was able to try it.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Trialability

Table 4.2 Continued.

22	I know where I can go to satisfactorily try out various uses of CLEERhub.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Trialability
23	I have seen the result of what others can do using CLEERhub	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Visibility
24	I have seen other colleagues using CLEERhub.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Visibility
25	Using CLEERhub makes my work visible.	Multiple Choice - Likert Scale of 5	Hsu et al. (2007) Visibility
Use Frequency			
1	In average, how often do you use CLEERhub in general? a. Frequently (more than once a week or twice). b. Every once in a while (once or twice every other week). c. Occasionally (once or twice per month). d. Rarely (once or twice in six months). e. Never.	Multiple Choice	Hacker & Magana (2011) Stages of Adoption - Impact
2	How often have you used or downloaded CLEERhub resources (e.g., software tool, document, database, video, or publication)? a. Frequently (more than once a week or twice). b. Every once in a while (once or twice every other week). c. Occasionally (once or twice per month). d. Rarely (once or twice in six months). e. Never.	Multiple Choice	Hacker & Magana (2011) Stages of Adoption - Impact

Table 4.2 Continued.

3	Have you incorporated some of the resources (software tool, document, database, video, or publication) available at CLEERhub into your work in engineering education? a. Frequently (more than once a week or twice). b. Every once in a while (once or twice every other week). c. Occasionally (once or twice per month). d. Rarely (once or twice in six months). e. Never.	Multiple Choice	Hacker & Magana (2011) Stages of Adoption - Impact
4	Have you made any kind of contributions to CLEERhub of data, documents, tools, learning modules, or publications that resulted from your work in engineering education? a. Frequently (more than once a week or twice). b. Every once in a while (once or twice every other week). c. Occasionally (once or twice per month). d. Rarely (once or twice in six months). e. Never.	Multiple Choice	Hacker & Magana (2011) Stages of Adoption - Impact
Personal Experience			
1	How do you think that the implementation of CLEERhub in your organization or personal work has been a Success? Why do you believe so?	Open	N/A
2	How do you primarily use CLEERhub as resource for engineering education research and collaboration?	Open	N/A
3	How or in which ways was the integration of CLEERhub challenging for your organization?	Open	N/A

Table 4.2 Continued.

4	If any changes need to be done to CLEERhub in order to be more effective or helpful to you or your organization, what would they be?	Open	N/A
5	Would you consider keep using CLEERhub in the future for engineering education research and collaboration? What CLEERhub's features or functionality have influenced your decision?	Open	N/A
6	Do you have any other comments for us?	Open	N/A

All questions were previously translated to Spanish to eliminate language limitations or misperceptions (Appendix B). The translation to Spanish was validated by four Spanish-speaking educational researchers.

In addition, two interviews were conducted with the Dean of the School of Engineering and the Director of "Proyecto 50". The questions for both interviews were the following:

1. What are the educational initiatives that are taking place in EAFIT's School of Engineering?
2. What is the role of "Proyecto 50" in the initiative described above?
3. What is the role of CLEERhub as part of the initiative?
4. What actions have been taken to socialize and implement the existing innovation and execute current strategies?
5. What are the resistance actions or limitations of the new changes?
6. What were the lessons learned? What would you change?

4.4 Validity and Reliability of the Instrument

The author has developed the survey instrument grounded on specific research goals and based on previous review of literature. Specifically, Hsu et al. work (2007) has established instrument reliability applying the Cronbach alpha coefficient (Cronbach , 1951) resulting on satisfactory levels of reliability (Hsu, Lu, & Hsu, 2007). Also, the instrument was validated by executing a factor analysis "to investigate the distinction among perceived attributes" (Hsu, Lu, & Hsu, 2007, p. 719) within acceptable levels of construct validity.

The scales for five key Diffusion of Innovations attributes (relative advantage, compatibility, complexity, observability, and trialability) were also obtained relying on Moore and Benbasat work (1991), which were subject to an intensive and rigorous process of validation and reliability.

Additionally, the Spanish version of the assessing instrument was reviewed by three educational researchers from the Colombian scientific community. Moreover, validations of the assessment instrument and interview questions were also provided by the two Purdue University researchers, who are also native Spanish speakers.

4.5 Procedures

The data was collected at EAFIT University, by conducting a survey to instructors of the field of engineering education. The participation in the study was voluntary. The data was collected two times in a period of one year. The first data collection is (time 0) at the beginning of the year, the second one (time 1) at the end of the year.

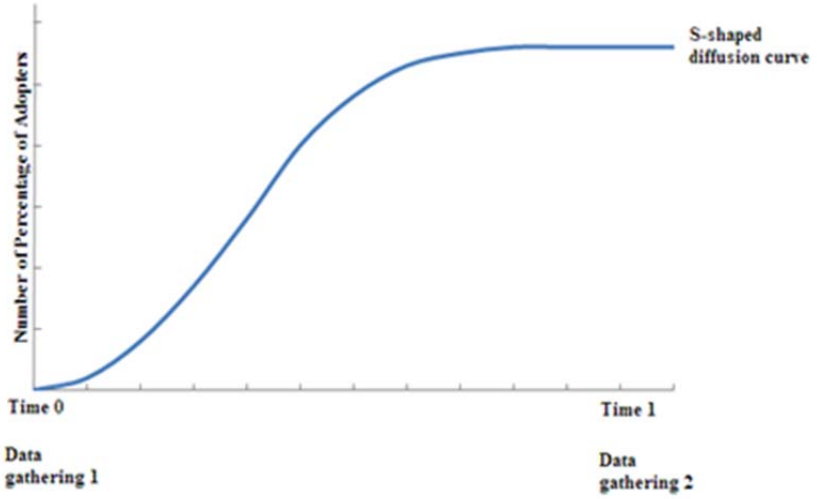

Figure 4.1 Research Design, Collection of Data. The S-shaped diffusion curve is expected according to Rogers (2003).

The participants had to answer a multiple choice as well as open-ended questions. The survey was prepared on-line using the Purdue Qualtrics system, which is a web-based survey software. This tool was selected because of its availability and accessible resources. The questionnaire will be distributed by a post on the home webpage of the collaboration tool. All potential participants have an account in webpage of the collaboration tool. Moreover, at the end of the study, two of the main actors were interviewed to provide further analysis and insights of the diffusion process, the thoughts of Dean of the School of Engineering and the Director of "Proyecto 50" will be part of that section.

4.6 Data Analysis

The respondents were classified into five categories on the basis of their behaviors concerning the use of the tool CLEERhub. These categories are the following: innovator,

early adopter, early majority, late majority, and laggards. Additionally to these attributes, habits of frequency were also analyzed (Hacker & Magana, 2011).

Each “Attribute” question was responded and then scored by means of a five-point Likert scale, ranking from “totally agree” (1) to “totally disagree” (5). The frequency of use of the tool will be measure in a scale from 1 to 5 and the answer options vary in every question.

In order to define the differences between the attributes of the rate of adoption Symmetry and McNemar’s tests were held comparing both samples. Also, an Analysis of Agreement will be executed using the SAS system to support further analysis .

During the second part of the survey, personal experiences towards the innovation process were requested in order to determine motives, reasons and causes that lead to adoption or rejection, including both interviews to the Dean of the School of Engineering and the Director of “Proyecto 50” at EAFIT University. The answers to these questions were evaluated and a categorical analysis approach was used for analysis.

The present study focuses on the innovation process from a longitudinal point of view where adoption factors and their environment are taken into account. The study pays attention to the time locations where the adoption decisions are made as well as the specific decision group (Mustonen-Ollila & Lyytinen, 2003). For the qualitative part of the study, the responses were studied and classified in order to determine the adoption or rejection of CLEERhub use.

4.7 Data Collection and Analysis Timeline

The following Gantt Diagram presents an overview of the data collection and analysis process for future reference:

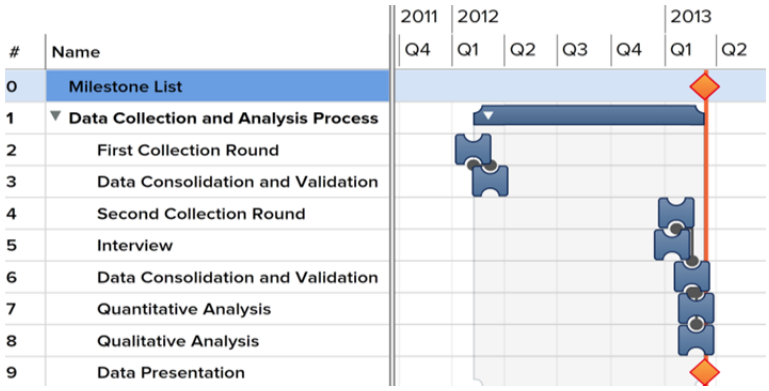

Figure 4.2 Gant Diagram of the Data Collection and Analysis Process

4.8 Summary

This chapter contains relevant information regarding methods and procedures that will try to provide significant results so further analysis could be performed.

CHAPTER 5. COLOMBIAN ECONOMIC, SOCIAL AND EDUCATIONAL CONTEXT & THE ROLE AND GOALS OF EAFIT UNIVERSITY

A worldwide phenomenon called globalization has generated a wide and deep impact in today's society and higher education institutions are not exempted. In this context, globalization has created numerous new challenges, where internationalization has been taken as a response to confront the inevitable tendencies of this global event. Latin America and its education institutions are part of this effort to overcome globalization difficulties, and yet, the region is still struggling with lack of support, resources, equality, opportunities and even quality of its education programs.

5.1 Higher Education in Latin America

Globalization and its reactions, such as internationalization, have brought up different edges to tackle Latin America's higher education issues. Internationalization has produced the mobility of the most and well educated individuals in the region (Wit, 2005) which has created antagonistic consequences. Access to up to date technology, new business opportunities and novel academic openings could be considered as beneficial. However, the mobility of those talented individuals has also "eroded the knowledge base of the region" (De Wit, Jaramillo, Gacel-Avila, & Knight, 2005, p. 39). Emigration has taken a significant portion of the educated population of Latin America (De Wit, Jaramillo, Gacel-Avila, & Knight, 2005).

Lack of resources combined with the deficiency of educated personnel and "underdeveloped plans of study" have weakened the foundation of college education in the continent (De Wit, Jaramillo, Gacel-Avila, & Knight, 2005, p. 47). In average, only 23% of Latin Americans are enrolled in tertiary institutions (De Wit, Jaramillo, Gacel-Avila, & Knight, 2005). New strategies and implementations need to be applied with the aim of addressing these issues, and maintain a respectable quality level of education, which can generate a definitive and sustainable trail to economic and social development (De Wit, Jaramillo, Gacel-Avila, & Knight, 2005).

However, higher education in the region has experienced a continuous growth in the last few decades, today's Latin American college students look for diversity in their interests for knowledge (Wit, 2005). Nevertheless, universities cannot keep up with this movement if there is not a proactive integration of new and creative teaching methods and educational contents based on technological development (Giraldo, Abad, & Díaz, 2007).

5.2 Higher Education in Colombia

Colombian issues are not different from the ones encountered in the region. In the last two decades, Colombian higher education institutions began their path to internationalization after a historic economical opening process of the country to the world (De Wit, Jaramillo, Gacel-Avila, & Knight, 2005).

From the early 90s, Colombian universities have been through numerous transformations, especially after the implementation of "Ley 30" in 1992. "Ley 30" tries to modernize, diversify and increase the access to education by the creation of regulatory

institutions which assure the quality of higher education institutions (Giraldo, Abad, & Díaz, 2007). Nevertheless, internationalization efforts have not been efficient enough due to a lack of planning that could lead to competent government policies in a society that demands new opportunities in a borderless academic world (De Wit, Jaramillo, Gacel-Avila, & Knight, 2005).

According to Giraldo (2007), in order to overcome the current challenges in front of the Colombian higher education system, it is necessary continuous learning schemes backed up with rapid processes and structure innovation.

5.3 EAFIT Role in Colombia

Besides all flaws and shortcomings of Colombian universities, "the development of institutions of higher education in Colombia, that have been addressed by private organizations, has been much faster than the one experienced in Latin America overall" (De Wit, Jaramillo, Gacel-Avila, & Knight, 2005, p. 182).

EAFIT University, as a private institution, has not fall behind pursuing academic excellence. After the constitutional approval of "Ley 30" in 1992, EAFIT University has defined their objectives based upon the integral education of Colombians, the provision of quality community service and knowledge transmission to address and meet the needs of the country (Universidad EAFIT, 2012). The commitment of EAFIT University to contribute to the social, economic, scientific and cultural development of Colombia has led to the creation of a strategic plan that guides and regulates EAFIT's effort to institutional growth (Universidad EAFIT, 2012).

5.3.1 Organizational Strategic Planning

In 2012, EAFIT University launched its strategic planning which will run until 2018 (Universidad EAFIT, 2011). Such plan possesses three fundamental edges: "maintaining academic excellence as the foundation of the institutional vision, consolidating university research and teaching, and the international projection of the institution" (Universidad EAFIT, 2011, p. 13).

Inside EAFIT's search for educational excellence resides the need for faculty guidance and instruction of a new pedagogical competence and novel didactic implementations that could foster learning abilities in students (Universidad EAFIT, 2011).

5.3.2 The School of Engineering at EAFIT University

EAFIT's school of Engineering pedagogical and curricular structure is supported by five fundamental proposals under main organizational objectives: "project-based learning, modeling and simulation, integration of technology and design through construction of artifacts, the characterization of matter and detailed management and development of new projects" (Zea, Magana, Lalinde, Toro, & Bueno, 2013, p. 1). The main purpose behind those plans is to endorse "significant changes in learning environments and to promote the innovation of pedagogical strategies" (Zea, Magana, Lalinde, Toro, & Bueno, 2013, p. 2).

The resulting approach will be based on three main processes:

a) Scientific investigation.
b) Engineering education, and
c) Interactive educational communities

The practical outcomes materialized on the creation of communities of practice for faculty development, and the design of engineering education research practices, where cyberinfrastructure platforms are involved, such as CLEERhub (Zea, Magana, Lalinde, Toro, & Bueno, 2013).

5.3.3 Proyecto 50

EAFIT's ideals take shape with tangible proposals and actions. "Proyecto 50" develops three basic strategies to maximize faculty skills by remodeling teaching, learning and research processes (Universidad EAFIT, 2011). Moreover "Proyecto 50" proposes three main objectives:

- "To develop innovative pedagogical strategies.
- To create a knowledge network.
- To build a learning community of permanent renovation." (Universidad EAFIT, 2011, p. 3)

The incorporation of communication and information technologies is the key to endorse "Proyecto 50" strategies and fulfill its objectives. Information technology helps to "consolidate the processes of educational innovation" (Universidad EAFIT, 2011, p. 7) complementing EAFIT's search for excellence.

In fact, EAFIT University has developed an approach for continuous improvement for its faculty members. Specifically, the School of Engineering has proposed three main goals to achieve:

1. "Student-centered learning.
2. Permanent curriculum revision.

3. Faculty development and continuous training." (Zea, Magana, Lalinde, Toro, & Bueno, 2013, p. 1)

Indeed, the creation of communities of practice (CoP) conformed by faculty members and the execution of a two-day workshop to introduce continuous curricular improvement processes, are clear signs of the upgrading efforts performed by the School of Engineering (Zea, Magana, Lalinde, Toro, & Bueno, 2013). Precisely, in order to support this work, CLEERhub provided a collaboration environment by "enabling the publication of materials, training, experiences and reflections (Zea, Magana, Lalinde, Toro, & Bueno, 2013, p. 1), the scholarly approach driven by this set of events benefits the fulfillment of the implemented objectives of "Proyecto 50" and the ones proposed by the current institutional strategies and specifically those from the School of Engineering.

CHAPTER 6. RESULTS AND IMPLICATIONS

In the following chapter, the results of both rounds of data collection are presented according to the main objectives stated on previous chapters of this work. The main assessment tool was tested during a one-year period and presented to respondents with minor modifications to better understand their perspectives in different phases of the diffusion process. The data is presented as a combination of both rounds to facilitate comparisons and intended analysis.

6.1 Response Rate

Out of forty faculty members, invited to the introductory CLEERhub workshop, from the School of Engineering at EAFIT University, considered as the first round sample universe, there were twenty three responses, in other words, 57.5% of engineering faculty involved in the study completed the survey.

For the second data collection round only those twenty three respondents were considered, an invitation email was sent to those individuals who completed the survey in the first round of data collection containing a new link to the second survey. Out of 23 possible respondents only 15 faculty members answered the survey, in other terms 65% of the possible respondents submitted back their responses. However, only eleven of those completed their survey, therefore, those eleven responses will be compared to the

corresponding ones obtained in the first data collection round. The following table illustrates the response rate:

Table 6.1 Response Rate

	Participants	Number of Respondents (Complete Responses)	Sample Universe	Response Rate
Round 1	Faculty	23 (23)	40	57.5%
Round 2		15 (11)	23	65% (48%)

6.2 Results and Statistical Analysis

The following section displays a comparison between the responses obtained in the first data collection round and the corresponding one from the second collection round. In order to execute a valid statistical analysis procedure, the comparison will be performed between complete responses gathered in both rounds.

6.2.1 Quantitative Analysis

The statistical analysis performed will help to determine whether there exists a behavioral modification of respondents towards the diffusion of CLEERhub at EAFIT University. The results for each quantitative question will be showed according to the number of responses based upon multiple choice answers (one to five scale) and Likert scale of five (one to five scale) choices in both rounds, raw data can be found on Appendix C.

In the first section basic statistics will help to determine user categories based on the Diffusion of Innovation Theory. The following figures and tables describe the user categories inside the Diffusion of Innovation process on both rounds:

Which of the following best describes your perception about CLEERhub?

a. Before the knowing about CLEERhub, I felt interested in the use of collaboration tools for engineering education, even though the environment is not mature. (1)

b. I decide to use CLEERhub in the basis of my intuition or imagination. The use of this platform will be useful.(2)

c. I hesitate to use CLEERhub wondering if it will become popular. I will not use this tool till I am sure of the completeness of the function.(3)

d. I hesitate to use CLEERhub wondering if it will become popular. I will not use this tool till I am sure of the completeness of the function.(4)

e. I will not use CLEERhub even if it becomes popular. However, if the tool incorporates some other functionality I will think about it.(5)

The following data was obtained in the first round of data collection:

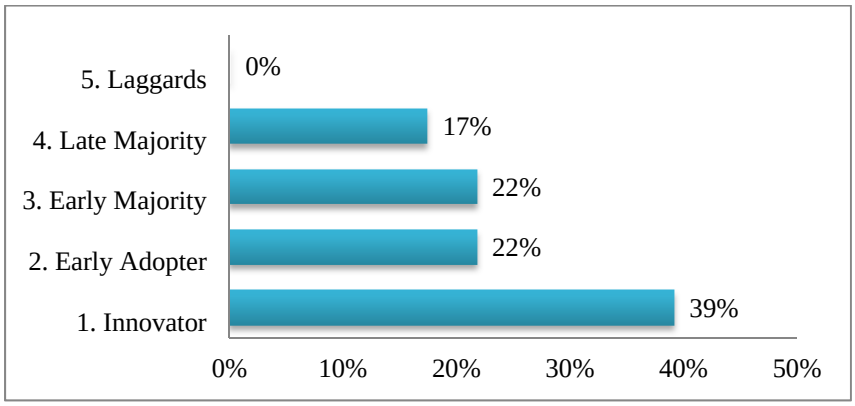

Figure 6.1 User Categories, Round 1

Table 6.2 User Categories, Round 1 - Statistics

Statistic	Value
Min Value	1
Max Value	4
Mean	2.17
Variance	1.33
Standard Deviation	1.15
Total Responses	23

According to the number of users assigned to each category, the following table shows their corresponding statistics:

Table 6.3 Number of Users per Category – Round 1

Statistic	Value
Min Value	0
Max Value	9
Mean	4.60
Variance	10.30
Standard Deviation	3.21
Total Responses	23

For the second round of data collection, the results obtained in this question are the following:

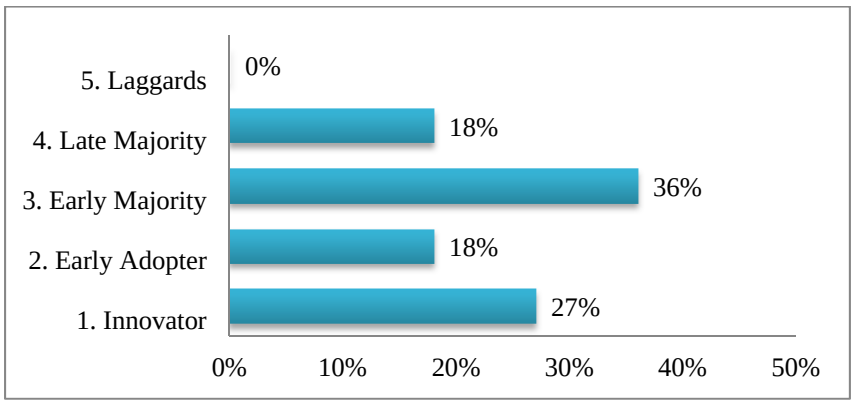

Figure 6.2 User Categories, Round 2

Table 6.4 User Categories, Round 2 - Statistics

Statistic	Value
Min Value	1
Max Value	4
Mean	2.45
Variance	1.27
Standard Deviation	1.13
Total Responses	11

According to the number of users assigned of each category, the following table shows their corresponding statistics:

Table 6.5 Number of Users per Category – Round 2

Statistic	Value
Min Value	0
Max Value	4
Mean	2.20
Variance	2.20
Standard Deviation	1.48
Total Responses	11

The following tables represent the number of responses on both collection rounds in the section of perceptions of the Diffusion of Innovation attributes stated in the survey. The data is presented in a 5 by 5 array symbolizing the possible responses based on a Likert scale of five (from Completely Agree (5) to Completely Disagree (1), please refer to table 4.2). Additionally, data from each round was compared using a descriptive statistical analysis.

1. Question 1: My superiors expect me to use CLEERhub.

Table 6.6 Number of Responses, Attribute Question 1

Count		Round 1				
		1	2	3	4	5
Round 2	1	2	1	-	-	-
	2	-	1	-	1	-
	3	1	-	1	2	-
	4	2	-	-	-	-
	5	-	-	-	-	-

Table 6.7 Statistics, Attribute Values Question 1

Statistic	Round 1	Round 2
Min Value	1	2
Max Value	5	4
Mean	3.70	3.27
Variance	0.95	0.62
Standard Deviation	0.97	0.79
Total Responses	23	11

2. Question 2: I intend to keep using CLEERhub voluntarily.

Table 6.8 Number of Responses, Attribute Question 2

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	1	1	-
	2	-	-	-	5	2
	3	-	-	1	1	-
	4	-	-	-	-	-
	5	-	-	-	-	-

Table 6.9 Statistics, Attribute Values Question 2

Statistic	Round 1	Round 2
Min Value	3	1
Max Value	5	3
Mean	4.04	2.00
Variance	0.32	0.40
Standard Deviation	0.53	0.67
Total Responses	23	11

3. Question 3: Using CLEERhub enhances my performance in my research in engineering education.

Table 6.10 Number of Responses, Attribute Question 3

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	-	-	-
	2	-	-	2	3	-
	3	-	-	4	2	-
	4	-	-	-	-	-
	5	-	-	-	-	-

Table 6.11 Statistics, Attribute Values Question 3

Statistic	Round 1	Round 2
Min Value	3	2
Max Value	5	3
Mean	3.48	2.55
Variance	0.35	0.27
Standard Deviation	0.59	0.52
Total Responses	23	11

4. Question 4: Using CLEERhub increases my productivity in engineering education or engineering education research.

Table 6.12 Number of Responses, Attribute Question 4

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	2	-	-
	2	-	-	-	2	-
	3	-	-	3	3	-
	4	-	-	-	1	-
	5	-	-	-	-	-

Table 6.13 Statistics, Attribute Values Question 4

Statistic	Round 1	Round 2
Min Value	3	1
Max Value	5	4
Mean	3.61	2.55
Variance	0.34	0.87
Standard Deviation	0.58	0.93
Total Responses	23	11

5. Question 5: Using CLEERhub fits well in the way I work.

Table 6.14 Number of Responses, Attribute Question 5

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	-	-	-
	2	-	-	2	1	-
	3	-	-	1	4	-
	4	-	1	1	-	-
	5	-	-	1	-	-

Table 6.15 Statistics, Attribute Values Question 5

Statistic	Round 1	Round 2
Min Value	2	2
Max Value	4	5
Mean	3.35	3.09
Variance	0.33	0.89
Standard Deviation	0.57	0.94
Total Responses	23	11

6. Question 6: Using CLEERhub is related to my daily activities.

Table 6.16 Number of Responses, Attribute Question 6

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	-	-	-
	2	-	-	-	2	-
	3	-	-	1	3	-
	4	-	1	1	1	-
	5	-	1	-	1	-

Table 6.17 Statistics, Attribute Values Question 6

Statistic	Round 1	Round 2
Min Value	2	2
Max Value	4	5
Mean	3.26	3.45
Variance	0.66	1.07
Standard Deviation	0.81	1.04
Total Responses	23	11

7. Question 7: Using CLEERhub improves my visibility within my research community or organization.

Table 6.18 Number of Responses, Attribute Question 7

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	-	1	-
	2	-	-	-	3	-
	3	-	-	2	3	-
	4	-	-	2	-	-
	5	-	-	-	-	-

Table 6.19 Statistics, Attribute Values Question 7

Statistic	Round 1	Round 2
Min Value	2	1
Max Value	5	4
Mean	3.48	2.73
Variance	0.44	0.82
Standard Deviation	0.67	0.90
Total Responses	23	11

8. Question 8: People in my organization or community who use CLEERhub have a high profile.

Table 6.20 Number of Responses, Attribute Question 8

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	-	-	-
	2	-	-	1	2	-
	3	-	-	4	1	-
	4	-	1	1	-	-
	5	-	-	-	1	-

Table 6.21 Statistics, Attribute Values Question 8

Statistic	Round 1	Round 2
Min Value	2	2
Max Value	4	5
Mean	3.09	3.09
Variance	0.36	0.89
Standard Deviation	0.60	0.94
Total Responses	23	11

9. Question 9: Learning to use CLEERhub is easy for me.

Table 6.22 Number of Responses, Attribute Question 9

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	1	-	-	-
	2	-	-	4	4	-
	3	-	-	1	1	-
	4	-	-	-	-	-
	5	-	-	-	-	-

Table 6.23 Statistics, Attribute Values Question 9

Statistic	Round 1	Round 2
Min Value	2	1
Max Value	5	3
Mean	3.65	2.09
Variance	0.42	0.29
Standard Deviation	0.65	0.54
Total Responses	23	11

10. Question 10: My using of CLEERhub requires a lot of mental effort.

Table 6.24 Number of Responses, Attribute Question 10

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	-	-	-
	2	-	-	1	1	-
	3	-	-	2	1	-
	4	-	5	1	-	-
	5	-	-	-	-	-

Table 6.25 Statistics, Attribute Values Question 10

Statistic	Round 1	Round 2
Min Value	2	2
Max Value	4	4
Mean	2.83	3.36
Variance	0.51	0.65
Standard Deviation	0.72	0.81
Total Responses	23	11

11. Question 11: Using CLEERhub is often frustrating.

Table 6.26 Number of Responses, Attribute Question 11

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	-	-	-
	2	-	-	-	-	-
	3	-	-	3	1	-
	4	-	3	2	-	-
	5	-	1	1	-	-

Table 6.27 Statistics, Attribute Values Question 11

Statistic	Round 1	Round 2
Min Value	2	3
Max Value	4	5
Mean	2.61	3.82
Variance	0.34	0.56
Standard Deviation	0.58	0.75
Total Responses	23	11

12. Question 12: My interaction with CLEERhub is clear and understandable.

Table 6.28 Number of Responses, Attribute Question 12

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	-	-	-
	2	-	-	-	3	-
	3	-	1	3	3	-
	4	-	-	1	-	-
	5	-	-	-	-	-

Table 6.29 Statistics, Attribute Values Question 12

Statistic	Round 1	Round 2
Min Value	2	2
Max Value	4	4
Mean	3.39	2.82
Variance	0.34	0.36
Standard Deviation	0.58	0.60
Total Responses	23	11

13. Question 13: Uploading and downloading information from CLEERhub is easy for me.

Table 6.30 Number of Responses, Attribute Question 13

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	1	-	-
	2	-	-	5	1	-
	3	-	-	1	1	-
	4	-	-	1	1	-
	5	-	-	-	-	-

Table 6.31 Statistics, Attribute Values Question 13

Statistic	Round 1	Round 2
Min Value	3	1
Max Value	5	4
Mean	3.48	2.45
Variance	0.35	0.87
Standard Deviation	0.59	0.93
Total Responses	23	11

14. Question 14: I believe I could communicate to others the consequences (advantages, scope and constraints) of using CLEERhub.

Table 6.32 Number of Responses, Attribute Question 14

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	-	1	-
	2	-	-	3	1	-
	3	-	1	1	2	1
	4	-	-	1	-	-
	5	-	-	-	-	-

Table 6.33 Number of Responses, Attribute Question 14

Statistic	Round 1	Round 2
Min Value	2	1
Max Value	5	4
Mean	3.65	2.55
Variance	0.87	0.67
Standard Deviation	0.93	0.82
Total Responses	23	11

15. Question 15: The results of using CLEERhub are apparent (clear) to me.

Table 6.34 Number of Responses, Attribute Question 15

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	-	-	-
	2	-	-	1	-	-
	3	-	-	2	3	-
	4	-	-	4	-	-
	5	-	-	-	-	-

Table 6.35 Number of Responses, Attribute Question 15

Statistic	Round 1	Round 2
Min Value	3	2
Max Value	4	4
Mean	3.30	3.30
Variance	0.22	0.46
Standard Deviation	0.47	0.67
Total Responses	23	10

16. Question 16: Before using CLEERhub I was able to try it.

Table 6.36 Number of Responses, Attribute Question 16

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	1	-	-	-
	2	1	-	-	1	-
	3	-	1	-	1	1
	4	-	3	1	-	-
	5	-	1	-	-	-

Table 6.37 Number of Responses, Attribute Question 16

Statistic	Round 1	Round 2
Min Value	1	1
Max Value	5	5
Mean	2.78	3.18
Variance	1.09	1.36
Standard Deviation	1.04	1.17
Total Responses	23	11

17. Question 17: I know where I can go to satisfactorily try out various uses of CLEERhub.

Table 6.38 Number of Responses, Attribute Question 17

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	-	-	-
	2	-	2	-	-	-
	3	-	1	2	1	-
	4	-	2	2	1	-
	5	-	-	-	-	-

Table 6.39 Number of Responses, Attribute Question 17

Statistic	Round 1	Round 2
Min Value	2	2
Max Value	4	4
Mean	2.65	3.27
Variance	0.60	0.62
Standard Deviation	0.78	0.79
Total Responses	23	11

18. Question 18: I have seen the result of what others can do using CLEERhub.

Table 6.40 Number of Responses, Attribute Question 18

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	-	-	-
	2	-	2	-	-	-
	3	-	1	2	1	-
	4	-	2	2	1	-
	5	-	-	-	-	-

Table 6.41 Number of Responses, Attribute Question 18

Statistic	Round 1	Round 2
Min Value	1	2
Max Value	4	5
Mean	2.61	3.45
Variance	0.79	0.87
Standard Deviation	0.89	0.93
Total Responses	23	11

19. Question 19: I have seen other colleagues using CLEERhub.

Table 6.42 Number of Responses, Attribute Question 19

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	-	-	-
	2	1	-	-	0	-
	3	-	-	1	2	-
	4	1	2	3	-	-
	5	-	1	-	-	-

Table 6.43 Number of Responses, Attribute Question 19

Statistic	Round 1	Round 2
Min Value	1	2
Max Value	4	5
Mean	2.57	3.64
Variance	0.98	0.65
Standard Deviation	0.99	0.81
Total Responses	23	11

20. Question 20: Using CLEERhub makes my work visible.

Table 6.44 Number of Responses, Attribute Question 20

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	-	-	-
	2	-	-	1	3	1
	3	-	1	2	2	-
	4	-	-	-	1	-
	5	-	-	-	-	-

Table 6.45 Number of Responses, Attribute Question 20

Statistic	Round 1	Round 2
Min Value	2	2
Max Value	5	4
Mean	3.57	2.64
Variance	0.53	0.45
Standard Deviation	0.73	0.67
Total Responses	23	11

For the following division, a global symmetry test will be presented for the attributes of perception's section of the survey, as a total sum of all previous 20 questions. The significance level applied in all statistical tests is: $\alpha = 0.05$.

The hypotheses to be tested are the following:

Null Hypothesis: $H_o: p_{"positive\ responses"} = p_{"negative\ responses"}$(No treatment effect)

Alternative Hypothesis: $H_a: p_{"positive\ responses"} \neq p_{"negative\ responses"}$ (Treatment effect)

Table 6.46 Attribute Perception, Total Number of Responses

Count		Round 1				
		1	2	3	4	5
Round 2	1	2	3	4	3	-
	2	2	4	20	35	4
	3	1	7	36	39	4
	4	3	20	24	10	-
	5	-	4	2	3	-

Table 6.47 Total Crosstabulation Table, Answer Distribution

Table of Round1 by Round2							
Round1		Round 2					
		1	2	3	4	5	Total
Frequency		2	2	1	3	0	8
Percent	1	0.87	0.87	0.43	1.30	0.00	3.48
Row Pct		25.00	25.00	12.50	37.50	0.00	
Col Pct		16.67	3.08	1.15	5.26	0.00	

Table 6.47 Continued.

Frequency		3	4	7	20	4	38
Percent	2	1.30	1.74	3.04	8.70	1.74	16.52
Row Pct		7.89	10.53	18.42	52.63	10.53	
Col Pct		25.00	6.15	8.05	35.09	44.44	
Frequency		4	20	36	24	2	86
Percent	3	1.74	8.70	15.65	10.43	0.87	37.39
Row Pct		4.65	23.26	41.86	27.91	2.33	
Col Pct		33.33	30.77	41.38	42.11	22.22	
Frequency		3	35	39	10	3	90
Percent	4	1.30	15.22	16.96	4.35	1.30	39.13
Row Pct		3.33	38.89	43.33	11.11	3.33	
Col Pct		25.00	53.85	44.83	17.54	33.33	
Frequency		0	4	4	0	0	8
Percent	5	0.00	1.74	1.74	0.00	0.00	3.48
Row Pct		0.00	50.00	50.00	0.00	0.00	
Col Pct		0.00	6.15	4.60	0.00	0.00	
	Total	12	65	87	57	9	230
		5.22	28.26	37.83	24.78	3.91	100.00

Table 6.48 Statistics for Attribute Perception, Total Number of Responses

Test of Symmetry	
Statistic (S)	19.5883
DF	10
Pr>S	0.0334

The test provides strong evidence to reject the null hypothesis of no treatment effect.

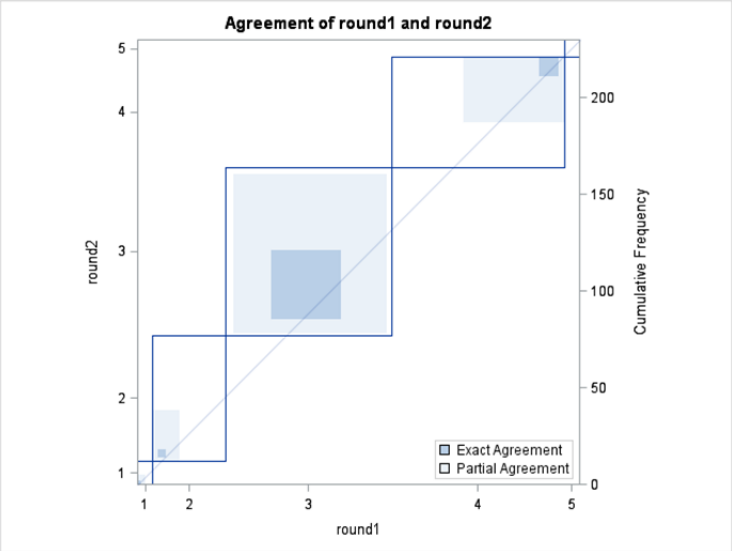

Figure 6.3 Agreement Diagram for Attribute Perception, Total Number of Responses

Next, each of the attributes of perception of the Diffusion of Innovation process will be displayed as a sum of their corresponding questions (according to Table 4.2) and their corresponding descriptive statistics. Those results will be then summarized in a 2 by 2 array showing only the responses which indicate an alteration from the first to the second round of data collection. Then, a McNemar's symmetry test will be executed, which actually excludes the elements of the main diagonal (responses with the same value in both rounds) and tries to determine statistical differences in the attitude of the respondents. The significance level applied in all statistical tests is: $\alpha = 0.05$.

The Hypotheses to be tested are the following:

Null Hypothesis: $H_o: p_{"positive\ responses"} = p_{"negative\ responses"}$(No treatment effect)

Alternative Hypothesis: $H_{\boldsymbol{a}}: p_{"positive\ responses"} \neq p_{"negative\ responses"}$ (Treatment effect)

1. Relative Advantage

Table 6.49 Relative Advantage Summary

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	2	-	-
	2	-	-	2	5	-
	3	-	-	7	5	-
	4	-	-	-	1	-
	5	-	-	-	-	-

Table 6.50 Relative Advantage Basic Statistics

Statistic	Round 1	Round 2
Min Value	3	1
Max Value	5	4
Mean	3.54	2.55
Variance	0.34	0.55
Standard Deviation	0.59	0.74
Total Responses	46	22

Table 6.51Relative Advantage 2x2 Array

Count		Round 1	
		"+"	"-"
Round 2	"+"		0
	"-"	14	

Table 6.52 Crosstabulation Table, Answer Distribution, Relative Advantage

Table of Round1 by Round2			
	Round 1	Round2	
		1	Total
Frequency	2	14	14
Percent		100.00	100.00
Row Pct		100.00	
Col Pct		100.00	
	Total	14	14
		100.00	100.00

Given that 100% of the responses are located above the main diagonal (inclusive) in this attribute summary, the data by itself provides strong evidence to reject the null hypothesis of no treatment effect.

2. Voluntariness

Table 6.53 Voluntariness Summary

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	1	1	-
	2	-	-	-	6	3
	3	-	-	1	3	2
	4	-	-	2	3	-
	5	-	-	-	-	-

Table 6.54 Voluntariness Basic Statistics

Statistic	Round 1	Round 2
Min Value	1	1
Max Value	5	4
Mean	3.87	2.64
Variance	0.65	0.91
Standard Deviation	0.81	0.95
Total Responses	46	22

Table 6.55 Voluntariness 2x2 Array

Count		Round 1	
		"+"	"-"
Round 2	"+"		2
	"-"	16	

Table 6.56 Crosstabulation Table, Answer Distribution, Voluntariness

Table of Round1 by Round2

		Round2		
	Round1	1	2	Total
Frequency	1	0	2	2
Percent		0.00	11.11	11.11
Row Pct		0.00	100.00	
Col Pct		0.00	100.00	
Frequency	2	16	0	16
Percent		88.89	0.00	88.89
Row Pct		100.00	0.00	
Col Pct		100.00	0.00	
	Total	16	2	18
		88.89	11.11	100.00

Table 6.57 Voluntariness Statistics

McNemar's Test

Statistic (S)	10.8889
DF	1
Pr>S	0.0010

The test provides strong evidence to reject the null hypothesis of no treatment effect.

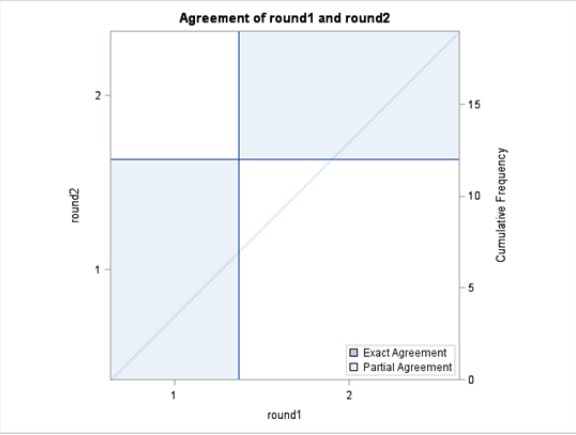

Figure 6.4 Voluntariness Agreement Diagram

3. Compatibility

Table 6.58 Compatibility Summary

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	-	-	-
	2	-	-	2	3	-
	3	-	-	2	7	-
	4	-	2	2	1	-
	5	-	1	1	1	-

Table 6.59 Compatibility Basic Statistics

Statistic	Round 1	Round 2
Min Value	2	2
Max Value	4	5
Mean	3.30	3.27
Variance	0.48	0.97
Standard Deviation	0.70	0.98
Total Responses	46	22

Table 6.60 Compatibility 2x2 Array

Count		Round 1	
		"+"	"-"
Round 2	"+"		7
	"-"	12	

Table 6.61 Crosstabulation Table, Answer Distribution, Compatibility

Table of Round1 by Round2				
		Round2		
	Round1	1	2	Total
Frequency		0	7	7
Percent	1	0.00	36.84	36.84
Row Pct		0.00	100.00	
Col Pct		0.00	100.00	

Table 6.61 Continued.

Frequency		12	0	12
Percent	2	63.16	0.00	63.16
Row Pct		100.00	0.00	
Col Pct		100.00	0.00	
	Total	12	7	19
		63.16	36.84	100.00

Table 6.62 Compatibility Statistics

McNemar's Test	
Statistics (S)	1.3158
DF	1
Pr>S	0.2513

The test does not provide strong evidence to reject the null hypothesis of no treatment effect.

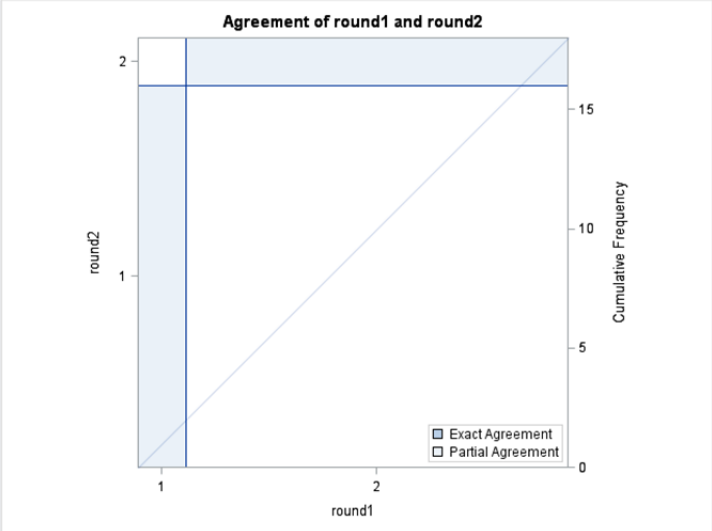

Figure 6.5 Compatibility Agreement Diagram

4. Image

Table 6.63 Image Summary

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	-	1	-
	2	-	-	1	5	-
	3	-	-	6	4	-
	4	-	1	3	-	-
	5	-	-	-	1	-

Table 6.64 Image Basic Statistics

Statistic	Round 1	Round 2
Min Value	2	1
Max Value	5	5
Mean	3.28	2.91
Variance	0.43	0.85
Standard Deviation	0.66	0.92
Total Responses	46	22

Table 6.65 Image 2x2 Array

Count		Round 1	
		"+"	"-"
Round 2	"+"		5
	"-"	11	

Table 6.66 Crosstabulation Table, Answer Distribution, Image

Table of Round1 by Round2

		Round2		
	Round1	1	2	Total
Frequency		0	5	5
Percent	1	0.00	31.25	31.25
Row Pct		0.00	100.00	
Col Pct		0.00	100.00	

Table 6.66 Continued.

Frequency		11	0	11
Percent	2	68.75	0.00	68.75
Row Pct		100.00	0.00	
Col Pct		100.00	0.00	
	Total	11	5	16
		68.75	31.25	100.00

Table 6.67 Image Statistics

McNemar's Test

Statistics (S)	2.2500
DF	1
Pr>S	0.1336

The test does not provide strong evidence to reject the null hypothesis of no treatment effect.

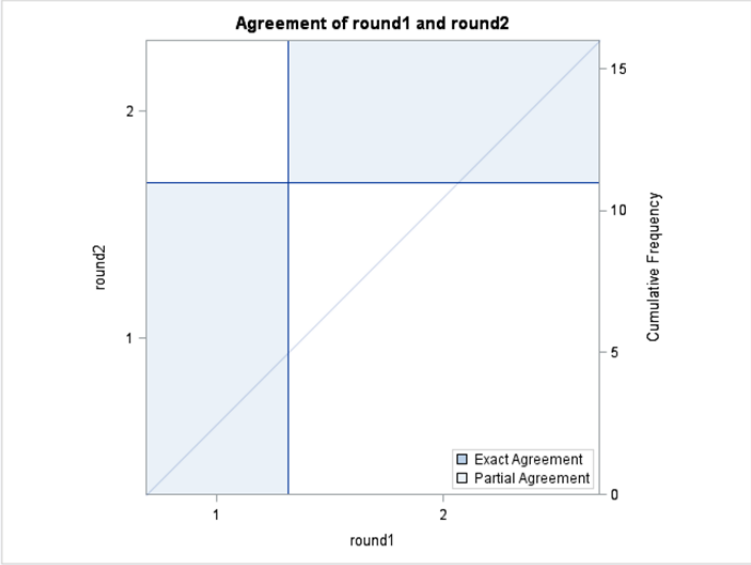

Figure 6.6 Image Agreement Diagram

5. Ease of Use

Table 6.68 Ease of Use Summary

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	1	1	-	-
	2	-	-	10	9	-
	3	-	1	10	7	-
	4	-	8	5	1	-
	5	-	1	1	-	-

Table 6.69 Ease of Use Basic Statistics

Statistic	Round 1	Round 2
Min Value	2	1
Max Value	5	5
Mean	3.19	2.91
Variance	0.54	0.90
Standard Deviation	0.74	0.95
Total Responses	115	55

Table 6.70 Ease of Use 2x2 Array

Count		Round 1	
		"+"	"-"
Round 2	"+"		16
	"-"	28	

Table 6.71 Crosstabulation Table, Answer Distribution, Ease of Use

Table of Round1 by Round2				
		Round2		
	Round1	1	2	Total
Frequency		0	16	16
Percent	1	0.00	36.36	36.36
Row Pct		0.00	100.00	
Col Pct		0.00	100.00	

Table 6.71 Continued.

Frequency		28	0	28
Percent	2	63.64	0.00	63.64
Row Pct		100.00	0.00	
Col Pct		100.00	0.00	
	Total	28	16	44
		63.64	36.36	100.00

Table 6.72 Ease of Use Statistics

McNemar's Test	
Statistics (S)	3.2727
DF	1
Pr>S	0.0704

The test does not provide strong evidence to reject the null hypothesis of no treatment effect.

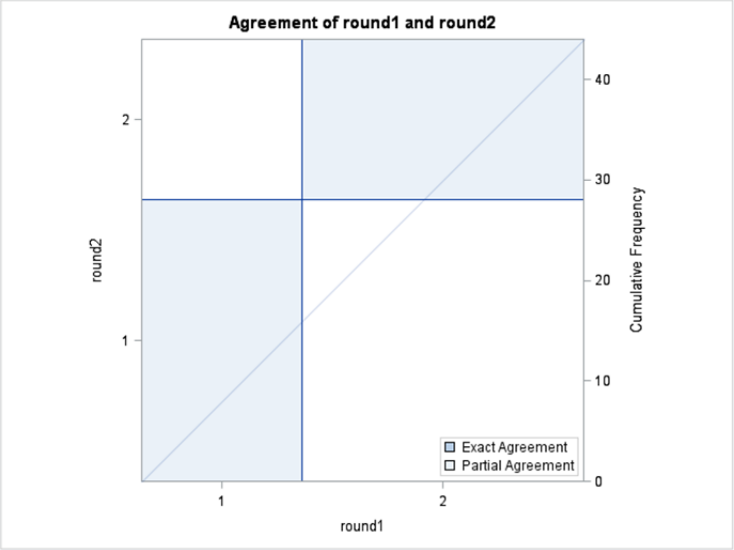

Figure 6.7 Ease of Use Agreement Diagram

6. Demonstrability

Table 6.73 Demonstrability Summary

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	-	1	-
	2	-	-	4	1	-
	3	-	1	3	5	1
	4	-	-	5	-	-
	5	-	-	-	-	-

Table 6.74 Demonstrability Basic Statistics

Statistic	Round 1	Round 2
Min Value	2	1
Max Value	5	4
Mean	3.48	2.90
Variance	0.57	0.69
Standard Deviation	0.75	0.83
Total Responses	46	21

Table 6.75 Demonstrability 2x2 Array

Count		Round 1	
		"+"	"-"
Round 2	"+"		6
	"-"	12	

Table 6.76 Crosstabulation Table, Answer Distribution, Demonstrability

Table of Round1 by Round2				
		Round2		
	Round1	1	2	Total
Frequency		0	6	6
Percent	1	0.00	33.33	33.33
Row Pct		0.00	100.00	
Col Pct		0.00	100.00	

Table 6.76 Continued.

Frequency		12	0	12
Percent	2	66.67	0.00	66.67
Row Pct		100.00	0.00	
Col Pct		100.00	0.00	
	Total	12	6	18
		66.67	33.33	100.00

Table 6.77 Demonstrability Statistics

McNemar's Test

Statistics (S)	2.0000
DF	1
Pr>S	0.1573

The test does not provide strong evidence to reject the null hypothesis of no treatment effect.

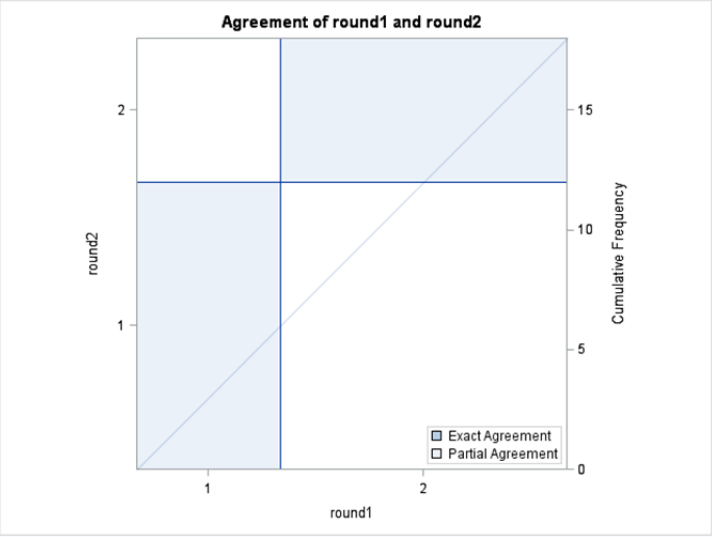

Figure 6.8 Demonstrability Agreement Diagram

7. Trialability

Table 6.78 Trialability Summary

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	1	-	-	-
	2	1	2	-	1	-
	3	-	2	2	2	1
	4	-	5	3	1	-
	5	-	1	-	-	-

Table 6.79 Trialability Basic Statistics

Statistic	Round 1	Round 2
Min Value	1	1
Max Value	5	5
Mean	2.72	3.23
Variance	0.83	0.95
Standard Deviation	0.91	0.97
Total Responses	46	22

Table 6.80 Trialability 2x2 Array

Count		Round 1	
		"+"	"-"
Round 2	"+"		12
	"-"	5	

Table 6.81 Crosstabulation Table, Answer Distribution, Trialability

Table of Round1 by Round2

		Round2		
	Round1	1	2	Total
Frequency		0	12	12
Percent	1	0.00	70.59	70.59
Row Pct		0.00	100.00	
Col Pct		0.00	100.00	

Table 6.81 Continued.

Frequency		5	0	5
Percent	2	29.41	0.00	29.41
Row Pct		100.00	0.00	
Col Pct		100.00	0.00	
	Total	5	12	17
		29.41	70.59	100.00

Table 6.82 Trialability Statistics

McNemar's Test	
Statistics (S)	2.8824
DF	1
Pr>S	0.0896

The test does not provide strong evidence to reject the null hypothesis of no treatment effect.

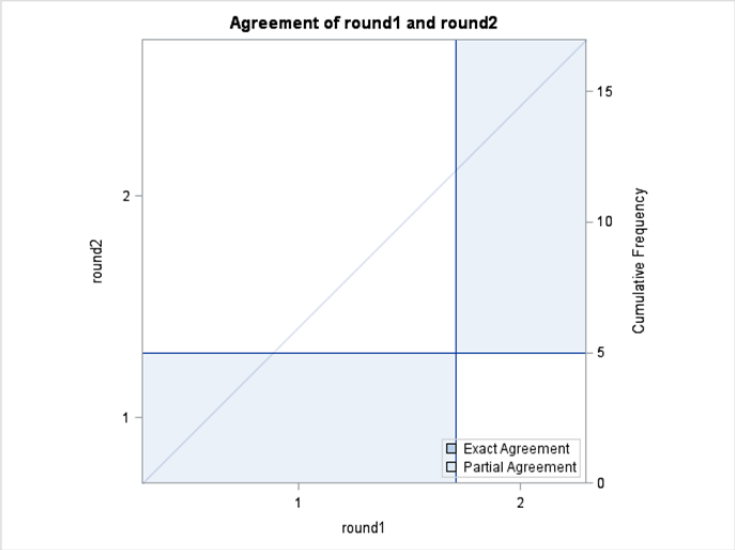

Figure 6.9 Trialability Agreement Diagram

8. Visibility

Table 6.83 Visibility Summary

Count		Round 1				
		1	2	3	4	5
Round 2	1	-	-	-	-	-
	2	1	1	1	4	1
	3	-	3	4	4	-
	4	1	4	4	3	-
	5	-	1	-	1	-

Table 6.84 Visibility Basic Statistics

Statistic	Round 1	Round 2
Min Value	1	2
Max Value	5	5
Mean	2.91	3.24
Variance	0.96	0.81
Standard Deviation	0.98	0.90
Total Responses	69	33

Table 6.85 Visibility 2x2 Array

Count		Round 1	
		"+"	"-"
Round 2	"+"		15
	"-"	10	

Table 6.86 Crosstabulation Table, Answer Distribution, Visibility

Table of Round1 by Round2				
		Round2		
	Round1	1	2	Total
Frequency		0	15	15
Percent	1	0.00	60.00	60.00
Row Pct		0.00	100.00	
Col Pct		0.00	100.00	

Table 6.86 Continued

Frequency		10	0	10
Percent	2	40.00	0.00	40.00
Row Pct		100.00	0.00	
Col Pct		100.00	0.00	
	Total	10	15	25
		40.00	60.00	100.00

Table 6.87 Visibility Statistics

McNemar's Test

Statistics (S)	1.0000
DF	1
Pr>S	0.3173

The test does not provide strong evidence to reject the null hypothesis of no treatment effect.

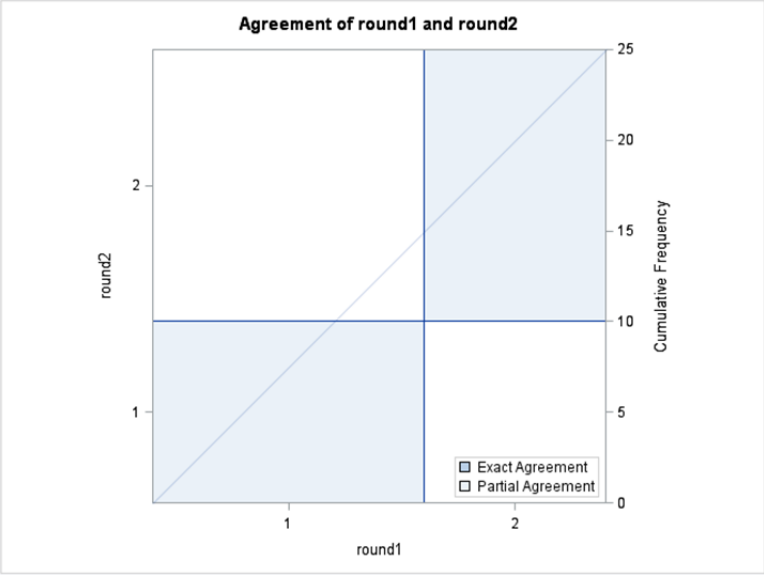

Figure 6.10 Visibility Agreement Diagram

Finally, a histogram will be offered to link quantifiable actions with most recent (Round 2) behavioral attitudes in terms of frequency. The following questions were presented to the respondents;

1. In average, how often do you use CLEERhub in general?
2. How often have you used or downloaded CLEERhub resources (e.g., software tool, document, database, video, or publication)?
3. Have you incorporated some of the resources (software tool, document, database, video, or publication) available at CLEERhub into your work in engineering education?
4. Have you made any kind of contributions to CLEERhub of data, documents, tools, learning modules, or publications that resulted from your work in engineering education?

For all questions, the following were presented as valid multiple choice answers:

1. Frequently (more than once a week or twice).
2. Every once in a while (once or twice every other week).
3. Occasionally (once or twice per month).
4. Rarely (once or twice in six months).
5. Never.

Table 6.88 Frequency of Use, Number of Responses, Round 2

		Frequency of Use - Round 2						
		1	2	3	4	5	Total	Mean
Questions	1	0	0	0	8	3	11	4.27
	2	0	0	1	7	3	11	4.18
	3	0	0	0	4	7	11	4.64
	4	0	1	0	3	7	11	4.45

Table 6.89 Frequency of Use Statistics

Statistic/Question	1	2	3	4
Min Value	4	3	4	2
Max Value	5	5	5	5
Mean	4.27	4.18	4.64	4.45
Variance	0.22	0.36	0.25	0.87
Standard Deviation	0.47	0.6	0.5	0.93
Total Responses	11	11	11	11

Table 6.90 Frequency of Use, Relative Frequency

		Relative Frequency - Round 2					
		1	2	3	4	5	Total
Questions	1	0	0	0	0.73	0.27	1.0
	2	0	0	0.09	0.64	0.27	1.0
	3	0	0	0	0.36	0.64	1.0
	4	0	0.09	0	0.27	0.64	1.0
		Frequently	Every once in a while	Occasionally	Rarely	Never	

After the relative frequency calculation has been done, the following histograms can be sketched for each Frequency of Use question:

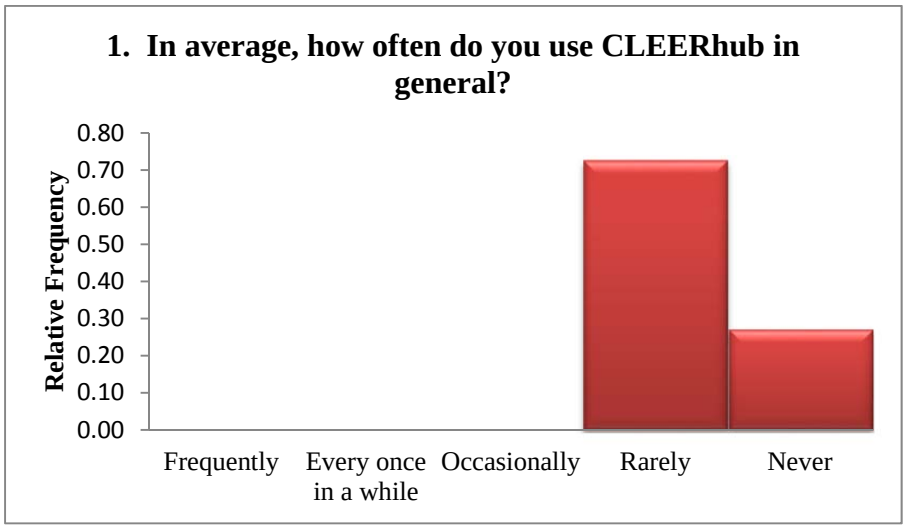

Figure 6.11 Frequency of Use Histogram, Question 1

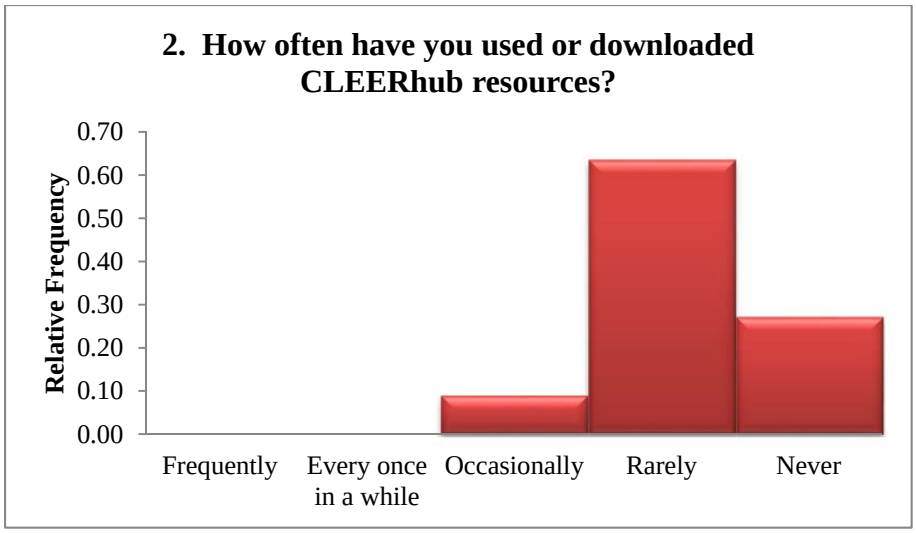

Figure 6.12 Frequency of Use Histogram, Question 2

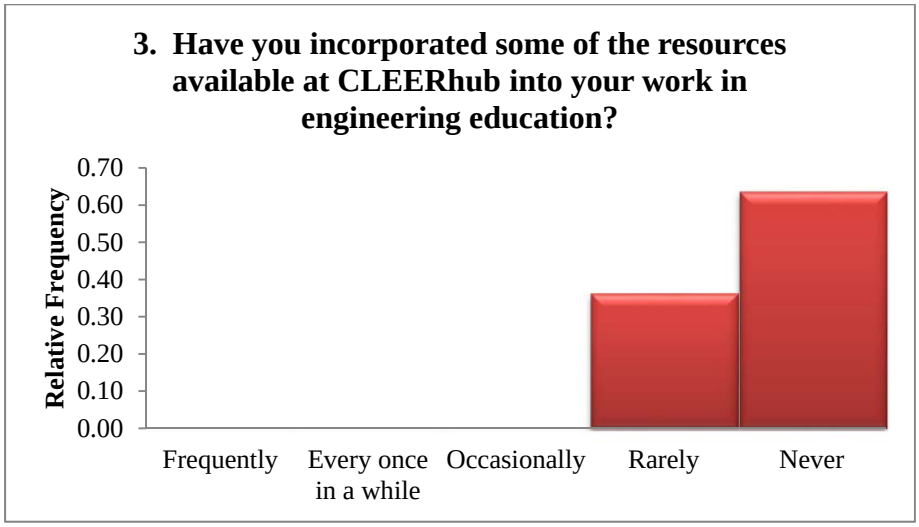

Figure 6.13 Frequency of Use Histogram, Question 3

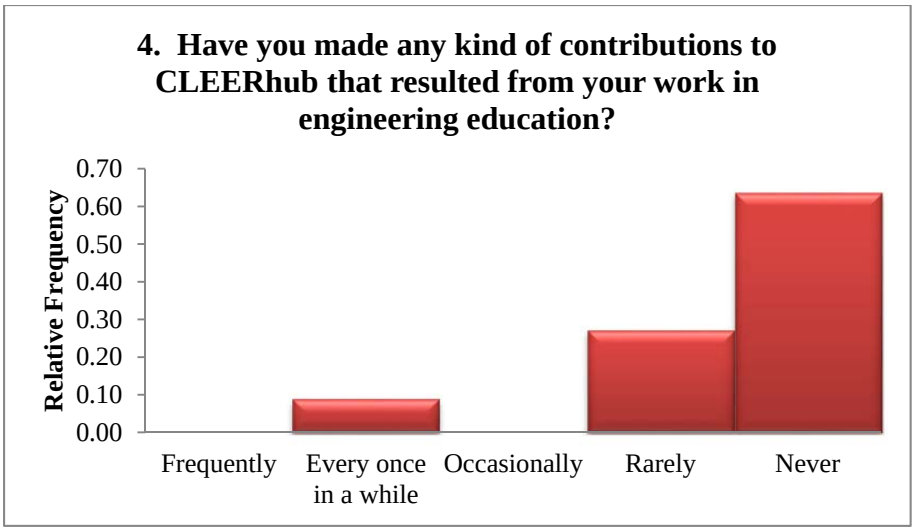

Figure 6.14 Frequency of Use Histogram, Question 4

6.2.2 Qualitative Analysis

On both data collection rounds open-ended questions were also included, however, in the first round only was displayed the following question:

- Do you have any comments for us?

Other open-ended questions provided on Table 4.2 cannot be answered without a previous introduction of CLEERhub. Since the stage where the first survey was deployed was considered as "Time 0", and EAFIT faculty members did not have any experience dealing with the presented innovation, the author considered that those questions were irrelevant to the objective of this work.

All twenty three responses of that question did not have valuable comments, which are valid answers regarding the state of the Diffusion process, for instance, one of the respondents wrote:

"I consider that this question is premature for the interactions obtained so far with CLLERhub."

6.2.2.1 Open-Ended Questions

In the other hand, for the second data collection round five open-ended questions were added to the survey. All questions were coded to analyze personal experiences towards the diffusion of CLEERhub. The following tables present the results:

1. How do you think that the implementation of CLEERhub in your organization or personal work has been a Success? Why do you believe so?

Table 6.91 Organizational or Personal Implementation Success

Responses	Number	%
Successful diffusion	1	9.09%
Unsuccessful diffusion	9	81.81%
Did not Answer	1	9.09%

The responses were coded and divided in three main groups, the ones who considered that the implementation of CLEERhub was successful, users who believed that CLEERhub was not embraced by faculty and people who did not provide an answer.

The following table describes the second part of the question; such responses are obviously connected to the ones obtained in the corresponding first portion.

Table 6.92 Reasons for Successful or Unsuccessful Implementation

Responses	Number	%
Lack of socialization	2	20%
Different research interests	7	70%
Advantageous resources	1	10%

Responses provided were cataloged as positive (Advategeous resources), such as “shared, downloaded and expert-related resources” found while using CLEERhub, and

negative (Lack of socialization and Different research interests), such as “I cannot find it convenient yet, I have not clearly perceived its potential” or “it is not part of my daily activities such as coursework and academic projects”.

2. How do you primarily use CLEERhub as resource for engineering education research and collaboration?

Table 6.93 Uses of CLEERhub

Responses	Number	%
Search of information.	4	36.36%
Sharing information	4	36.36%
Did not use CLEERhub	4	36.36%
Did not Answer	1	9.09%

All responses were divided in four categories, some of the respondents have simultaneously used CLEERhub to search information and to share resources, which are considered as pro-embracement and the last two, where users cannot be considered as active users or simply did not respond.

3. How or in which ways was the integration of CLEERhub challenging for your organization?

Table 6.94 Integration Challenges

Responses	Number	%
Different research interests	2	18.18%
Socialization	5	45.45%
Use of similar platforms	1	9.09%

Table 6.94 Continued.

Lack of resources	1	9.09%
It was not a challenge	1	9.09%
Did not Answer	1	9.09%

Most users found as challenging the implementation of CLEERhub, however, the embracement experience was truncated by negative aspects, especially by socialization issues. Additionally, one of the users did not find it challenging at all since the interaction with CLEERhub was null.

4. If any changes need to be done to CLEERhub in order to be more effective or helpful to you or your organization, what would they be?

Table 6.95 CLEERhub Improvement Suggestions

Responses	Number	%
Have no basis to answer the question	5	45.45%
Improve resource reachability and features	1	9.09%
Improve socialization efforts	3	27.27%
Did not Answer	1	9.09%

Many faculty members could not provide any kind of feedback since their interaction with the tool was limited, for instance one of the users responded: “I’m not able to respond to this question given my frequency of use”. Many others replied that the resources found at CLEERhub have potential but organizational socialization-related efforts need to be improved. Only one respondent believed that CLEERhub features need some kind of upgrade.

5. Would you consider keep using CLEERhub in the future? What CLEERhub's features or functionality have influenced your decision?

Table 6.96 Future use of CLEERhub

Responses	Number	%
Positive	7	63.63%
Negative	3	27.27%
Did not Answer	1	9.09%

The majority of respondents provided positive answers to the first part of this question and would keep using CLEERhub. Only three of the respondents will discontinue its use.

Table 6.97 Reasons for Future Use or Disuse

Responses	Connotations	Number	%
Collaboration	Positive	3	27.27%
Resource Availability	Positive	1	9.09%
Different Research Interests	Negative	1	9.09%
Department Policy	Positive	1	9.09%
Did not Answer	-	5	45.45%

For the second part, the responses were categorized by positive and negative connotations based on the first part of the same interrogation. However, most of users did not provide any reasons at all.

6. Do you have any comments for us?

Table 6.98 Comments

Responses	Number	%
No comments	4	36.36%
Improve socialization efforts	2	18.18%
Need to use similar platforms	1	9.09%
CLEERhub improvements	1	9.09%
Did not Answer	2	18.18%

The responses to this question were related to the feedback provided on question number four, where socialization issues arise again. Nevertheless, most of users did not provide a comment at all.

6.2.2.2 Interviews

Additionally, the Dean of the School of Engineering and the Director of "Proyecto 50" were interviewed after the second round of data collection to get their insights and perspectives of the experience. The results obtained for each question after both interviews are the following:

1. What are the educational initiatives that are taking place in EAFIT's School of Engineering?

EAFIT and the School of Engineering are carrying out numerous initiatives to foster faculty development and curriculum improvement. According to the Dean of the School of Engineering, four major edges are taking place inside the School, (1) Complementary Learning Areas, (2) Modeling and Simulating Practices, (3) Subject

Characterization or Definition, and (4) Technology Integration. Additionally, the Director of "Proyecto 50" mentioned another important initiative inside the School, the implementation of a curricular reform where graduation time is being shortened.

> "The School of Engineering proposes a curricular reform where programs are shortened from five and a half years to four and a half years, and then those reforms are oriented to the development of quality EAFIT engineering graduates where the edges mentioned by the Dean take place." – Director of "Proyecto 50"

2. What is the role of "Proyecto 50" in the initiative described above?

The Director of "Proyecto 50" established that "Proyecto 50" is used to maximize faculty competencies to bring up educational innovation through technological utilization. In fact, the Dean stated that "Proyecto 50" is a proposal to improve and determine significant evaluation of teaching and learning systems.

> "Proyecto 50 is implemented to support teaching and learning processes, all projects inside the School need to be sheltered by Proyecto 50 in order to promote academic discussions." – Dean of the School of Engineering

3. What is the role of CLEERhub as part of the initiative?

The Director of "Proyecto 50" see CLEERhub as the medium to share resources related to academic and faculty development before and after activities such as workshops, "thematic coffees" and meetings. The Dean agreed with the definition provided by the Director and goes even further stating that the resources shared are not only for faculty involved on those activities but also for all the EAFIT community. However, both agreed that CLEERhub was only being used as a data repository, and it was not utilized as a collaboration tool.

"…CLEERhub is useful to upload different informative resources so everybody have access to them." – Dean of the School of Engineering

4. What actions have been taken to socialize and implement the existing innovation and execute current strategies?

Proyecto 50's Director indicated that many of the actions that were part of the School's socialization efforts, such as seminars, workshops, meetings, paper publications, and "thematic coffees", the Dean was actively involved.

"…thematic coffees and meetings were used as a platform for project socialization efforts." – Director of "Proyecto 50"

The Director of Proyecto 50 also believed that the Dean's involvement in the socialization efforts was an important component and motivator for the rest of the professors to come and participate.

5. What were the resistance actions or limitations of the new changes?

The lack of online resources and participation in the execution of the organizational strategies online was considered as the main limitation of all proposed initiatives in the School of Engineering according to "Proyecto 50" Director. Moreover, the intended EAFIT virtual community is still under construction and cannot be fully operational to satisfy staff educational needs. Additionally, many faculty members experienced technology manipulation issues due to language and social shortcomings, as stated by the Director.

"…many faculty members have limitations when it comes to the use of new technology, they do not know how to use resources available in the net, and they are not consistent with the use of technological tools. Moreover, some members

have idiosyncratic issues that make them reluctant to share information." – Director of "Proyecto 50"

6. What were the lessons learned? What would you change?

According to the Director, "thematic coffees" were prioritized over the online collaboration resources. In fact, top management was actively involved in them causing starvation to other initiatives such as CLEERhub implementation in all curricular activities. Additionally, the Director stated that during the workshops delivered to faculty members, direct engagement with the tool was not promoted and therefore an opportunity was lost for initial contact and training. Therefore, different instructional activities will be executed in the future to engage faculty in the utilization of technological platforms.

6.3 Summary

On this chapter the results of the two rounds of data were presented together with their statistical analysis for the quantitative and qualitative sections. We also presented complementary data gathered from interviews with two members of EAFIT's School of Engineering top management. The outcomes of these analyses will discussed and concluded in the next chapter.

CHAPTER 7. DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

7.1 Discussion

The results displayed on the previous chapter help to determine the outcome of a one-year diffusion of innovation process of faculty members at EAFIT University School of Engineering in their intent to embrace CLEERhub in their scholarly activities. For this purpose, two research questions were provided at the beginning of this study:

> How CLEERhub attributes of the diffusion of innovation model are perceived over time by college instructors for supporting collaborative engineering education research at EAFIT University?
>
> What are the challenges, difficulties, and motivators encountered in the diffusion of innovation process that lead to the adoption or rejection of the use of CLEERhub?

7.1.1 User Categorization

Data obtained from the first collection round (time 0) seems to be contradictory to the one encountered on following segments, in this section 39% of the users categorized themselves as innovators. In fact, 27% of those still considered themselves as pacesetters (round 2), however, none of those have capitalized its modernization believes in actions regarding CLEERhub use or communication. Actually, 36% of the latest respondents, 14%

more than those respondents in round 1, “Early Majority” category, hesitate to use CLEERhub until they are sure of its completeness, which is confirmed by the following survey questions. The innovativeness of those 36 and 27 percent may refer to the use of different engineering education collaboration tools, other than CLEERhub, given the nature of that answer (Before the knowing about CLEERhub, I felt interested in the use of collaboration tools for engineering education, even though the environment is not mature). “Early Adopters” and “Late Majority” categories remain equally populated on both rounds, “Laggards” cannot be found on any responses of both surveys. In general, it appears so far that the diffusion process has just begun and those who have interest in new and modern collaboration hubs have not been established as innovation leaders who can actually spread the word of CLEERhub (Rogers, 2003). Wenger at al. (2009) stress the need of “technology stewards” inside the virtual community . Technology stewards or online community leaders posses the technical knowledge and skills which can actually encourage participation and further collaboration through technological development and trust.

7.1.2 Perception of the Attributes of the Diffusion of Innovation Process

The comparison made of the total number of responses obtained on both data collection rounds shows a statistical difference produced by the introduction of CLEERhub. Nevertheless, raw data shows that the effect is adverse to embracement efforts of CLEERhub at EAFIT’s School of Engineering. In general terms, the CLEERhub experience appears to be less appealing to faculty members, however, there is a need to break down the responses and analyze each attribute perception to identify

potential explanations. The following attributes are presented from the most to the least significant according to the Diffusion of Innovation Theory provided by Rogers (2003) and Hsu et al framework (2007).

- Relative Advantage: According to Rogers (2003) the "Relative Advantage" refers to the ability of users to understand that the characteristics or features of the innovation supersede the ones of its predecessors. It is very interesting to realize that 100% of the responses gathered and compared of both questionnaires show a decrease or no change on their opinions towards the benefits that CLEERhub offers over a one-year period. In fact, statistical analysis strongly suggests a "treatment effect" to CLEERhub exposition. Specifically, raw data shows that users' ratings on relative advantage have declined. This can be interpreted as users having problems recalling or not finding pluses when using this tool. Many authors, including C. L. Hsu (2007) and Rogers (2003), indicated that user's perception of relative advantage has the greatest significance over the intention to use an innovation; foretelling, maybe, the present outcome of the CLEERhub adoption process. Rogers (2003) in his theory has given an important clue to understand this behavior given the environmental circumstances, it seems the lack of incentives may have diminished users' exploring interests.
- Voluntariness: The same occurs to the voluntariness variable, there is strong statistical evidence that a perception change has occurred over this time period in EAFIT users, and still can be perceived as a downward trend. Literature indicates that users might have lost their willingness to embrace CLEERhub (Hsu, Lu, &

Hsu, 2007). Between all attribute perception appraisals, only these first two variables indicate a statistically significant change of users' attitude.

- Compatibility: This variable is closely related to users' previous experiences, personal values and needs (Rogers, 2003). As mentioned before, the results do not show statistical evidence of a behavioral change when comparing both collection rounds. However, raw data suggests that users still believe on the validity of CLEERhub to satisfy their needs. That behavior may be given by previous pleasant experiences of users with similar tools. Moreover, as faculty members, is very plausible that CLEERhub users at EAFIT University strongly believe in job-related improvements through technological innovations. However, raw numerical reports indicate that fewer users find CLEERhub compatible with their professional interest at this time.
- Image: The results obtained from the statistical analysis performed to the "Image" variable do not represent any significant perception change among users when comparing both rounds. However, there is an slightly deterioration when examining numerical values of the raw data, EAFIT CLEERhub users' good image have not persisted in some users' mind after one year. As mentioned before, CLEERhub pacesetters at EAFIT may have not seen as role models for other users in that social system, and without significant community members involved in the diffusion process it is very likely to fail embracing an innovation (Rogers, 2003). For instance, a different outcome was obtained after top management got involved with the "Thematic Coffee" activities, where successful

results were obtained by having most of the faculty attending these events. It seems that in these case role models played a significant part.

- Ease of Use: Regarding the complexity perception over CLEERhub use, faculty members opinion has hardly change in the last year statistically speaking. Nevertheless, in a strictly numerical environment, there are more "negative" answers than "positive" ones. Over this time period, for many users CLEERhub experience is perceived as more complicated, another barrier for innovation diffusion (Rogers, 2003). Training, guidance and continuous use of the tool may be needed.
- Demonstrability: Statistical analyzes dictate that EAFIT faculty members maintain their ideas towards CLEERhub demonstrability. Actually, there are more people supporting the testing capabilities of the new tool than there were in the first data collection round at time 0. Ideas over CLEERhub keep being "easily observed and communicated" (Rogers, 2003, p. 258) facilitating its diffusion. Two perceived attributes have numerically increased their ratings in round 2; the second one is visibility, closely related to trialability or demonstrability.
- Visibility: If the tool at stake can be easily communicated to other members of the social system, it also means that it became visible to themselves and to other members. Visibility ratings have not showed statistical improvement at comparison, however, besides "Demonstrability", many users have a better opinion on this aspect. It appears that both can work as a "lifesaver" to CLEERhub adoption at EAFIT's School of Engineering. Clearly Visibility and Demonstrability attributes are strong positive characteristics of CLEERhub,

which is essential for the late majority group to make an adoption decision (Hsu, Lu, & Hsu, 2007).

7.1.3 Frequency of Use

According to Hacker and Magana's (2011) framework, EAFIT faculty members appear to be entering the knowledge stage, even though the introductory workshop was held more than one year ago. CLEERhub participants of the School of Engineering seem to have acquired usage and operating knowledge of the innovation, in theory. However, according to the records of multiple-choice questions proposed in the second survey for this purpose, the frequency of use is low and in some case null. Frequency data shows that users possess general functional knowledge with some grasps of the benefits that the tool can offer; nonetheless, it has not been incorporated into their planning, preparation or searching activities yet. In fact, 100% of respondents have barely or have never integrated CLEERhub in any scholarly activity, and only 9% of users have made some kind of contribution to the platform. The number of visits and interactions with the tool show lack of confidence and indifference from faculty members towards active collaboration, in some way users are not technologically mature enough. Long term commitment from users to CLEERhub seems categorically distant for the moment.

7.1.4 The CLEERhub Experience from Participants' Perspective

Most participants considered that the assimilation of CLEERhub into their activities has not been successful; many of them are not really interested since the tool applies to a different expertise level. It appears that the versatility of the innovation has

not been entirely or appropriately socialized, as evidenced from the interview data provided by the Director of “Proyecto 50”. It would be interesting to determine faculty members who are located at the same expertise level of the main CLEERhub community to deepen diffusion efforts within them, nevertheless, EAFIT strategic plan pretends to engage its entire faculty on scholarly activities.

Confirming the statements made by participants over general knowledge of CLEERhub, the majority of subjects had clear insights and know-hows of the implemented cyberinfrastructure. The author cannot discard language barriers that impede daily utilization; moreover, the feasibility of using resources available in CLEERhub for classroom activities (for Spanish native speakers) is also a concern. Maybe the number of current members in the Colombian community is not big enough to engage on significant discussions with practical results, in this case one of the pivotal dimensions of a community of practice is missing (Wenger, White, & Smith, 2009). In this context, perhaps there are other tools available that supersede the benefits of the proposed innovation.

Most respondents also found socialization efforts insufficient, in despite of the two-day introductory workshop held one year ago authorities could not conduct a follow-up process to reinforce the acquired knowledge. As a matter of fact, many users stated that there are many other platforms introduced and they seemed overwhelmed, which obstructs this specific effort, and of course also hinders the assimilation of all other implementations.

Many concerns were also raised about the poor experience that users go through while using CLEERhub, some of them even feel frustrated and quit, the lack of a user

friendly interface combined with poor training conspire against desired practices. Nonetheless, faculty members are reluctant to give up the use of the innovation, most of them see in CLEERhub potential to enhance future activities at EAFIT's School of Engineering.

7.2 Conclusions

The attributes of the Diffusion of the Innovation model perceived by EAFIT's School of Engineering faculty members have in some way been altered over time, however, those insights of the principal attributes are not the ones expected by EAFIT authorities, objectives and strategies. Many of the faculty members do not feel yet as theirs the ideas proposed by the authorities regarding the use of CLEERhub and its importance. Nonetheless, they do know the importance of collaborative environments supporting engineering education research efforts. The potential of CLEERhub is still present and remains strongly in their minds, providing some room for improvement in the diffusion process.

Different current interests, overwhelming number of applications, absence of training, almost inexistent socialization, and poor communication arose as the main challenges that have decrease the rate of adoption of the innovation. Such low rate of adoption creates uncertainty of whether CLEERhub is going to be embraced or excluded by the EAFIT community. For the moment the individuals of this organization are still part of the introductory stage of the diffusion process. According to Rogers (2003), individual optional innovations are acknowledged more rapidly than an organizational

one providing some optimism over CLEERhub diffusion at EAFIT's School of Engineering.

7.3 Recommendations and Future Work

EAFIT University is self-conscious of their need to achieve academic excellence through an engineering approach to engineering education and "Proyecto 50" has a preeminent role in supporting that goal. However, it seems that CLEERhub has not awakened the expected interest over the faculty members of the School of Engineering. The results obtained in both rounds of data collection over one-year period indicate room for improvement for a sustainable embracement process of technological novelties. Change management appears to be a resourceful research-based approach to facilitate organizational and personal diffusion on innovations. The framework provided by Hiatt and Creasey (2003) provides interesting insight to manage people's tendency to resist change.

The first step is to understand and assess the individual side of the proposed change, assure clear communications, diagnose arising gaps, and execute corrective actions; the ADKAR (Awareness, Desire, Knowledge, Ability and Reinforcement) model helps its application. Nevertheless, given the results obtained in the study, the ADKAR model needs a slightly modification, instead of a linear application it is necessary to stress the awareness, desire, ability and reinforcement using the existing knowledge as a pivotal force.

The second step is to manage the organizational flank of change; Hiatt and Creasey (2003) propose a three-phased process. In the first phase, it is necessary to

define a change management strategy, prepare a change management team and develop and sponsorship model. Phase two indicates the implementation of communication, coaching, training, sponsor and resistance management plans. The last phase reinforces change by providing a complete assess of the implementation to take corrective actions where needed and celebrates success with all involved parties. The strict execution of change management plans will ease in some way and speed up the diffusion process of desired innovations.

Top management involvement, perceived effectiveness, user intention and end-user support are considered as the most important predictors for technological innovation embracement (Jeyaraj, Rottman, & Lacity, 2006). Active participation from authorities in the use of CLEERhub is required since top administrators help users to align to organizational goals through a direct communication channel and to implement structural priorities necessary for success (Hiatt & Creasey, 2003). Additionally, technological implementations, such as CLEERhub at the EAFIT's School of Engineering, require a technology steward or a community operational leader to facilitate the discussion and keep online transactions going. A steward acts as the continuous nexus between users and administrators. The steward generates trust inside the group and facilitates transitions for all members based on deep knowledge of the platform and the community itself (Wenger, White, & Smith, 2009).

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APPENDICES

Appendix A IRB Approval Letter

PURDUE
UNIVERSITY

HUMAN RESEARCH PROTECTION PROGRAM
INSTITUTIONAL REVIEW BOARDS

To:	ALEJANDRA MAGANA DELEON KNOY
From:	JEANNIE DICLEMENTI, Chair Social Science IRB
Date:	01/15/2013
Committee Action:	**Approval**
IRB Action Date	01/15/2013
IRB Protocol #	1212013065
Study Title	CLEERHUB.ORG Adoption by EAFIT University Faculty Members: A Longitudinal Study
Expiration Date	01/14/2014

Following review by the Institutional Review Board (IRB), the above-referenced protocol has been approved. This approval permits you to recruit subjects up to the number indicated on the application form and to conduct the research as it is approved. The IRB-stamped and dated consent, assent, and/or information form(s) approved for this protocol are enclosed. Please make copies from these document(s) both for subjects to sign should they choose to enroll in your study and for subjects to keep for their records. Information forms should not be signed. Researchers should keep all consent/assent forms for a period no less than three (3) years following closure of the protocol.

Revisions/Amendments: If you wish to change any aspect of this study, please submit the requested changes to the IRB using the appropriate form. IRB approval must be obtained before implementing any changes unless the change is to remove an immediate hazard to subjects in which case the IRB should be immediately informed following the change.

Continuing Review: It is the Principal Investigator's responsibility to obtain continuing review and approval for this protocol prior to the expiration date noted above. Please allow sufficient time for continued review and approval. No research activity of any sort may continue beyond the expiration date. Failure to receive approval for continuation before the expiration date will result in the approval's expiration on the expiration date. Data collected following the expiration date is unapproved research and cannot be used for research purposes including reporting or publishing as research data.

Unanticipated Problems/Adverse Events: Researchers must report unanticipated problems and/or adverse events to the IRB. If the problem/adverse event is serious, or is expected but occurs with unexpected severity or frequency, or the problem/even is unanticipated, it must be reported to the IRB within 48 hours of learning of the event and a written report submitted within five (5) business days. All other problems/events should be reported at the time of Continuing Review.

We wish you good luck with your work. Please retain copy of this letter for your records.

Ernest C. Young Hall, 10th Floor • 155 S. Grant St. • West Lafayette, IN 47907-2114 • (765) 494-5942 • Fax: (765) 494-9911

Figure A IRB Approval Letter

Appendix B Survey - Round 1

Table B Survey Round 1 (English)

	Question
1	What is your CLEERhub username?
2	Which of the following best describes your perception about CLEERhub? 1. Before the knowing about CLEERhub, I felt interested in the use of collaboration tools for engineering education, even though the environment is not mature. 2. I decide to use CLEERhub in the basis of my intuition or imagination. The use of this platform will be useful. 3. I hesitate to use CLEERhub wondering if it will become popular. I will not use this tool till I am sure of the completeness of the function. 4. I hesitate to use CLEERhub wondering if it will become popular. I will not use this tool till I am sure of the completeness of the function. 5. I will not use CLEERhub even if it becomes popular. However, if the tool incorporates some other functionality I will think about it.
Attribute Perception	
3	My superiors expect me to use CLEERhub. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
4	I intend to keep using CLEERhub voluntarily. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
5	Using CLEERhub enhances my performance in my research in engineering education. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree

Table B Continued.

6	Using CLEERhub increases my productivity in engineering education or engineering education research. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
7	Using CLEERhub fits well in the way I work. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
8	Using CLEERhub is related to my daily activities. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
9	Using CLEERhub improves my visibility within my research community or organization. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
10	People in my organization or community who use CLEERhub have a high profile. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
11	Learning to use CLEERhub is easy for me. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree

Table B Continued.

12	My using of CLEERhub requires a lot of mental effort. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
13	Using CLEERhub is often frustrating. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
14	My interaction with CLEERhub is clear and understandable. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
15	Uploading and downloading information from CLEERhub is easy for me. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
16	I believe I could communicate to others the consequences (advantages, scope and constraints) of using CLEERhub. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
17	The results of using CLEERhub are apparent (clear) to me. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree

Table B Continued.

18	Before using CLEERhub I was able to try it. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
19	I know where I can go to satisfactorily try out various uses of CLEERhub. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
20	I have seen the result of what others can do using CLEERhub 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
21	I have seen other colleagues using CLEERhub. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
22	Using CLEERhub makes my work visible. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
23	Do you have any comments for us?

Appendix C Survey - Round 2

Table C Survey Round 2 (English)

	Question
1	What is your CLEERhub username?
2	Which of the following best describes your perception about CLEERhub? 6. Before the knowing about CLEERhub, I felt interested in the use of collaboration tools for engineering education, even though the environment is not mature. 7. I decide to use CLEERhub in the basis of my intuition or imagination. The use of this platform will be useful. 8. I hesitate to use CLEERhub wondering if it will become popular. I will not use this tool till I am sure of the completeness of the function. 9. I hesitate to use CLEERhub wondering if it will become popular. I will not use this tool till I am sure of the completeness of the function. 10. I will not use CLEERhub even if it becomes popular. However, if the tool incorporates some other functionality I will think about it.
Attribute Perception	
3	I am knowledgeable of the purpose and resources that CLEERhub offers to its users. 6. Totally agree 7. Agree 8. Neither agree or disagree 9. Disagree 10. Totally disagree
4	My superiors expect me to use CLEERhub. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
5	I intend to keep using CLEERhub voluntarily. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree

Table C Continued.

6	Using CLEERhub enhances my performance in my research in engineering education. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
7	Using CLEERhub increases my productivity in engineering education or engineering education research. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
8	I find the use of CLEERhub advantageous in my research in engineering education. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
9	Using CLEERhub fits well in the way I work. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
10	Using CLEERhub is related to my daily activities. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
11	Using CLEERhub improves my visibility within my research community or organization. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree

Table C Continued.

12	People in my organization or community who use CLEERhub have a high profile. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
13	Learning to use CLEERhub is easy for me. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
14	My using of CLEERhub requires a lot of mental effort. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
15	Using CLEERhub is often frustrating. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
16	My interaction with CLEERhub is clear and understandable. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
17	Uploading and downloading information from CLEERhub is easy for me. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree

Table C Continued.

18	I believe I could communicate to others the consequences (advantages, scope and constraints) of using CLEERhub. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
19	I am aware of the consequences of the use of CLEERhub. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
20	I can form a favorable opinion about the use of this technology. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
21	I would recommend the use of CLEERhub to other colleagues. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
22	The results of using CLEERhub are apparent (clear) to me. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
23	Before using CLEERhub I was able to try it. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree

Table C Continued.

24	I know where I can go to satisfactorily try out various uses of CLEERhub. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
25	I have seen the result of what others can do using CLEERhub 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
26	I have seen other colleagues using CLEERhub. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
27	Using CLEERhub makes my work visible. 1. Totally agree 2. Agree 3. Neither agree or disagree 4. Disagree 5. Totally disagree
Use Frequency	
28	In average, how often do you use CLEERhub in general? 1. Frequently (more than once a week or twice). 2. Every once in a while (once or twice every other week). 3. Occasionally (once or twice per month). 4. Rarely (once or twice in six months). 5. Never.
29	How often have you used or downloaded CLEERhub resources (e.g., software tool, document, database, video, or publication)? 1. Frequently (more than once a week or twice). 2. Every once in a while (once or twice every other week). 3. Occasionally (once or twice per month). 4. Rarely (once or twice in six months). 5. Never.

Table C Continued.

30	Have you incorporated some of the resources (software tool, document, database, video, or publication) available at CLEERhub into your work in engineering education? 1. Frequently (more than once a week or twice). 2. Every once in a while (once or twice every other week). 3. Occasionally (once or twice per month). 4. Rarely (once or twice in six months). 5. Never.
31	Have you made any kind of contributions to CLEERhub of data, documents, tools, learning modules, or publications that resulted from your work in engineering education? 1. Frequently (more than once a week or twice). 2. Every once in a while (once or twice every other week). 3. Occasionally (once or twice per month). 4. Rarely (once or twice in six months). 5. Never.
Personal Experience	
32	How do you think that the implementation of CLEERhub in your organization or personal work has been a Success? Why do you believe so?
33	How do you primarily use CLEERhub as resource for engineering education research and collaboration?
34	How or in which ways was the integration of CLEERhub challenging for your organization?
35	If any changes need to be done to CLEERhub in order to be more effective or helpful to you or your organization, what would they be?
36	Would you consider keep using CLEERhub in the future for engineering education research and collaboration? What CLEERhub's features or functionality have influenced your decision?
37	Do you have any other comments for us?

Appendix D Survey Answers – Multiple Choice Question Comparison

1. Which of the following best describes your perception about CLEERhub?

Table D 1 Question 1 Data Comparison

Respondents	Round 1	Round 2
User 1	4	3
User 2	4	2
User 3	3	3
User 4	4	3
User 5	2	-
User 6	2	-
User 7	1	1
User 8	1	4
User 9	2	-
User 10	2	1
User 11	1	-
User 12	1	-
User 13	1	3
User 14	1	-
User 15	3	-
User 16	1	1
User 17	1	-
User 18	1	4
User 19	3	-
User 20	4	-
User 21	2	2
User 22	3	-
User 23	3	-

2. My superiors expect me to use CLEERhub.

Table D 2 Question 2 Data Comparison

Respondents	Round 1	Round 2
User 1	4	4
User 2	4	3
User 3	3	4
User 4	3	4
User 5	5	-
User 6	4	-
User 7	4	4
User 8	4	4
User 9	3	-
User 10	4	3
User 11	3	-
User 12	4	-
User 13	5	3
User 14	2	-
User 15	4	-
User 16	5	3
User 17	1	-
User 18	4	2
User 19	4	-
User 20	4	-
User 21	5	2
User 22	3	-
User 23	3	-

3. I intend to keep using CLEERhub voluntarily.

Table D 3 Question 3 Data Comparison

Respondents	Round 1	Round 2
User 1	3	3
User 2	4	2
User 3	4	3
User 4	5	2
User 5	4	-
User 6	4	-
User 7	4	2
User 8	4	2
User 9	4	-
User 10	4	1
User 11	4	-
User 12	4	-
User 13	4	2
User 14	4	-
User 15	3	-
User 16	5	2
User 17	5	-
User 18	3	1
User 19	4	-
User 20	4	-
User 21	4	2
User 22	4	-
User 23	5	-

4. Using CLEERhub enhances my performance in my research in engineering education.

Table D 4 Question 4 Data Comparison

Respondents	Round 1	Round 2
User 1	3	3
User 2	4	2
User 3	3	3
User 4	4	2
User 5	4	-
User 6	3	-
User 7	3	3
User 8	4	3
User 9	3	-
User 10	3	2
User 11	3	-
User 12	3	-
User 13	4	2
User 14	4	-
User 15	3	-
User 16	4	3
User 17	5	-
User 18	3	2
User 19	4	-
User 20	4	-
User 21	3	3
User 22	3	-
User 23	3	-

5. Using CLEERhub increases my productivity in engineering education or engineering education research.

Table D 5 Question 5 Data Comparison

Respondents	Round 1	Round 2
User 1	4	4
User 2	4	2
User 3	3	3
User 4	4	2
User 5	3	-
User 6	3	-
User 7	3	3
User 8	4	3
User 9	4	-
User 10	3	1
User 11	3	-
User 12	4	-
User 13	4	3
User 14	4	-
User 15	3	-
User 16	4	3
User 17	5	-
User 18	3	3
User 19	4	-
User 20	4	-
User 21	3	1
User 22	3	-
User 23	4	-

6. I find the use of CLEERhub advantageous in my research in engineering education.

Table D 6 Question 6 Data Comparison

Respondents	Round 1	Round 2
User 1	2	4
User 2	4	2
User 3	3	5
User 4	3	4
User 5	4	-
User 6	3	-
User 7	3	3
User 8	4	3
User 9	3	-
User 10	3	2
User 11	3	-
User 12	3	-
User 13	4	3
User 14	4	-
User 15	3	-
User 16	4	3
User 17	4	-
User 18	4	3
User 19	3	-
User 20	4	-
User 21	3	2
User 22	3	-
User 23	3	-

7. Using CLEERhub is related to my daily activities.

Table D 7 Question 7 Data Comparison

Respondents	Round 1	Round 2
User 1	2	5
User 2	3	3
User 3	4	5
User 4	2	4
User 5	3	-
User 6	2	-
User 7	3	4
User 8	4	3
User 9	3	-
User 10	4	2
User 11	3	-
User 12	3	-
User 13	4	3
User 14	4	-
User 15	2	-
User 16	4	2
User 17	3	-
User 18	4	4
User 19	4	-
User 20	4	-
User 21	4	3
User 22	2	-
User 23	4	-

8. Using CLEERhub improves my visibility within my research community or organization.

Table D 8 Question 8 Data Comparison

Respondents	Round 1	Round 2
User 1	4	3
User 2	4	3
User 3	3	4
User 4	3	4
User 5	2	-
User 6	4	-
User 7	3	3
User 8	4	3
User 9	4	-
User 10	4	1
User 11	3	-
User 12	3	-
User 13	4	2
User 14	3	-
User 15	3	-
User 16	4	2
User 17	5	-
User 18	3	3
User 19	3	-
User 20	3	-
User 21	4	2
User 22	3	-
User 23	4	-

9. People in my organization or community who use CLEERhub have a high profile.

Table D 9 Question 9 Data Comparison

Respondents	Round 1	Round 2
User 1	3	2
User 2	3	3
User 3	4	5
User 4	2	4
User 5	2	-
User 6	3	-
User 7	3	4
User 8	3	3
User 9	3	-
User 10	4	3
User 11	3	-
User 12	4	-
User 13	4	2
User 14	2	-
User 15	3	-
User 16	4	2
User 17	3	-
User 18	3	3
User 19	3	-
User 20	3	-
User 21	3	3
User 22	3	-
User 23	3	-

10. Learning to use CLEERhub is easy for me.

Table D 10 Question 10 Data Comparison

Respondents	Round 1	Round 2
User 1	2	1
User 2	4	2
User 3	3	2
User 4	3	2
User 5	4	-
User 6	3	-
User 7	3	3
User 8	4	2
User 9	4	-
User 10	3	2
User 11	3	-
User 12	4	-
User 13	3	2
User 14	4	-
User 15	4	-
User 16	4	2
User 17	5	-
User 18	4	3
User 19	4	-
User 20	4	-
User 21	4	2
User 22	4	-
User 23	4	-

11. My using of CLEERhub requires a lot of mental effort.

Table D 11 Question 11 Data Comparison

Respondents	Round 1	Round 2
User 1	4	2
User 2	2	4
User 3	3	3
User 4	3	4
User 5	4	-
User 6	4	-
User 7	3	3
User 8	2	4
User 9	3	-
User 10	4	3
User 11	3	-
User 12	2	-
User 13	3	2
User 14	2	-
User 15	3	-
User 16	2	4
User 17	3	-
User 18	2	4
User 19	3	-
User 20	3	-
User 21	2	4
User 22	2	-
User 23	3	-

12. Using CLEERhub is often frustrating.

Table D 12 Question 12 Data Comparison

Respondents	Round 1	Round 2
User 1	4	3
User 2	2	4
User 3	3	3
User 4	3	4
User 5	3	-
User 6	3	-
User 7	3	3
User 8	2	4
User 9	3	-
User 10	3	4
User 11	3	-
User 12	2	-
User 13	3	3
User 14	2	-
User 15	3	-
User 16	2	4
User 17	2	-
User 18	3	5
User 19	2	-
User 20	2	-
User 21	2	5
User 22	2	-
User 23	3	-

13. My interaction with CLEERhub is clear and understandable.

Table D 13 Question 13 Data Comparison

Respondents	Round 1	Round 2
User 1	2	3
User 2	4	3
User 3	3	4
User 4	4	2
User 5	3	-
User 6	3	-
User 7	3	3
User 8	4	3
User 9	4	-
User 10	3	3
User 11	3	-
User 12	4	-
User 13	3	3
User 14	4	-
User 15	3	-
User 16	4	3
User 17	3	-
User 18	4	2
User 19	3	-
User 20	3	-
User 21	4	2
User 22	3	-
User 23	4	-

14. Uploading and downloading information from CLEERhub is easy for me.

Table D 14 Question 14 Data Comparison

Respondents	Round 1	Round 2
User 1	3	1
User 2	3	2
User 3	3	3
User 4	3	2
User 5	4	-
User 6	3	-
User 7	3	2
User 8	4	3
User 9	4	-
User 10	3	2
User 11	5	-
User 12	4	-
User 13	3	4
User 14	4	-
User 15	3	-
User 16	4	4
User 17	4	-
User 18	4	2
User 19	3	-
User 20	4	-
User 21	3	2
User 22	3	-
User 23	3	-

15. I believe I could communicate to others the consequences (advantages, scope and constraints) of using CLEERhub.

Table D 15 Question 15 Data Comparison

Respondents	Round 1	Round 2
User 1	3	2
User 2	4	3
User 3	3	4
User 4	4	3
User 5	4	-
User 6	4	-
User 7	3	3
User 8	4	2
User 9	2	-
User 10	4	1
User 11	5	-
User 12	4	-
User 13	3	2
User 14	4	-
User 15	3	-
User 16	5	3
User 17	5	-
User 18	3	2
User 19	4	-
User 20	5	-
User 21	2	3
User 22	2	-
User 23	4	-

16. The results of using CLEERhub are apparent (clear) to me.

Table D 16 Question 16 Data Comparison

Respondents	Round 1	Round 2
User 1	3	4
User 2	4	3
User 3	3	4
User 4	3	4
User 5	4	-
User 6	3	-
User 7	3	4
User 8	4	3
User 9	3	-
User 10	3	-
User 11	4	-
User 12	3	-
User 13	3	3
User 14	3	-
User 15	3	-
User 16	4	3
User 17	4	-
User 18	3	3
User 19	3	-
User 20	3	-
User 21	3	2
User 22	3	-
User 23	4	-

17. Before using CLEERhub I was able to try it.

Table D 17 Question 17 Data Comparison

Respondents	Round 1	Round 2
User 1	2	1
User 2	4	3
User 3	5	3
User 4	1	2
User 5	2	-
User 6	4	-
User 7	3	4
User 8	2	4
User 9	4	-
User 10	2	4
User 11	3	-
User 12	2	-
User 13	2	4
User 14	3	-
User 15	3	-
User 16	2	5
User 17	2	-
User 18	2	3
User 19	2	-
User 20	2	-
User 21	4	2
User 22	4	-
User 23	4	-

18. I know where I can go to satisfactorily try out various uses of CLEERhub.

Table D 18 Question 18 Data Comparison

Respondents	Round 1	Round 2
User 1	2	2
User 2	3	4
User 3	2	4
User 4	2	2
User 5	2	-
User 6	2	-
User 7	3	3
User 8	3	4
User 9	4	-
User 10	4	3
User 11	4	-
User 12	2	-
User 13	2	4
User 14	2	-
User 15	3	-
User 16	4	4
User 17	3	-
User 18	3	3
User 19	2	-
User 20	2	-
User 21	2	3
User 22	2	-
User 23	3	-

19. I have seen the result of what others can do using CLEERhub.

Table D 19 Question 19 Data Comparison

Respondents	Round 1	Round 2
User 1	2	3
User 2	4	2
User 3	2	4
User 4	2	2
User 5	2	-
User 6	2	-
User 7	3	3
User 8	3	4
User 9	2	-
User 10	4	4
User 11	3	-
User 12	2	-
User 13	2	4
User 14	3	-
User 15	3	-
User 16	4	5
User 17	1	-
User 18	4	4
User 19	2	-
User 20	2	-
User 21	2	3
User 22	2	-
User 23	4	-

20. I have seen other colleagues using CLEERhub.

Table D 20 Question 20 Data Comparison

Respondents	Round 1	Round 2
User 1	1	4
User 2	3	3
User 3	2	5
User 4	1	2
User 5	2	-
User 6	4	-
User 7	3	4
User 8	3	4
User 9	2	-
User 10	3	4
User 11	3	-
User 12	2	-
User 13	2	4
User 14	4	-
User 15	3	-
User 16	4	3
User 17	1	-
User 18	2	4
User 19	2	-
User 20	2	-
User 21	4	3
User 22	2	-
User 23	4	-

21. Using CLEERhub makes my work visible.

Table D 21 Question 21 Data Comparison

Respondents	Round 1	Round 2
User 1	4	4
User 2	4	3
User 3	2	3
User 4	5	2
User 5	4	-
User 6	3	-
User 7	3	3
User 8	3	3
User 9	4	-
User 10	4	2
User 11	3	-
User 12	3	-
User 13	4	2
User 14	3	-
User 15	3	-
User 16	4	3
User 17	5	-
User 18	3	2
User 19	3	-
User 20	4	-
User 21	4	2
User 22	3	-
User 23	4	-