Integrating Culture in Designing Groupware Applications as Contribution to Intercultural Collaboration Technology

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Rein Suadamara

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Referent: Prof. Dr.-Ing. Axel Hunger

Korreferent: Prof. Dr. Nicole Krämer

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Rein Suadamara

For the treasures all my life

my son Olrey, my husband Oloan, my Mother and my late Father

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-Abstract-

Many industries are now dealing with the issue of globalization and emphasized the need of the influence of a global marketplace. Globalization extends computing, information, and communication technologies across an increasing number of cultural boundaries, generating a corresponding need for cross-cultural partnerships. Due to globalization, global virtual teams with members from different cultures are an emerging trend. The use of collaborative projects is increasing and affects users' approach to work in a collaboration application, so called groupware. Groupware is a collaboration application designed to support the work of groups. It can allow globalized industries and organizations greater coordination of activities, reducing and eliminating time and geography barriers, and speeding the decision making process.

Groupware users are influenced by demographic, social, cultural, psychological and contextual factors, which complicate the understanding of groupware use. The different backgrounds of users may cause them to have different expectations and attitudes towards their acceptance of using groupware. In order for a specific technology application to be useful, applying technology appropriately to the needs of its users is very important. Groupware that only determines structures of communication, such as floor control, turn-taking, communication procedures, and so on may disadvantage and discourage people from different cultural communication styles. These factors should be considered by designers when designing such groupware application in order to be successful. A groupware targeted for multicultural users should have a flexible intercultural support which means can adaptively manage the cultural differences of its users. A great attention should be given for the cultural element in creating products and interfaces that are culture "fit" to its users. Understanding these social and cultural differences is very important in groupware to support cross-cultural collaboration. This dissertation offers solutions to the design issues in groupware for multicultural user to avoid a failed system.

Most software engineers when designing applications focuses only on the technical issues and fail to include the social factors that are very important in developing technologies that serves as social applications. Therefore in this dissertation, two extension layers are introduced extending the well know 7-layers OSI model. These two extension layers of ISO/OSI layer model mainly focus on the end-user of the applications consisting of social layer as the 8^{th} layer and cultural layer as the 9^{th} layer, used to link applications to human needs. The social layer representing the support of groups and the cultural layer representing the communication as it is influenced through different cultural backgrounds of users using the tools. These extension layers help software engineers to develop applications within a socio-cultural deployment context.

The Technology Acceptance Model (TAM) is extended in this dissertation to understand the mechanism by which cultural differences could explain users' behaviors toward the acceptance of groupware applications as a remote collaboration tool for global virtual team. A new approach, called culture-centered design and cultural engineering as the anchor for groupware development in multicultural context is introduced to define the requirements, features and functions that should be included in groupware as an intercultural collaboration tool. An expert system to be embedded in groupware, called Intercultural Collaboration Environment Expert System (ICEES), is also developed in the context of a cross-cultural collaboration and is expected to support PASSENGER 2, a new innovative groupware that is currently under development at the Institute of Computer Engineering, University Duisburg-Essen. ICEES provide advice to the group in selecting the most suitable tools for enhancing the group discussion. This dissertation is expected to serve as a benchmark for future research on groupware design for multicultural users across different countries.

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my world is dark. He gives me light when I almost lost my hope, he gives me inspiration, motivation, and happiness. He holds my hand to make my dreams come true, and I dedicate this Dissertation to him.

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CHAPTER 1

INTRODUCTION

1.1 Background and Motivation

Computing nowadays has become a global discipline. Many industries are now dealing with the issue of globalization and emphasized the need of the influence of a global marketplace. Globalization extends computing, information, and communication technologies across an increasing number of cultural boundaries, generating a corresponding need for cross-cultural partnerships [1]. Recent findings [2] stated that the importance of understanding culture and the key role it plays in the software industry has substantially increased over the last twenty years. There is a great need for cultural knowledge and intercultural skills within members, where intercultural awareness and the ability to work in multi-cultural and globally distributed teams are considered very important. Different cultures have different approaches working in a collaboration project. Cultural differences that exist between different countries may affect a multinational organization's ability to adopt and utilize IT [3].

Groupware technologies have become an important part of the business computing infrastructure in many organizations. Corporate executives recognize the potential of groupware technologies where collaborative efforts can be made much more effective and efficient [4], [5]. It can help globalized industries and organizations greater coordination of activities, reducing and eliminating time and geography barriers, and speeding the decision making process. Users working in globalised industries as team working apart together may come from very different cultures, and may have different ways to interact with technology. From experiences in multicultural workgroups, it is known how difficult to get multi-cultural groups to function [6]. People from different cultures tend to misunderstand each other's behaviors and hence come to distrust one another [6]. Team members' intercultural competence have an impact on a team's task performance and interaction, therefore communication, coordination, cooperation and culture, are all the aspects that need to be considered, if these are lacking, collaboration can quickly disintegrate. The social influence is an important factor for social software like groupware. An electronic tool that determines structures of communication, such as floor control, turn-taking, communication procedures, and so on may disadvantage and discourage people from different cultural communication styles. These factors should be considered by designers when designing such groupware application in order to be successful. Groupware is one form of computer supported cooperative work (CSCW). Ishii (1993) suggested that when designing forms of CSCW are better seen as cultural tools rather than computer tools. He described the difficulties of developing cross-cultural groupware, i.e. cultural patterns of decision-making processes and hopes that the next generation of groupware will be designed to take these cross cultural issues into consideration [7]. Groupware applications that are currently available in the market are not sufficient enough to meet the needs of several elements necessary to facilitate users' engagement. Therefore, groupware that can accommodate collaboration and coordination without any barrier to cultural matters is urgently needed and useful.

Questions that are raised in this dissertation, includes:

1. How does culture influence groupware in order for groupware to become effective for multicultural users?
2. How can culture support the design of groupware in multicultural context?
3. What are the requirements that must be incompliance for groupware as an intercultural collaboration tool?
4. What can be done to support cultural differences in groupware application?

At University Duisburg-Essen, Germany, a synchronous groupware named PASSENGER has been developed at the Institute of Computer Engineering throughout the last years. Tele-cooperation is not new at all, but the approach has been to start not with available technology rather with the needs of humans, then mapping these requirements onto technology. This groupware application enables student teams to communicate and cooperate via internet, even if the members are located at distributed sites and is implemented in a way that it consists of a fixed set of tools to support exactly one scenario (Software Engineering education) [8]. The usage of the system is limited and does not provide any flexibility which allow multicultural user to collaborate conveniently using the available tools and less suitability for working environment. To counter these limitations, a new system approach is under development at the Institute of Computer Engineering, namely PASSENGER 2. Demands towards the supporting technology for different users from different cultures which make it necessary to gain more in-depth knowledge about the relation between cultures and the impact on the possibility and use of supporting technology [9]. Research is needed on the intercultural users' behavior and the technology supporting it, since groupware cannot just be simply deployed into multi-culture organizations to be well accepted. Users' requirement set on how cultural factors should be taken under consideration when designing the tools and features for the groupware design will be defined in this dissertation.

This dissertation will propose on top of the seven layers of the ISO/OSI model, two extension layers. The social layer (the 8th layer) as the representation and support of groups and the cultural layer (the 9th layer) representing the communication as it is influenced through different cultural backgrounds of people using the tools (i.e. Passenger 2). These two extension layers to OSI reference model will serve as the socio-cultural awareness in designing new technologies. The 8th layer has been implemented completely (i.e Passenger 1) but the 9th layer the mapping onto technical communication is still missing and the cultural influence should be studied more detail. Therefore, this dissertation will be focusing mainly on the ninth layer, which is the cultural layer.

Also, these extensions of the OSI seven layers will serve as guidelines to help software engineers to develop and design new systems. It is needed for software engineers or developers to be aware of the socio-cultural issues that affect various parts or layers by providing these two extension layers that includes social and technical factors.

1.2 State of the Art and Related Works

Although CSCW research has been conducted for more than almost two decades, many issues are still under study, especially regarding social aspects. Most drawbacks in groupware are associated with the human factors. Although the implementation of groupware has become very popular in business industries, there are still cultural factors within many organizations that make the implementation of groupware difficult [10].

To understand the problems encountered by groupware applications, it is essential to realize that most interest in groupware development is found among the developers and users. Current groupware systems do not fully match the work life of organizational work groups [11]. Adoption of CSCW systems are often more difficult than for single-user systems [12], groupware need to be built such that users can customize the majority of the application to their needs.

The failure of the early groupware system was often characterized by computer scientists intending to radically increase the efficiency of organizations through deterministic models of cooperative activity [13], a mistake that Passenger 2 can also experience if we don't learn from the previous failures. The design strategies that previous groupware systems have implemented, also in Passenger 1, is the lack of account for the social factors such as the cultural aspect in the group work. Therefore CSCW research must be broadened and include the cultural layer that study the factors encompassing collaborative work.

The study of CSCW can be defined as a middle field of research between Human Computer Interaction (HCI) and Information System (IS), as CSCW studies the way people work in group as well as technological solutions. Previous HCI researchers have investigated how cultural factors may affect design and evaluation of single-user applications ([14–18], but very little research has been conducted on how cultural factors affect the design of a multi-user application, such as groupware. Most research on cultural influences ([15], [18]) was examined for website interface purposes or focused only on the development of technical skills while the broader human and social aspects of software engineering have not been addressed. Designing user interface for multi-cultural users may require interfaces that adapt to the standards to the cultural context of the specific user targets. It is therefore necessary to investigate in more detail the role of groupware in the multicultural contexts. It is necessary to acknowledge the relevance of how culture influences the design groupware and to successfully support cooperative work.

In order for the new groupware system to be able adopted by its users, a great attention should be given for the cultural element in creating products and interfaces that are culture "fit" to its users. Groupware users are influenced by demographic, social, cultural, psychological and contextual factors, which complicate the understanding of groupware use. Examining the influence of culture on the relationship between cultural variables is necessary to establish a usability groupware for multicultural users [19].

Groupware technology is perceived to be unstable [20], evolutionary and difficult to develop [21]. One of the major challenges for CSCW technology today lies in the achievement within integrated systems of the same flexibility and usability experienced with discrete applications [22]. Groupware tools influence the interpersonal communication as well as people satisfaction, therefore it should be able to communicate and cooperate between users effectively.

Another CSCW challenge is the socio-technical gap [12]. One of the aspects of social technical gap that must be considered in CSCW system is the consideration of ambiguity of awareness and privacy [23]. Groupware technology still lacks of cultural issues affecting the user's acceptance on the groupware usage. Groupware development requires software engineers to pay extra attention in enhancing the collaboration support. Giving equal weight to social and technical issues when designing new work systems is the core importance for success [24], since social processes are the basis for the development of technology and vice versa the technology structures the possibilities for social exchange [25].

Groupware give the possibility for the team members to work collaboratively to achieve certain common task together. Developing groupware is more difficult in comparison to the task of developing application for single user. Groupware developers must handle input from and output to multiple users plus coordination and collaboration among them. Ellis et al (1991) suggest that groupware relies on the approach and contributions of the following four disciplines: distributed systems (operating systems and databases), network communications (bandwidth, connectivity, and multimedia protocols), human-computer interaction, and artificial intelligence (intelligent agents) [26]. Baeker (1993) suggest human-computer interaction, networking and communication, operating systems and database systems, windowing systems and environments, audio and video technology, and artificial intelligence as the areas of computer science within which groupware developers require expertise [27]. This dissertation will contribute to the human-computer interaction category, which involve human-human and human-computer interaction, and artificial intelligence which involve an expert system.

Previous research has been conducted about the analysis of groupware tools and the effectiveness in distributed teams, for instance Damian et al. described a case study of a real multi-site organization, where stakeholders use a mix of synchronous and asynchronous tools to interact and detected problems for stakeholders which are: (1) lack of informal or face-to-face communication and (2) difficulty in sharing drawings on a whiteboard during spontaneous discussions [28]. Another example has been conducted by Aranda et al., where their research used cognitive psychology in choosing groupware tools [29]. Results in both cases have interesting points that can be analyzed further with a cultural perspective, which is an issue that is still missing from these previous researches and also very limited studies has been conducted in relation to groupware.

Considering that cultural perception and differences are sometimes the rooting problem that causes misunderstanding and miscommunication within distributed teams, communication that involves aspects of human factors based on their cultural tendency are of the particular interest in this research. Therefore in order to improve intercultural collaboration, this dissertation uses a different approach, with culture as the 9^{th} layer, cultural aspect is used as the social factors that influences users' preference toward the selection of groupware tools.

1.3 Research Objective

Teams working together apart offer potentials of intercultural communication that may either attract or unite people and may face varieties of constraints. In order for a specific technology application to be useful for its user, applying technology appropriately to the needs of its users is very important. A groupware targeted for multicultural users should have a flexible intercultural support which means can adaptively manage the cultural differences of its users. The different backgrounds of users may cause them to have different expectations and attitudes towards their acceptance of using certain technologies. Understanding these social and cultural differences is very important in designing the next generation of groupware that can support cross-cultural collaboration.

CSCW should take into account human behavior and the social support that users need to work as a group in a more productive way. The objective of this research is to study the design issues in groupware for multicultural users to avoid a failed system by exploring how culture plays an important role in the design of groupware as an intercultural collaboration tool. Another objective of this research is to develop strategies for groupware developers and designers for greater effectiveness in a

global settings, an enhanced sensitivity to cultural differences and to develop a better understanding of the important factors influencing the successful utilization of groupware.

1.4 Research Approach

Groupware functions as a social technical oriented environment, where only focusing to the technical issues will fail to fulfill the requirements of this type of system. This dissertation proposed to use the socio-technical design as an approach to design the next generation of groupware. The socio-technical approach requires a comprehensive picture of what is required in the design task to be established [30].

In order to fill in the socio-technical gap in the context of collaborative technology, the main direction of this dissertation is on how groupware technology should be designed in order to support these collaborative activities. By adopting the social orientation of CSCW, this dissertation will look at the way different users from different culture interact and collaborate. Increasing the usability of virtual environments for distributed collaborative work will result in a successful collaboration regardless of the geographic distance and location. This brings groupware technology associated to work reengineering initiatives and the new way to conduct global business.

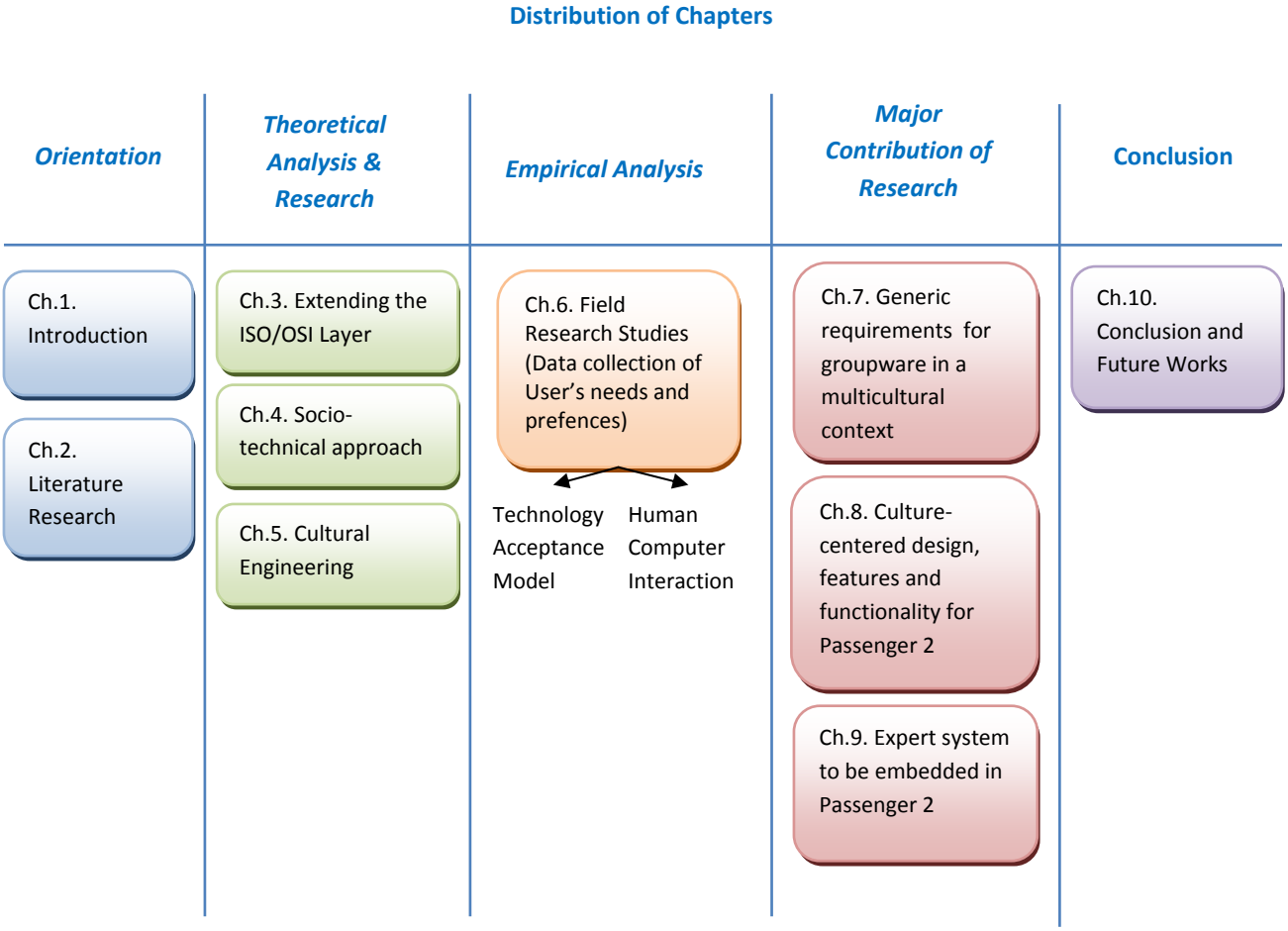
Human as the user of the computer, does not interact *with* computers but *through* computers. Therefore this research will explore the potential of computer as a media for human-human interaction with a broader understanding on how human and social environment affects software engineering. Software engineering is shaped by human and the social world that exist. When measuring people's attitude about a particular technology, a researcher need to rely on subjective measures for inferring conclusions as no objective measure can help in deciding whether a particular technology is "good" or "bad" from user's perspective [31]. It combines many aspects of different study fields, such as CSCW, intercultural communication and human computer interaction.

1.5 Overview of Thesis

This dissertation is divided into ten chapters. Chapter 1 gives an overview of the driving motivation, state of the art and related works, objectives and content of this dissertation. Chapter 2 discusses works and literature review related to this research. Chapter 3 proposes two new extension layers, complementing the seven ISO/OSI layers, where social layer as the 8th layer and cultural layer as the 9th layer. A brief introduction on the seven layers of OSI reference model, followed by the two extension layers will be discussed. Chapter 4 discusses the need to fill in the social-technical gap in the CSCW development and give the overview of the research framework. Chapter 5 introduce a new approach called cultural engineering that will be use to develop strategies in the successful utilization of groupware in multicultural context. Chapter 6 reports the field research studies which the data collection of user's needs and preferences by deploying the Technological Acceptance Model (TAM) and theories from the Human Computer Interaction (HCI). The major contributions of this research is discussed in three chapters (Chapter 7, chapter 8, and chapter 9), which is the end results on how culture effect the development of groupware application. As a final outcome, Chapter 7 discusses the guidelines for developers in designing interface design for groupware as a communication and collaborative system that will overcome the cultural barriers between multicultural users. Chapter 8 defines the cultural-centered design, features and functions propose for Passenger 2. A culture

sensitive design of a groupware technology is important for designers when expecting a multicultural range of users. Chapter 9 discuss an expert system that should be embedded to give recommendation for its users in selecting the most recommended communication tools and features based on user's preference for the group to use in order to avoid cultural misunderstanding. Finally, Chapter 10 reports the research conclusion, contributions, and possible future research.

Table 1.1 Distributions of Chapters



CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

One focus of this PhD research is to examine the relationship between culture and groupware and how these relationships affect the acceptance and the use of groupware for multicultural users oriented by globalised industries. Chapter 2 presents the review of literature to lay a theoretical foundation for the studies proposed in this dissertation. The aim is to bring together the research areas that are important to this research. The literature helps to explain why users from different cultural background may differ in accepting and adopting groupware application. It is important to note that the topic of this dissertation addresses several disciplines, which covers human computer interaction (HCI), computer supported cooperative work (CSCW) and groupware, and social science which focus on intercultural communication and culture.

Culture has a high impact of importance in the design of computer-supported communication tools. The new direction is designing the CSCW interface and tools have the effect in shifting the focus of this study on computer interfaces from HCI to "human-human interaction mediated by computer and communication". The technology has advanced so far, this research will devote more effort to the human side of the system. The resulting summaries collected from the literature review lead to a powerful tool for guiding this research.

2.2 Computer Supported Cooperative Work (CSCW) and Groupware

Computer supported cooperative work as a research field can be traced back to the early 1980s. It started as a workshop that took place in Endicott House, Massachusetts, in 1984 and brought together participants from different disciplines to exchange ideas and results about using IT for supporting collaborative work [25]. Since then, many technologies and tools have been developed for supporting communication and collaboration.

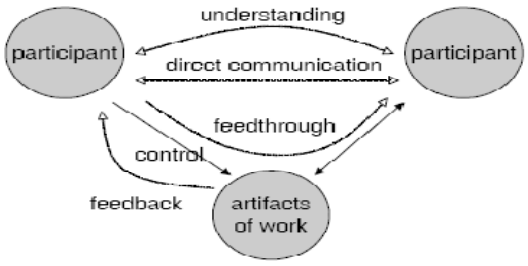


Figure 2.1 People/Artifact frameworks [25]

The people/artifact framework, as depicted in Figure 2.1, is developed in CSCW for understanding different modes of communication in groups which address the functional relationship between members and the tools to support collaboration, and maps out these relationships in a way that allows designer to follow the flow of information within the system [25], [32]. The directional and bi-

directional arcs indicate channels of communication either between participants or between a participant and the artifact.

Computer Supported Cooperative Work (CSCW) is defined by Wilson (1991) as "a generic term which combines the understanding of the way people work in groups with the enabling technologies of the computer networking, and associated hardware, software, services and techniques". CSCW, the term "supported" refers to both very simple, uncoordinated access to shared data and to complex, synchronized modeling and provision of group-international relationships and interactions [33]. The evolution of CSCW has been strongly influenced by a variety of technologies. The use of CSCW, in combination with an organizational restructuring, results in more flexible and efficient organizations. Research and development mostly consider CSCW to be simply a part of office communication [34].

CSCW refers to the theoretical foundations and methodologies for teamwork and its computer support, while groupware refers to the software systems supporting teamwork and integrating foundations achieved by CSCW research. Groupware in a simple term can be defined as a computer and communication system that supports a group of people working together. It is a tool use to improve group performance, achieved by enhancing communication and collaboration among group members. The emphasis of groupware is characterized by the high value for the common task and the shared environment. A groupware system can also be regarded as a logical extension of a single user system. In groupware, desktop images of all other users who work on the same document may be displayed. This technology may be in form of an application that is used to communicate, cooperate, coordinate, negotiate or solve problems. Below are several definitions of groupware:

> *"Groupware is a technology that provides electronic network to support communication, coordination, and collaboration across a wide range of service tasks."* [35].

> *"Groupware represents a special form of IT in that its usage involves multi-person interaction and social process"* [36]

> *"Groupware is a generic term for specialized computer aids that are designed for the use of collaborative work groups. Typically, these groups are small project-oriented teams that have important tasks and tight deadlines. Groupware can involve software, hardware, services and/or group process support"* [32].

> *"Groupware are computer-based-systems that support groups of people engaged in a common task (or goal) and that provide an interface to a shared environment"* [37].

The groupware paradigm views the computer as a shared space in which people collaborate, a clear shift in the relationship between people and information [38]. For the purpose of this dissertation, the definition of groupware by Ellis, Gibbs, and Rein (1991) that defined groupware as a computer based system that support groups of people engaged in a common task will be used.

Most CSCW application have the goal to provide the rich communication paths needed for coordinating work at all level. Groupware has the potential to enrich communication by incorporating information dissemination, work tasks and tools, and work structure into the communication channel [39]. The eight challenges for groupware developers according to Grundin [40], [41] are: (1) disparities in who does work to make an application succeed and who benefits from it; (2) challenges in obtaining a critical mass of use; (3) social, political, and motivational currents that software must navigate; (4) providing the flexibility required by variable work routines; (5) the challenge of designing infrequently used features to be unobtrusive but accessible when needed; (6) the difficulty

of learning from experience, of evaluation groupware; (7) our lack of intuition for the needs of groups and their diverse members; and (8) the need to make acceptance management part of the design and development job.

In a traditional face-to-face meeting, participants are physically present in the same place at the same time and interact with or without technological support. Groupware enables people to collaborate without having to deal with the space constraints; it supports face to face meeting by allowing computer to mediate the interaction. An interaction that occurs in the groupware usually takes place in a session. Session is defined by Olson et al as "a period of time when two or more members of a group are working together synchronously" [33].

According to Borghoff and Schlicter, groupware is classified according to the 3C model (Figure 2.2): (1) Communication, focuses on the mutual understanding of persons through information exchange; (2) Coordination, aims at finding the best way in which to arrange task-oriented activities and the allocation of resources in the best possible order; and (3) Cooperation, additional requirement of common goals makes cooperation the most demanding of the three.

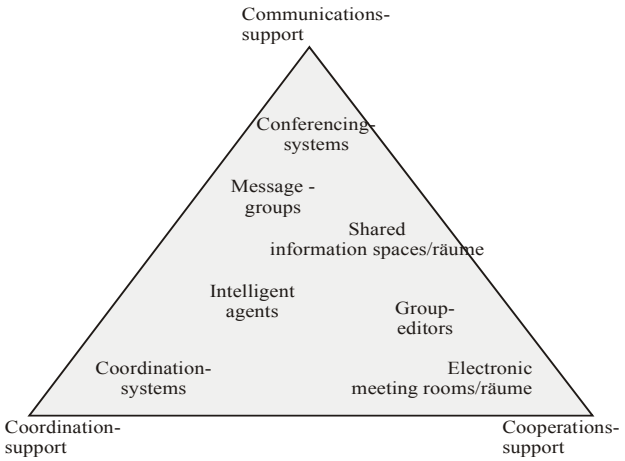
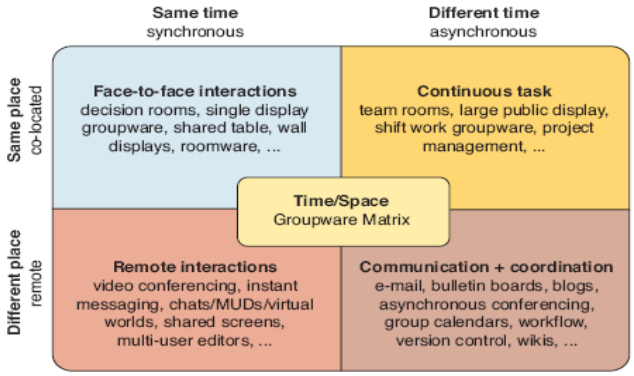


Figure 2.2 Classification according to support functions [42]

Presence or social presence is defined as "the degree of awareness of another person in an interaction and the consequent appreciation of an interpersonal relationship" and is seen as "fundamental to person-to-person communication" [43]. In face-to-face situations, social presence is achieved through verbal and non-verbal communications. In online situations, social presence is achieved through feeling of community, and the extent to which members feel connected. Table 2.1 below classifies groupware applications along two axes whether the cooperating people have to work together at the same time (synchronously) or may work at different times (asynchronously), and whether the people work at the same physical location, or at different places [42]. Both types of collaboration are important especially in geographically distributed environments. Synchronous mode allows people to work together at the same time, and provide the possibility to receive instant feedback. Asynchronous mode allows team members to work individually and contribute to the collective activity of the group for later discussion. The availability of an asynchronous tool becomes important when groups are distributed across time zones and difficult to schedule real time meetings. Blogs and wikis are often used for socialization, but frequently require someone with the technical skills to guide and facilitate the process. Research has indicated that while wikis are ideal for recording and authoring, they are not

sufficient for collaborative projects, and that synchronous communication, is necessary for timely decision making [43].

Table 2.1 Time-place matrix of groupware (source: [35])



As organizations are adopting new structures such as the networked organization and the virtual organization, groupware is increasingly being used as a way of implementing these organizational forms [44]. Within the last 10 years, there have been many positive reports on the use of groupware systems to support several software engineering activities, such as requirement negotiations, software design, quality assurance, etc. Many organizations have implemented different types of groupware, such as instant messaging, emails, and team collaboration platforms. Groupware have been successful evaluated as a promising way to minimize meeting costs, maximize asynchronous work, and conserve precious organizational resources [45]. However, the use of such technologies is a social process and to be effective in supporting collaboration, all team members must appreciate its value ([46],[47]). Even though groupware may give many benefits to the companies, and become available to their employees to use; many employees do not necessarily enthusiastic and eagerly start using it right away. If the technology is not used by the intended end users, it has the potential to lose its benefits.

A CSCW theory is a systematic conception of how information system work in organizations, how people process information, make decisions, and behave toward others, or how groups and organizations operate in their social environment [48]. CSCW is a broad designation that focuses on work, on the tasks that people carry out, their workplaces, and technology that could provide the support. CSCW reaches from sociological analyses and anthropological descriptions of work to the technological foundation of the systems [41] and groupware is more specifically focused on the technology. Ackerman (2000) described CSCW is an engineering discipline attempting to construct suitable systems for groups, organizations and other collectivities, and at the same time, CSCW is a social science attempting to understand the basis for that construction in the social world (or everyday experiences) [12].

2.2.1 Why CSCW fail

The main goal of CSCW applications and groupware is to assist groups in carrying out a common task through a shared interface or environment [26], [38]. Although CSCW applications give the advantages of supporting technologies, it has not reached the expected level of success. This failure is mainly due to the lack of adaptation of the CSCW applications to the target users that will be using the applications and due to the internal structure of the organizations in which they are intended to be used [49–56].

According to Grundin (1988) there were three main problems with CSCW applications. The first is that "CSCW requires that some people do additional work, while those people are not the ones who perceive a direct benefit from the use of the application" [57]. In this case, additional work, means while people (often managers) may benefit from the introduction of CSCW facilities, others (usually lower in the organizational hierarchy) have to do additional work to support those facilities [58]. With an extra work that one need to perform can sometime be reason enough for abandoning technologies or certain courses of action [59]. The second problem according to Grundin is that the design process fails because our intuitions are poor for multi-user applications [57], since intuition may be a far more reliable guide to single-user applications. The third problem with CSCW is that "we fail to learn from experience because these complex applications introduce almost insurmountable obstacles to meaningful, generalizable analysis and evaluation" [57]. Groupware equates to multi-user systems which require a much more significant investment and therefore induce a greater willingness for organizational change.

The fail of CSCW also have been attributed to the designers lack of information on the use of the technology [26], lacking a one-to-one correlation with existing social activities, the use of many CSCW application requires further technical and social changes [22] and due to the complexity of the social interactions between the end-users, system designers and implementers [60].

2.3 Human Computer Interaction (HCI)

Human computer interaction is defined as "a discipline concerned with the design, evaluation, and implementation of interactive computing systems for human use, and with the study of major phenomena surrounding them" [61]. It is also often related to the study of the interaction between humans and computers and the purpose is to enable designers to build more usable systems by making explicit the user's model of the task and system [61]. The term "human-computer interaction" is commonly used interchangeably with terms such as "man-machine interaction" (MMI), "computer and human interaction" (CHI) and "human-machine interaction" (HMI) [61]. HCI is concerned with both the software and hardware of interactional techniques and technologies [62]. Preece et al (1994) lists the major research areas of the HCI discipline (see Table 2.2). This dissertation will focus on the "user" and "user interface" areas only. The "user" and "user interface" were particularly important because user will be evaluating the interface style and the user interface is the object that the user perceives [63].

Table 2.2 Factors in HCI (source: [64])

In HCI, the user interface is there to transform the properties of the computer's representational system to those that match the concepts of the user. It is the media for users to interact with computer based "tools" and "messages", where tools consisting of office productivity tools and messages are the computer supported communication. An important issue in developing a graphical interface is the choice of mapping between the representing world (real world metaphor) and the represented world (virtual world) [43]. The main goal is to faithfully match the real world to the represented virtual world. In order for a technology to be usable, the surface representation must correspond to something that is interpretable by the user. In this study, the goal of the user interface to make the user experience productive, efficient, pleasing and humane.

2.3.1 HCI in relevance to Culture and CSCW

CSCW is a field that is growing enormously with the advantage of inexpensive, powerful computer and communication technologies. The World Wide Web has expanded its options for collaboration and social media participation that give benefits to its users. Virtual environment, such as Facebook™ as a social networking has been booming these last few years. Electronic collaboration gives positive benefits for business in the networked global companies. Colleagues and teammates enjoy working and file sharing halfway around the world. The distance to their teammates is not measured in mile or kilometers, but rather in intellectual compatibility and responsiveness [15], [18], [65]. How people use tools together are cultural matters. Cross-cultural communication between users also depicted from the technical issues occurring while using the system. The ability of telecommunication and computer-based technologies to overcome time and space constraints as a tool is needed to promote international collaboration in many aspects.

Usability is very important when designing an interface. "Human interface" is an interface between an individual user and a computer ("human-computer interface" or HCI). Many researches has been conducted to improve the human-computer interfaces which focused on communication issues between user and computer, such as screen layout, icon design, data visualization, pointing devices, etc [64]. Research on human interface, communication and CSCW, all share common goals, which is

to understand the nature of cross-cultural communication and to design systems that facilitate communication and collaboration between its users using computer technology. Cross cultural considerations that need to be adjusted in designing an interface includes the following: language, culture, technical infrastructure, loyal/global perspective, learning styles, reasoning patterns, high/low context communication, and social context.

User-interface design is influenced by cultural differences. Different cultures in the world have its own pattern of social interaction and behavior. Culture is significant to user interface design because quite often a design will touch several of these areas consciously or unconsciously. If the interface does not take the cultural symbols into account, misunderstanding can occur. Fernandes (1995) mentioned in his book that "*Culture is something in which people take pride. It gives us all a sense of dignity. It must be respected in the user interface. Insulting someone's culture intentionally or unintentionally is very dangerous. It may not only prevent somebody from using your product, it may prevent someone from ever using any of your company's products ever again*."

2.3.2 Global software

Due to a trend towards standardization, companies aimed to develop one version of the software to be used in all cultures. Standardization without paying attention to specific cultural preferences might lead to a user feeling forced to receive disturbing output or perform counter-intuitive tasks. When the software market became global, designer had to make changes to existing products or change their approach to product development. Fernandes (1995) defined a "globalized" product refers to a set of easily localized functionality that can be modified and built upon to create designs and features unique to a country of culture. Jacob Nielsen describes three levels of globalised product design (Nielsen, 1990): (1) Software that is able to process and display the user's native language; (2) Software with a user interface that is understandable and usable in the user's native language; (3) Software that is able to accommodate the users' cultural characteristics (software which goes beyond avoiding offensive or nonsensical icons in order to address specific cultural models such as the way business is done and the way people communicate).

Companies tried to accommodate the cultural diversity of users by adopting the internationalization and localization approach. Internationalization consists of removing all culturally specific features from the software and describing these in an attachment. Localization uses an internationalized product and adds features to accommodate the target locale (the cultural group to which the software will be sold). In order to provide interfaces that are properly localized for a target locale, a company needs to learn about the target locale and needs to be able to identify culturally specific features of software and of cultural biases in the target culture as well as its own. Knowledge to the target culture is necessary to provide for cultural metaphors, real world representation of artificial objects, and to eliminate culturally offensive material. Figure 2.3 shows an example of a localized user interface.

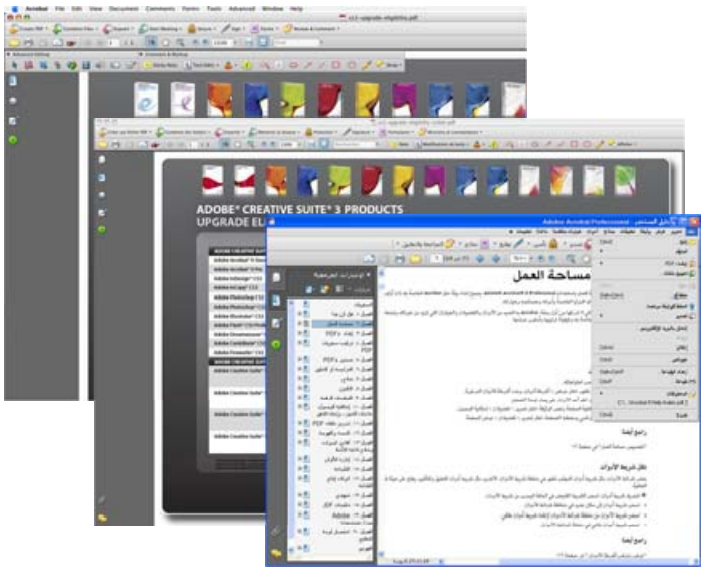


Figure 2.3 Localized user interfaces in Arabic, Hebrew and Greek [66]

2.4 Virtual teams and Global Virtual Teams

A team is a small group of people with complementary skills who are equally committed to a common purpose, goals, and working approach for which they hold themselves mutually accountable (Katzenbach and Smith, 1999). Team members are people who: have complementary technical, problem solving, and interpersonal skills; are committed to a meaningful purpose and specific, understandable performance goals; maintain a high degree of mutual accountability; can achieve high levels of performance (Katzenbach and Smith, 1999). Traditional team is defined as a social group of individuals who are collocated and interdependent in their tasks; the group undertakes and coordinates their activities to achieve common goals and share responsibility for outcomes. Virtual team has the same goals and objectives as traditional team and interact through interdependent tasks, but operate across geographic, temporal and organizational boundaries (Lipnack and Stamps 1997). On a simple level, a virtual team is separated physically and uses information and communication technologies to connect and complete the team's task. Team members use interaction media such as chat, email, audio conference, and video conferencing to interact with one another without needing to meet face-to-face. The more a team relies on media for interaction, the more virtual it is [67]. This physical separation is a function of time and place – virtual teams do not occupy the same place at the same time [68].

Virtual teams often operate in a multicultural and multilingual environment [52].Global virtual teams are technology-mediated groups of people from different countries that work on common tasks [69]. In order to be able to compete in the global economy, organizations and industries are almost forced to work with global virtual teams [67]. Global virtual teams enable companies to combine skills, talents and other benefits from people around the world. In the workplace, global virtual teams are commonplace and the number of virtual teams keeps growing [70]. The increased growth of virtual teams practice can be attributed on the main to advances in ICTs and the globalization of industry and markets. Virtual team is described as the core building block of the virtual organization [71], [72], since it is sometime related to creativity and creativity is an essential part of organizational life. The advantage of having virtual group and working collaborate in distributed places are that companies are

able to draw on a wide range of knowledge and skills, and most important travel costs and time are reduced.

To make global virtual team effective, it is important to focus on behaviors that are critical for effective team functioning [70]. In a study among professional virtual team workers, Dekker and Rutte (2008) designed a framework of 13 categories that contain behaviors that are crucial in a global virtual team (see Table 2.2). The categories contain behaviors that were perceived to be critical for the satisfaction and performance of the team.

Table 2.3 Categories of interaction behavior in virtual teams and how team members should behave [73]

No.	Category Label	Interaction Behavior
1	Media use	Effectively matching the media to the task and effective use of media
2	Handling diversity	Taking into account language, time zone, and cultural differences when interacting and behaving accordingly
3	Interaction volume	Communicating short, to the point, and only when necessary
4	In-role behavior	Taking task and goal of the team seriously and complying with obligations
5	Structuring of meeting	Planning and structuring of meeting
6	Reliable interaction	Being predictable in behavior and responsive to messages of team members
7	Active participation	Showing active participation in meetings by contributing and listening
8	Including team members	Including and inviting team members for contributions
9	Task-progress communication	Communicating deadlines, actions, and progress of a task to a team
10	Extra-role behavior	Showing pro-social behavior towards team member
11	Sharing by leader	Sharing of information and decision with the team by team leader
12	Attendance	Being involved in the meeting and no showing up late or not at all. No multitasking
13	Social-emotional communication	Talking about non-task-related subjects
14	Respectfulness	Behaving in accordance with the hierarchy of the team

Virtual collaboration requires competencies such as effective communication, and the ability to build trust and understanding to create a community with common aims [73]. Individuals need to understand cultural differences that determine behavior, successful teamwork and outcomes, but at the same time so be able to notice and be aware of their own cultural identity, beliefs and assumptions. Research has identified issues that can arise in global virtual collaboration [74]. Cultural diversity is part of the equation, building trusting relationships means being open-minded, curious and accepting of others' differences [75]. If culturally inclusive relationship building is prioritized, then the effectiveness of global virtual team will be enhanced. Daniels (2010) identified three essential skills in relation to working in a global collaboration setting, namely: (1) having general communication and distributed team working skills; (2) having a cultural awareness including understanding societal impact; and (3) being open minded in a creative and innovative way to solutions.

In an intercultural virtual collaboration, intercultural skills and competence is necessary, which includes openness to other perspectives, flexibility and creativity. Most virtual collaboration activity begins with a socialization process to try to build relationships through a sense of belonging, trust and shared common values [33]. Terence (2008) defined the three major challenges of virtual collaboration: (1) Isolation, as result of reduced contact, restricted social cues, difficulty of trust-building, reduced sense of team identity, and the out-of-sight/out-of-mind syndrome; (2)

Fragmentation, as a result of unclear purpose, fuzzy roles and responsibilities, local pressures and priorities, uncertainties around decision making, neglect of finding common ground; and (3) Confusion, as a result of too much or too little communication, imprecise communication, lack of shared contextual understanding, conflicting assumptions, activities hidden from one another by distance. In order counter this challenges, in the book titled "Where in the World is my Team", Terence stated the six performance zones for global team success, which are:

1. Cooperation – the ability to develop and maintain trusting relationships across geographies, time zones, and cultures.
2. Convergence – the ability to maintain a clear purpose, direction, and shared set of priorities.
3. Coordination – the ability to align work through clearly defined roles and responsibilities, shared tools, processes, and methods.
4. Capability – the ability to leverage the knowledge, skills and experiences of all members, and increase the capabilities of the team as a whole
5. Communication – the ability to generate shared verbal and written understanding across distance via technology.
6. Cultural intelligence – the ability to develop and maintain a global virtual workplace inclusive of value and style differences.

2.5 Technology Acceptance Model (TAM)

Technology can have far-reaching consequences in many areas. Understanding the factors which influence the adoption and use of information technology by individuals is one of the important issues which continue to interest Information Systems researchers. Many factors influence the process of adaptation, these factors are important to take into account when application developers want users to adopt their products and it can get even more complicated when different cultures are involved.

Technology adoption involves the use, the technology and the context [76]. There are many models for understanding technology adoption that have been proposed over the recent years. From these various models, Pedersen (2003) lists Rogers's innovation diffusion model, the domestication model and technology acceptance model (TAM) as the three most commonly applied:

a. Roger's innovation diffusion model is founded in sociology but has been applied to the world of marketing where users are seen as economic entities, the model provides an approach to understanding how innovations are adopted by a particular population [77].
b. Domestication model where users are seen as social entities and the model aim to provide a framework for understanding how technology innovations change and are changed by their social contexts [78].
c. Technology acceptance model to explain the determinants of computer acceptance and usage behavior [79].

While Roger's innovation diffusion model focuses on marketing and sales processes, the domestication approach deals with a more global analysis of adoptions *ex post facto* and the TAM focuses on information technology adoption in organizations [80].

The theoretical foundation for TAM is based on Fishbein and Ajzen's theory of reasoned action (TRA) model [81]. TRA is widely used as a study model in social psychology. It attempts to explain why people behave as they do in situations of 'reasoned action' by identifying causal relations

between beliefs, attitudes, intentions and behavior [82]. Attitude is defines as the individual's positive or negative feelings about enacting a target behavior. TRA is illustrated in Figure 2.4 below:

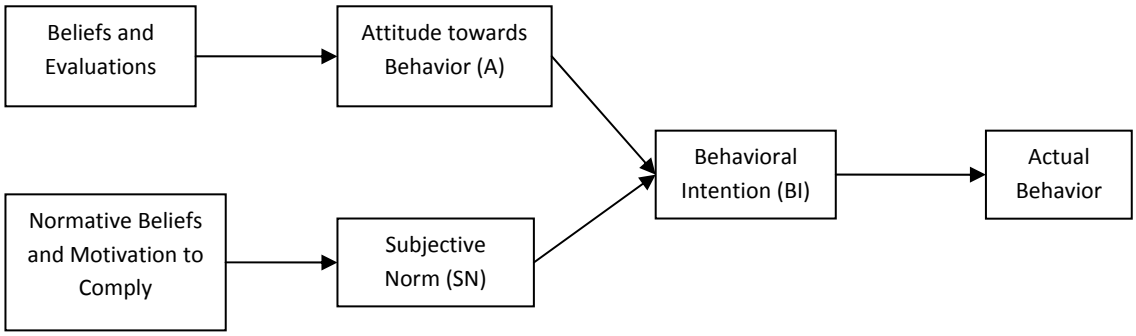


Figure 2.4 Diagrammatic representation of the TRA adapted from [83]

TRA is a general model and it does not specify the active beliefs for a specific behavior. Therefore, for researchers to use the TRA, firstly they have to identify the beliefs that are relevant for subjects regarding the behavior under investigation. For example, if TRA is applied to groupware usage, people's belief regarding the benefits or liabilities of groupware use have to be identified by the researcher.

The TAM is a special case of TRA for modeling technology adoption in organizations [82]. TRA asserted that beliefs influence attitudes, which in turn lead to intentions that result in behavior. Accordingly, Davis (1986) reasoned that an individual's beliefs with regard to 'perceived usefulness' and 'perceived ease of use' resulting in an intention to use that in turn resulted in actual use. The TAM developed by Davis (1989) explained about the acceptance of information technology and aims at assessing user beliefs about the usefulness and ease of use of a technology that is expected to support their work. It has become the core template for much technology acceptance theory. A key purpose of TAM is to provide a basis for tracing the impact of external variables on internal beliefs, attitudes, and intentions. Perceived ease of use (PE) and perceived usefulness (PU) are the two most important factors in TAM. These two factors combined will generate an acceptance or rejection disposition for the user towards using a particular technology. The TAM has the following components [84]:

1. External variables (EV): External variable influence perceived usefulness (PU) and perceived ease of use (PE), for example cultural factors in this research.
2. Perceived usefulness (PU): Perceived usefulness is defined as 'the extent to which a person believes that using the system will enhance his or her job performance' [84].
3. Perceived ease of use (PE): Perceived ease of use is 'the extent to which a person believes that using the system will be free of effort' [82].
4. Attitudes towards use (A): Attitude toward use is defined as 'the user's desirability of his or her using the system. Perceived usefulness (PU) and perceived ease of use (PE) are the sole determinants of attitude (A) towards the technology system.
5. Behavioral intention (BI): Attitude (A) combined with perceived usefulness (PU) predict behavioral intention (BI)
6. Actual use: Behavioral intention (BI) in turn predicts actual use.

TAM is illustrated in Figure 2.5 below which includes six concepts [82].

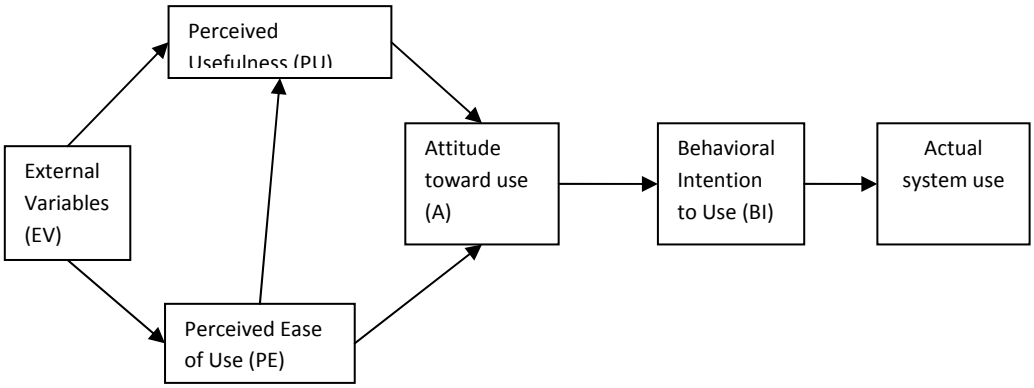


Figure 2.5 Technology Acceptance Model (TAM) [85]

Previous research indicated that TAM is one of the most influential models in the adoption of technology and represents an important theoretical contribution towards the usage of information system and information system acceptance behavior [86]. A review of scholarly research on IS acceptance and usage suggests that TAM has emerged as one of the most influential models in the stream of research [87] and has been fully validated to be powerful as a framework to predict user acceptance of new technology and for predicting whether users will adopt new information technologies. TAM has been tested in many empirical researches and the tools used with the model have proven to be of quality and yield statistically reliable results [46].

TAM model is mainly applied to the adoption of technology within organization and the construed of the model are meant to be general and universal to different types of computer systems and user populations. In general, TAM is able to explain up to 40% of the variance in usage intentions and 30% in system usage [84]. However, over the past years it has also been criticized for its shortcomings. Malhotra and Galletta (1999) indicated that the attitude towards adopting a technology is believed to be the result of personal and social influences and the fact that TAM does not account for social influence is a limitation. TAM received criticism as it does not include social factors that affect technology acceptance and usage, therefore, a further model (TAM2) was later introduced by Venkantesh and Davis (2000). The revised model reveals the effect of three interrelated social forces that influence users to accept or reject adopting the technology, consisting of subjective norms, voluntariness, and perceived status [2]. With this in mind, the TAM model that is used in this research has been extended and modified to fit for applying the social influences.

2.6 Expert System (ES)

Fein and Feigenbaum (1981) defined artificial intelligence (AI) as the part of computer science that is concerned with designing intelligent computer systems, that exhibit the characteristic associated with intelligence in human behavior – understanding language, learning, reasoning, solving problems and so on [88]. AI is concerned with programming computers to perform tasks that are presently done better by humans, because they involve such higher mental processes such as perceptual learning, memory organization and judgmental reasoning [89].

Expert system (ES) emerged as a branch of artificial intelligence to develop computer programs that could reason as humans [90]. ES are the most extensively used and developed in AI systems. An expert system is defined as “a program which has a wide base of knowledge in a restricted domain,

and uses complex inferential reasoning to perform tasks which a human expert could do" [91]. Another definition of an expert system is "a computer program that represents and reasons with knowledge of some specialist subject with a view to solving problems of giving advice" [92]. One of the important features in an expert system in practical content is the capability of explanation.

Expert systems are typically composed of two modules consisting of a knowledge base and an inference machine. The knowledge-base contain the knowledge about a particular problem domain, while the inference machine solves problem stated by the user by using the knowledge based and generates user-oriented explanations of the solutions [93]. Knowledge is encoded within such programs, and therefore they are powerful tools for use by humans [94]. The knowledge is attained from experts. The basic idea behind ES is simply that expertise, which is the vast body of task-specific knowledge, is transferred from a human to a computer [95]. The knowledge is then stored in the computer and the computer can make inferences and arrive at a specific conclusion, which users can call upon the computer for specific advice as needed [95]. The main parts of an expert system are the knowledge base and inference mechanism which handle the knowledge, and an interface to allow a user to access that knowledge, as shown in Figure 2.6 below.

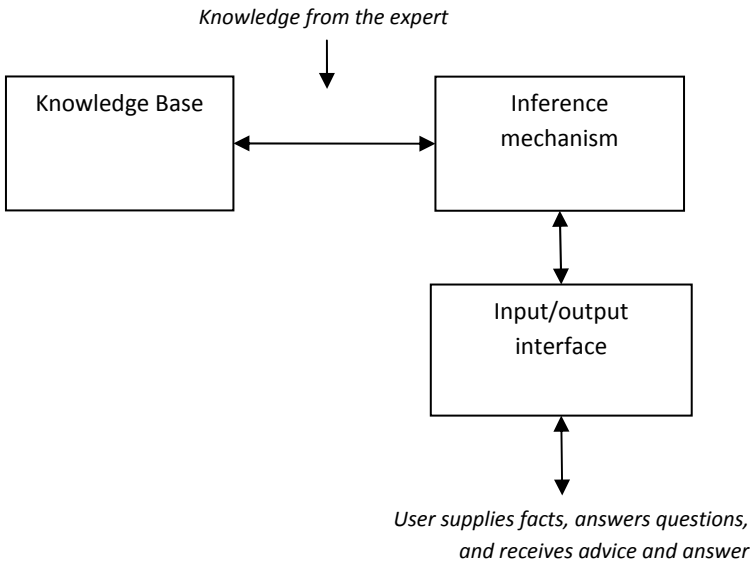


Figure 2.6 The main parts of an expert system (adopted from [94])

As shown in Figure 2.7 below, the process of collecting the required knowledge for developing the rule base of an expert system is known as knowledge engineering [96]. The knowledge base is usually represented by a set of If-Then rules and the inference engine of the expert system matches appropriate combinations of rules in order to generate conclusions [96].

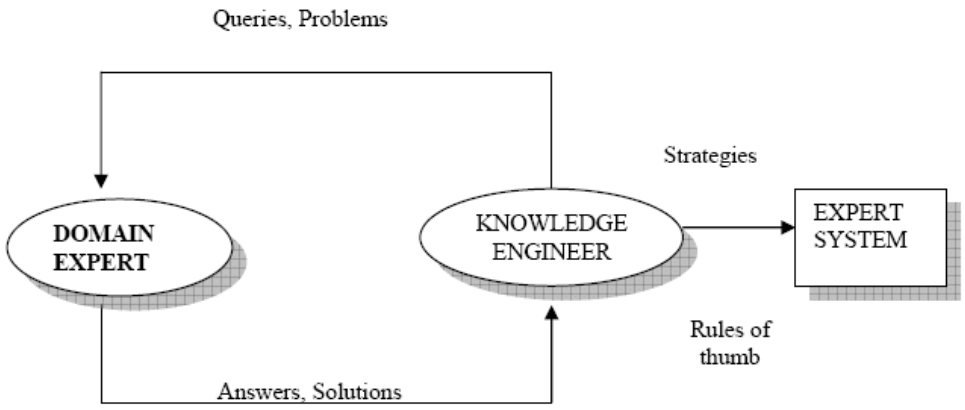


Figure 2.7 Knowledge Engineering Process (source: [96])

Some ES methodologies have common concepts, such as the rule-based system and knowledge-based systems. A rule-based system consists of rule-base, inference engine and a workspace. A rule-based expert system contains information obtained from human experts, and represents that information in the form of rules, such as IF-THEN. The rule can then be used to perform operations on data to inference in order to reach appropriate conclusion [95].

Knowledge-based system (KBS) has their roots in the field of artificial intelligence (AI) and attempts to understand and initiate human knowledge in computer systems [97]. The four main components of KBS are usually distinguished as: a knowledge base, an inference engine, a knowledge engineering tool, and a specific user interface [98]. A knowledge-based system performs a task by applying rules of thumb to a symbolic representation of knowledge, instead of employing more algorithmic or statistical methods [92].

Knowledge acquisition is defined by Buchanan et al. (1983) as the transfer and transformation of potential problem-solving expertise from some knowledge source to a program [99]. Knowledge representation is a substantial subfield in its own right, on the borderline between AI and cognitive science; it is concerned with the way in which information might be stored in the human brain, and the ways in which large bodies of knowledge can be formally described for the purposes of symbolic computation [92]. Knowledge acquisition (KA) is seen as a crucial problem concerning the success of an expert system and has always been regarded as the bottleneck in developing any expert system [100].

2.7 Socio-technical systems approach

The term “socio-technical system” has been coined in the year 1950s at Tavistock Institute London by Trist and Bamforth in the context of a number of studies of work organization in the British coal mining and textile industries [101]. In their studies, they found very different results emerging from the introduction of identical technology into different groups (social systems), and concluded that the technical system and the social system have to be co-optimized for the whole system to be successful.

The socio-technical approach is based on the view that organizations must optimize the functioning of both technical and social systems [102], [103], whereas the technical system refers to the components that contribute to the task accomplishment goals of the organization and the social system refers to the quality of work life goals [104]. In the groupware context, a socio-technical approach implies a study

of user requirements, an understanding of various technical options, and a conscious attempt to match technology to requirements [104].

Socio-technical systems approaches advocate a human-centric analysis that investigates the impact of computer systems (the technical systems) on people and considers ways in which technology can be designed more effectively for people [105]. The socio-technical systems approach considers formal and informal networks or groups in organizations because most individuals develop a sense of identity to belonging to a group [106].

2.8 Culture

"Our own culture is like water to a fish. It sustains us. We live and breathe through it." – Trompenaars, 2005

This section introduces some basic theories on how culture influence collaborative interaction mediated through computer. The goal is to establish a knowledge foundation of intercultural and cross-cultural collaborative models, theories and research approaches in order to define an analytical framework to design a groupware application for multicultural users that is oriented by globalised industries.

Culture has been defined according to several perspectives and depends on the context in which culture is studied. It provides individuals with an identity with those who share their cultural background. It is a key element of who someone is and directly impacts how they live, act, work, and socialize [107]. In the book, "Culture: a critical review of concepts and definitions", Kroeber and Kluckhohn (1952) gave 164 definitions of culture. Culture is the collective programming of the mind that distinguishes the members of one group or category of people from another [108]. Anthropologist, Edward T. Hall stated that "culture is communication and communication is culture" [109], while Kluckhohn (1951) defined culture as "patterned ways of thinking, feeling and reacting, where the essential core of culture consists of traditional ideas and especially their attached values" [108].

Culture describes everything that makes a large group of people unique. Members of the same culture share similar experience and thoughts. Hall concluded that "there is not one aspect of human life that is not touched and altered by culture" [110]. Culture is learned, the term enculturation denotes the total process of learning one's culture. Members of a culture learn their patterns of behavior and ways of thinking until most of them become internalized and habitual. Culture is often analogized with an iceberg (Figure 2.8), representing its visible and invisible aspects, where the deeper layers (e.g., values, beliefs, traditions) are hidden from our view. We tend to see and hear only the uppermost layers of the cultural artifacts (e.g. music, fashion). To understand a culture, we have to match their underlying values coherently with their respective norms, meanings, and symbols. It is the underlying set of cultural beliefs and values that drives people's thinking, reactions, and behaviors. Even though people in diverse cultures are dissimilar in many ways, they are also alike in many aspects, especially in the deep levels of the needs for human respect, connection, and security.

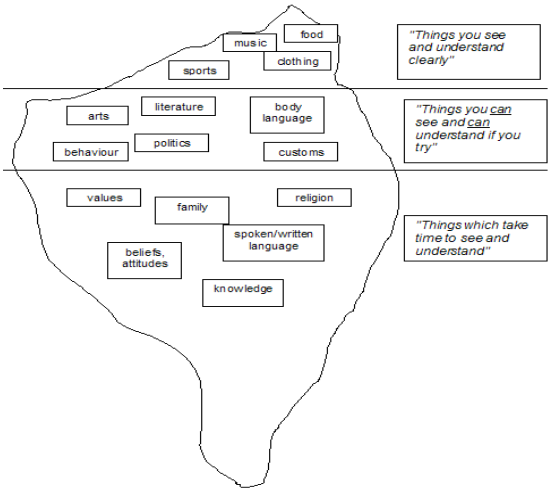


Figure 2.8 Culture: an iceberg metaphor

Culture depends on the context in which it is studied; two types of culture will be described in this dissertation, namely national culture and organizational culture. National culture has been described in terms of shared values, beliefs and philosophies that affect the way society is organized. National culture is hard to change and can only effectively take place over an extended time period [111]. These values, norms and beliefs are shaped by common history, tradition, climate and prosperity [111]. At the organizational level, a number of strategies are implemented to develop organizational culture. Organizational culture is defined as the "shared values and beliefs, which are seen to characterize particular organizations" [112]. Organizational norms, beliefs, values and objectives are imparted through training, management style, communication methods, rewards and organizational structure. National culture differs primarily in their values, while organizational culture differs mainly in their practices. National cultures describe the collective mental programming of otherwise similar persons from different nations, while organizational cultures describe the collective mental programming of similar persons from different organizations [60]. This dissertation will consider both national and organizational cultures as a context or frame of reference with which to understand the differences emerging between countries in the use and perception of technology.

2.8.1 Intercultural communication competence

The term intercultural communication in scholarly literature was first introduced by anthropologist Edward T. Hall. Hall's view on culture is "an unconscious framework which makes communication possible, but intercultural conflict inevitable, as people are generally unaware of their cultural conditioning and the hidden differences in how we think, creating barriers to cross-cultural understanding [113]. Practicing intercultural communication is especially critical in today's global world since people often view the world by the perspective of their own culture, in which made them often difficult to understand and appreciate many of the actions originating by other people from different culture. When communicating with people from different cultures, it is very important to keep in mind that culture and communication are strongly connected with one another. The way that people view communication is part of their culture. In general, people from Western and Asian cultures have the greatest chance of misunderstanding each other. Much of this misunderstanding comes from the fact that Western and Asian cultures have two very different views of communication. Good intercultural communicators have personality strength (with a strong sense of self and are socially relaxed), communication skills (verbal and nonverbal), psychological adjustment (ability to

adapt to new situations), and cultural awareness (understanding of how people of different cultures think and act) [114].

Intercultural competence is the ability of successful communication with people of other cultures. It comprises knowledge, skills, attitudes and behavior to be able to interact with people from another culture. Guo-Ming Chen and William J. Starosta (1996) defined intercultural communication competence as "the ability to negotiate cultural meanings and to execute appropriately effective communication behaviors that recognize the multiple identities in a specific environment". This means that the competent intercultural communicators interact effectively and appropriately to achieve their own goals and respect and affirm the cultural identities of those with whom they interact [73]. Intercultural competence includes awareness of one's own identity, beliefs and assumptions, respect for the value of others, curiosity about other cultures and openness to diverse cultural perspectives and alternatives, sensitivity to cultural differences and a willingness to adapt one's own behavior as appropriate [115].

The need for intercultural competency skills and intercultural sensitivity has become strikingly evident in the global computing arena, where much project and development work is done by virtual teams whose individual members are located in different parts of the world and from a variety of nationalities (Hitchcock, Hai Quan, and Cong Danh 2010). An understanding of the basic cultural assumptions will have a significant effect on the development on intercultural competences and the success in cross-cultural situations.

2.8.2 Social Scientist and Cultural Dimensions

Of several cultural models referenced in HCI literature, Hofstede, Edward T. Hall, Trompenaars, and the Globe Studies are outlined here.

2.8.2.1 Geert Hofstede

Hofstede (1991, 2001) derived four cultural variability dimensions in his large-scale study of the U.S multinational business corporation. The corporation has subsidiaries in 50 countries and three regions (the Arabic-speaking countries, East Africa, and West Africa). As the result, Hostede (1991) delineated four organizational value patterns across a diverse range of cultures. The four dimensions are individualistic vs. collectivistic, power distance, uncertainty avoidance, and femininity vs. masculinity. Hofstede's fifth dimension, Long-term vs. Short-term time orientation was added later with the help of Michael Bond [116] who had lived and worked in Asia. It is a dimension particularly important to cultures influenced by Confucian religion. Hofstede's four cultural value dimensions (Table 2.4) are related to business organizational values in different cultures. Hofstede research on cultural dimensions provides a theoretical foundation for exploring the impact of cultural differences on the adoption and diffusion of IT-based innovations such as E-mails. Hofstede used the analogy of the way computers are programmed, such patterns of thinking, feeling, and acting mental programs, or „software of the mind".

Table 2.4 Hofstede Cultural Dimension

Dimension	Description
Individualism	Degree to which people in a culture prefer to act as individuals rather than as members of groups
Uncertainty Avoidance	Degree to which people in a culture feel uncomfortable with uncertainty and ambiguity
Power Distance	Degree of inequality among people which the population of a culture considers normal
Maculinity	Degree to which values like assertiveness, performance, success, and competition prevail among people of a culture over gentler values like the quality of life, maintaining warm personal relationships, service, care for the weak, etc.

This dissertation will only cover three dimensions by Hofstede, namely collectivism-individualism, power distance and uncertainty avoidance.

a. Collectivism - Individualism (CI) - is the major dimensional of cultural variability used to explain differences and similarities in communication across cultures. Collectivism - Individualism exists at the cultural level (such as cultural norms/rules) and the individual level (such as individual values). Collectivism and individualism exist in all cultures. Individualism refers to the broad value tendencies of a culture in emphasizing the importance of individual identity over group identity, individual rights over group rights, and individual needs over group needs. Individual goals are emphasized more than group's goals in individualistic cultures. Group goals in contrast, take precedence over individual goals in collectivistic cultures. Collectivism refers to the broad value tendencies of a culture in emphasizing the importance of the "we" identity over the "I" identity, group rights over individual rights, and in-group needs over individual wants and desires.

b. Uncertainty avoidance (UA) - Uncertainty avoidance deals with the degree to which members of a culture try to avoid uncertainty. Members of high uncertainty avoidance cultures have a lower tolerance "for uncertainty and ambiguity, which expresses itself in higher levels of anxiety and energy release, greater need for formal rules and less tolerance for people or groups with deviant ideas or behavior" than members of low uncertainty avoidance cultures [117]. Members of low uncertainty avoidance cultures have lower stress levels; they accept dissent and taking risks more than members of high uncertainty avoidance cultures. High uncertainty avoidance cultures tend to have clear norms and rules to guide behavior for all situations. Norms and rules in low uncertainty avoidance cultures are not as clear-cut and rigid as those in high uncertainty avoidance culture. In high uncertainty avoidance culture, aggressive behavior is acceptable, but individual prefer to contain aggression by avoiding conflict and competition [107].

c. Power Distance (PD) - Power distance is "the extent to which the less powerful members of institutions and organizations accept that power is distributed unequally [108]. Members of high power distance cultures accept power as part of society (e.g. superiors consider their subordinates to be different from themselves and vice versa). Low and high power distance exist in all culture, but one tends to predominate. In small power distance countries there is limited dependence of subordinates on bosses, and a preference for consultation, that is interdependence between boss and subordinate. In large power distance countries there is considerable dependence of subordinates on bosses.

2.8.2.2 Edward T. Hall

a. High vs. Low Context (HLC)

The concept of high and low context culture was popularized by Edward T. Hall (1976). Low- and high-context communication is used in all culture. Culture in which little of the meaning is determined by the context because the message is encoded in the explicit code are labeled low context. Culture in which less has to be said or written because more of the meaning is in the physical environment or already shared by people are labeled high context [112]. First-naming in the United States is an artificial attempt at high-contexting; it tends to offend Europeans, who view the use of first names as acceptable only between close friends and family. With Europeans, one is always safe using a formal form of address, waiting for the other person to indicate when familiarity is acceptable. High context people often become impatient and irritated when low-context people insist on giving them information they don't need. In the contrary, low context people are at loss when high context people do not provide enough information. One of the great communication challenges in life is to find the appropriate level of contexting needed in each situation. Too much information leads people to feel they are being talked down to; too little information can make them feel left out.

Gudykunst and Ting-Toomey (1988) argued that low-context communication predominates in individualistic and high-context communication predominates in collectivistic culture. Members of individualistic cultures tend to use low-context communication and communicate in a direct fashion. Members of collectivistic culture tend to use high-context messages when maintaining in group harmony is important and communicate in an indirect fashion [118]. Another distinguishable characteristic of high and low context cultures is their orientation to time. In high context culture, time is less structured and more responsive to people's need. Low context cultures are characterized by the opposite attributer, messages are explicit and dependent on verbal codes, group memberships change rapidly, innovation is valued and time is highly structured.

b. Monochromic vs. polychromic time

To collaborate with virtual team members in other countries, it is essential to know how much or how little time is required for each activity. In some cultures people move very slowly; in others, they move rapidly. When people from two such different cultures meet, they often have difficulty relating because they are not "in sync". Monochromic time means paying attention to and doing only one thing at a time. Polychromic time means being involved with many things at once. These two systems do not mix. In monochromic culture, time is experienced and used in a linear way. Monochromic time is schedule, in which a person can concentrate on one thing at a time. In monochromic system, the schedule may take priority and treated as unalterable.

The messages of time carry more weight than they do in polychromic countries. In monochromic culture, such as Germany, keeping others waiting can be a deliberate putdown or a signal that the individual is much disorganized and can't keep to a schedule. In polychromic cultures, such as East Asian countries, no such message is intended. In other words, one's reading of the message should be tempered by the context, the realities of the situation, and not with an automatic projection of one's own culture. Interaction between monochromic and polychromic people can be stressful unless both parties know and can decode the meanings behind each other's language of time.

2.8.2.3 Trompenaars and Hampden-Turner

Fons Trompenaars and Charles Hampden equate culture to an onion that comes in layers and has to be peeled (see Figure 2.9), to be understood, consisting of: (1) the explicit, visible outer layer: the underlying norms and values reflected by this outer layer; (2) the inner: undercurrent of implicit basic cultural assumptions and worldviews; (3) the outer, visible layer that which can be immediately observed – its symbols: moments and shrines, art and architecture, dance and song, food, language, etc.

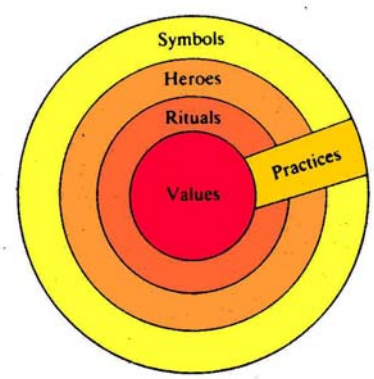


Figure 2.9 The "Onion" manifestation of culture at different levels of depth

Trompernaars & Hampden Turner defined a different set of dimensions during his cross-cultural studies and outlined seven dimensions of culture, which can be an alternative or a complement to Hofstede's dimension.

a. Individualism vs. Communitarianism -This dimension is similar to the 'Individualism and Collectivism' presented by Hofstede. Individualism seeks to locate the origins of value in the creative, feeling, inquiring, and discovering person who seeks fulfillment and is solely responsible for choices made and convictions formed. Communitarianism seeks to locate the origins of value within the social discourse of the living society, which nurtures, educates, and takes responsibility for the spirit engendered among its members [119].

b. Achieved vs. Ascribed Status - In an achievement based culture status is gained from what the individual has and is capable of achieving. In an ascribed culture, status is derived from who a person is and what position or role they hold. This dimension, presented in Trompenaars studies, is similar to Hofstede's power distance concept. Ascribed status is often seen as privilege and special pleading. Status is ascribed to people for many reasons, some of which are suspect; other reasons may be entirely justified. Status is ascribed to those who are "well born", of noble or royal origins. Achieved status often is not always necessitates a degree of conformity. Ascribed status is importantly connected to the foundations of business enterprise in relationships of trust and reputation for fair dealing. People from achievement-oriented countries respect their colleagues based on previous achievements and the demonstration of knowledge, they only show their job titles when relevant. On the contrary, people from the ascription-oriented culture use their titles extensively and usually respect their superiors in hierarchy.

c. Affective vs. Neutral - This dimension is used to describe the acceptability of showing emotion. In an affective culture, it is acceptable for people to show their feelings, while in a neutral culture the expressing of feelings is controlled and individuals are not encouraged to publicly display their emotions. According to Trompenaars, people from neutral cultures control their feelings but can

suddenly explode during stressful periods. While people from high affective cultures, use all forms of gesturing, smiling and body language to openly voice their feelings.

d. Specific vs. Diffuse - Trompenaars researched differences in how people engage colleagues in similar or multiple areas of their lives, classifying the results into two groups: people from more specific-oriented cultures tend to keep private and business agendas separate, having a completely different relation of authority in each social group, they are usually precise, transparent and direct, preferring meetings with precise agendas and detailed plans [119], while people in diffuse-oriented cultures, the authority level at work can reflect into social areas, and employees can adopt a subordinated attitude when meeting their managers outside office hours.

e. Universalism vs. Particularism - outlines two cultural approaches to what is considered good and correct. This dimension defines how people judge the behaviors of their colleagues. In universalism culture, there is usually a set of defined rules which are correct and should be implemented in all circumstances. Universalism culture tends to search for similarities and tries to impose on their commonality. On the contrary, particularism culture emphasizes on relationships and circumstances rather than on rules. Particularism searches for differences, for unique and exceptional forms of distinction that render phenomena incomparable and or matchless quality [120]. In a universalistic approach, "what is good and right can be defended and always applies" and must be followed. In a particularist culture, greater attention is given to obligations, relationships, and other special circumstances with less attention given to societal protocols and rules [120]. People from universalistic cultures focus more on rules, are more precise when defining contracts and tend to define global standard for company policies. Within more particularist national cultures, the focus is more on the relationships, contracts can be adapted to satisfy new requirements in specific situations and are created to adapt to different requirements [2].

f. Sequential vs. synchronous time - relates to time and the ordering of tasks. The sequential approach is to see time as a narrow band and plan accordingly. Synchronic cultures on the other hand see time as a wide ribbon, where multitasking is acceptable and time and deadlines are considered flexible and plans can be easily changed [121]. This is similar to monochromic and polychromic time as outlined by Hall [118]. The cultures of East Asia are, among the more synchronous [118].

g. Internal vs. external - Every culture has developed its own way of dealing with nature. Culture with an internal viewpoint perceives the environment as mechanical and something that can be controlled; external viewpoint, on the other hand view themselves and their environment as part of the nature [122]. They have to go along with what happens and they believe they have very little control over their own destiny.

2.8.2.4 The Globe Studies

Global Leadership and Organizational Behavior Effectiveness (GLOBE) research project is a cross-cultural study of leadership, societal culture, and organizational culture spanning more than 60 countries and 700 organizations [122]. The GLOBE research project was originally conceived by Robert J. House in 1991. GLOBE focused on studying the inter-relationships between societal culture, organizational culture, and effective leadership in organizations. Nine attributes of culture were

identified by GLOBE, which was selected based on measurement of culture: uncertainty avoidance, power distance, the individualism-collectivism continuum, family/organizational collectivism, gender egalitarianism, assertiveness, future orientation, performance orientation, and human orientation.

Table 2.5 Globe Studies Cultural Dimensions

No.	Cultural Dimension	Definition / Cultural Characteristics
1.	Uncertainty Avoidance (UA)	"the extent to which members of an organization or society strive to avoid uncertainty by relying on established social norms, rituals, and bureaucratic practices"
2.	Power Distance (PD)	"the degree to which members of an organization or society expect and agree that power should be stratified and concentrated at higher levels of an organization or government"
3.	Collectivism I (Col 1) Institutional Collectivism	"the degree to which organizational and societal institutional practices encourage and reward collective distribution of resources and collective action"
4.	Collectivism II (Col II) In-Group Collectivism	"the degree to which individuals express pride, loyalty, and cohesive in their organizations or families"
5.	Gender Egalitarianism	"the degree to which an organization or a society minimizes gender role differences while promoting gender equity and the equality of genders"
6.	Assertiveness	"the degree to which individuals in organizations or societies are assertive, confrontational, and aggressive in social relationships"
7.	Future Orientation	"the degree to which individuals in organizations or societies engage in future-oriented behaviors such as planning, investing in the future, and delaying individual or collective gratification"
8.	Performance Orientation	"the degree to which an organization or society encourages and rewards members for performance improvement and excellence"
9.	Human Orientation	"the degree to which individuals in organizations or societies encourage and reward individuals for being fair, altruistic, generous, caring, and kind to others"

(Adopted and modified from: [122])

The Globe studies classified the cultural patterns in two ways. First, it separates the cultural practices from the cultural values. Cultural practice is the ways that people typically behave in interactions; cultural values is what people regard as important and believe is ideal (See Table 2.6). Second, the Globe studies helps to explain the complex nature of cultural patterns (see Table 2.7).

Table 2.6 Grouping on the Globe Dimension: Actual Practice

Culture	PD	UA	Col I	Col II	Gender	Assertiveness	Performance	Future	Humane
Germany	Low	High	Low	Low	Masculine	High	High	High	Low
Indonesia	High	Low	High	High	Masculine	Low	High	High	High
Malaysia	Low	High	High	High	Low	Low	High	High	High

(Adopted and modified from: [122])

Table 2.7 Grouping on the Globe Dimension: Ideal Values

Culture	PD	UA	Col I	Col II	Gender	Assertiveness	Performance	Future	Humane
Germany	Low	Low	Low	High	Feminine	Low	Low	High	High
Indonesia	Low	High	Low	High	Masculine	High	High	Low	Low
Malaysia	High	High	High	High	Masculine	High	High	High	High

(Adopted and modified from: [123])

CHAPTER 3

EXTENDING THE ISO LAYERS

3.1 Introduction

The Open Systems Interconnection (OSI) was created in 1977, when the International Organization for Standardization (ISO) recognized the urgent need for standards for heterogeneous informatics networks [124]. The term "open" emphasized on a system will be open to all other systems obeying the same standards throughout the world [124]. The OSI model has been established as a framework for open communication between completely different computers in a heterogeneous environment [125]. It was originally devised as a standard for enabling diverse computer systems to communicate with each other via a general purpose network [126]. The ISO is responsible for developing standards, by international agreement, over a wide range of technical areas.

The OSI model comprised of seven layers which describe how applications running upon network-aware devices may communicate with each other. The upmost layer, which is the application layer is not responsible for networking, the lower layers handle all networking operations. The topmost layers (consisting of the three upper layers) are the actual user application functionality, including its user interface. The seven layers of OSI model is only applicable to the technical network consideration and only addresses technical issues, applications that require socio-cultural issues, including human-human computer interaction, and group communication are not accommodated. Also, networks and their application only work well with single user application and not well suited for multi-user application. Social factors are important for multi-user application and play a significant role toward the actual usage of the system. Therefore, to help software engineers to make the necessary transition, this dissertation tries to propose an extension to the seven layers OSI Reference Model with two additional layers as the eighth and ninth layer to complement OSI.

The eighth layer is proposed as the social layer and the ninth layer as the cultural layer. The social and cultural layer will serve as the human factors extension to the seven-layer OSI reference model that link human needs to the supporting applications. The extension of this model will include multidisciplinary consisting of computer supported cooperative work (CSCW), human computer interaction (HCI) and social science mainly focusing on intercultural communication.

The two extension layers are people issues. The 8th layer is a representation and support of groups' technology that connects people, namely the social layer. The goal of this layer is to ensure the connection of people that are located geographically distributed to be able to communicate and collaborate together. The eighth layer will include support for multiple media modalities such as text, voice, image and video. Multiple forms of media may be used, but this dissertation will be limited to only CSCW technologies. The 9th layer as the cultural layer representing the communication as it is influenced through different cultural backgrounds or people using the tools created in the 8th layer (i.e. groupware).

Socio-cultural awareness should be included in designing application in order to be effective. The cultural layer represents the intercultural communication bridge between people from different places of the world using the same application to communicate and to work together. Unlike the 7 OSI layers, the communicating entities proposed in this dissertation will be the people (end-users), not the applications. Therefore the two topmost layers are the social and the cultural layer. This is perhaps the

most important and complicated layer to design for, since people communicate in different ways and should include the socio-cultural factors that needs to be understood by software engineers or developers in order to design the right application for the right users. These two extension layers to OSI reference model will serve as the socio-cultural awareness in designing new technologies.

3.2 Overview of the 7 layers of OSI ISO Reference Model

The objective of OSI is "to provide a common basis for the co-ordination of standards development for the purpose of systems interconnection, while allowing existing standards to be placed into perspective within the overall reference model" [127]. It provides communication-based user services that operate between computer systems which may be located in different countries and supplied by different manufacturers [128]. Figure 3.1 depicts the OSI seven layers model:

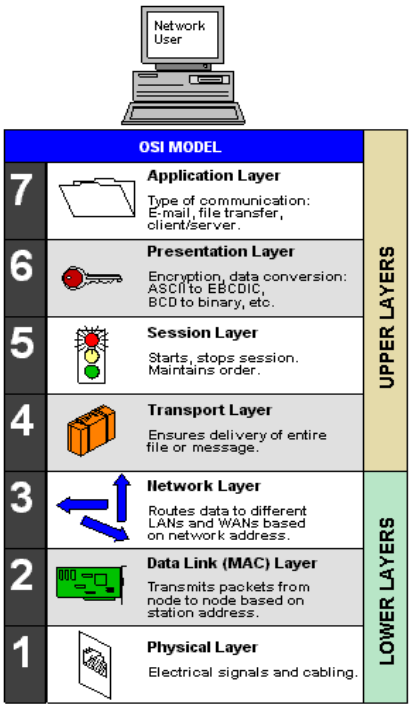


Figure 3.1 OSI 7 layers (source: [129])

Below is the overview of the seven layers of the OSI architecture [124]:

Layer 7 – Application layer

The application layer is the highest layer in the OSI architecture. The application layer differs fundamentally from the other layers of the ISO reference model. Protocols of this layer directly serve the end user by providing the distributed information service appropriate to an application, to its management, and to system management. This layer is aimed at supporting different types of applications. The application layer provides the communication-based service to the end-users. In this layer all 'high-level' system-independent application activity is performed, where such activity is managed by an entity embedded in local operating system which interfaces the system-interdependent nature of the ISO reference model to the specific nature of the computer system [128]. As the uppermost layer, this layer differs from the other six in that it makes the OSI services available to the

users of the computer system on which it resides. This layer include application functions such as: file transfer and file directory operations (delete, rename, etc.), message handling services (e.g. electronic mail), job transfer and remote job management. The application layer is concerned with providing services, covering a range of applications to the end users.

Layer 6 – Presentation layer

The presentation layer provides the set of services which may be selected by the application layer to enable it to the meaning of the data exchanged. In the presentation layer, the application data is either packed or ready for use by the running applications. In order that data may be delivered to application process in recognizable format, presentation services are required, thus this layer is responsible for selection of the appropriate syntax for data representation, and syntax conversion [127]. The application layer offers high-level system-independent activity over OSI between two cooperating computer systems, and the presentation layer ensures that any information exchanged between the systems, as a result of application layer activity [128].

Layer 5 – Session layer

The session layer is to support of the interactions between cooperating presentations entities. The session layer provides for two communicating presentation entities to exchange data with each other. It allows for two-way simultaneous and two-way alternate operation, provides major and minor synchronization points in the dialogue and defines special tokens for use in structuring information exchange [127]. As shown in Figure 3.2, the session layer occupies the area between the application-oriented upper layer and the 'real-time' data communication environment [128]. It provides services for the management and control of data flow between two computer systems.

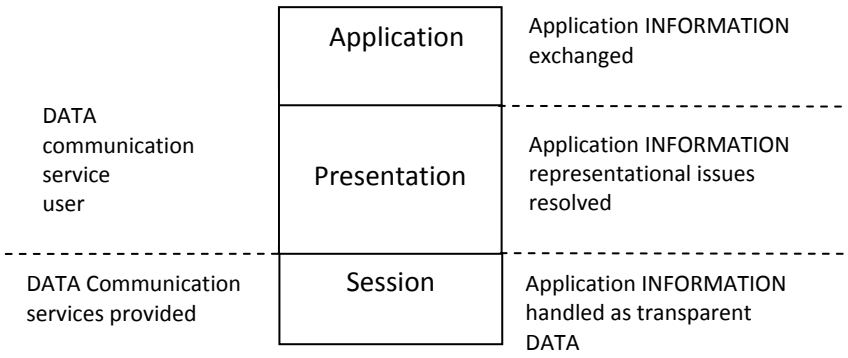


Figure 3.2 The three upper layers ([128])

Session layer activity management services allow activities to be restarted, halted, abandoned or restarted under the (indirect) instruction of the application layer. The use of this service allows an application to order and manage its work. The 'real-time' communication environment begins at layer 4 or the transport layer.

Layer 4 – Transport layer

The transport layer provides a universal transport service in association with the underlying services provided by lower layers. Transport layer standards have been developed to provide reliable, cost-effective data transfer, flow controlled end-to-end as required on an individual basis [127]. An

important function of the transport layer is to perform error handling on data transmitted across sub-networks which are not designed for reliable data exchange. Consequently, the transport layer provides session with a reliable data transmission service [128] (see Figure 3.3 below). The transport layer operate end-to-end between two computer systems.

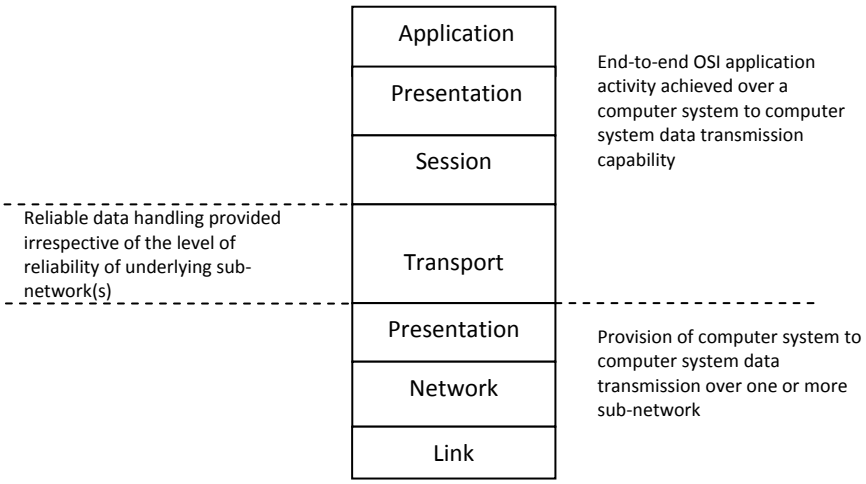


Figure 3.3 Role of Transport Layer (source: [128])

Within the seven layers: physical, data link, network, transport, session, presentation and applications, it is the top four that are of primary concern to those wishing to provide specific services through OSI.

Layer 3 – Network layer

The lowest three layers of the ISO reference model - network (layer 3), data link (layer 2), and physical (layer 1) – are concerned with the provision of data transmission. The lower layers deal with data transmission over a real physical medium (such as coaxial cable). The network layer provides data transmission services to the transport layer, or the layer above. The network layer provides functional and procedural means to exchange network service data units between two transport entities over a network connection. It provides means for communicating open systems to establish, maintain and terminate network connection. This layer is particularly concerned with *routing*, that is establishing a route between the two computer systems, and *relaying*, the use of intermediate computer systems to provide a data flow from one sub-network to another sub-network which may be necessary on the chosen route [128].

Layer 2 – Data Link layer

The data link layer provides the functional and procedural means to establish, maintain, and release data links between network entities. This layer defines the access strategy for sharing the physical medium which includes the data link and the media access issues. The data link layers controls communication between the physical layer and the network layer. This layer includes functional and procedural means to transfer blocks of data and to detect, and possibly correct, error which may occur in the physical layer [127]. Detection and correction of errors may be performed in this layer.

Layer 1 – Physical layer

The physical layer provides mechanical, electrical, functional, and procedural characteristics to establish, maintain, and release physical connections between data link entities. It defines the physical and electrical characteristic of the network and the physical networking medium such as cabling, fiber-optics, connectors, repeaters, receivers, etc [130].The physical layer provides for digital data to be transferred across physical media. It includes aspects such as physical connectors from the computer system to the medium and the voltage level to be used in the data bit transmission [128].

The next subsection describes the two extension layers that include the social layer as the 8th layer and the cultural layer as the 9th layer. It will present the two layers that are intended to supplement the OSI layers by providing mechanism to integrate the technical and the socio-cultural issues.

3.3 Proposing the 8th and 9th layer as the extension layers complimenting the OSI model

Two indispensable layers directly on top of the Open Systems Interconnection should be added. These layers would be the 'Social' Layer and the 'Cultural' Layer. Both of these layers are considered necessary to solve the problems facing us in today's rapidly globalizing world, where technology progresses at an unlimited boundary, or where the internet can reach the world without limit. The approach to the social layer needs to be supported by the necessary account of the psychological factors. The two extension layers are meant to bridge the socio-technical gaps which serve as a guideline in supporting software engineers in developing new multi-users innovative applications.

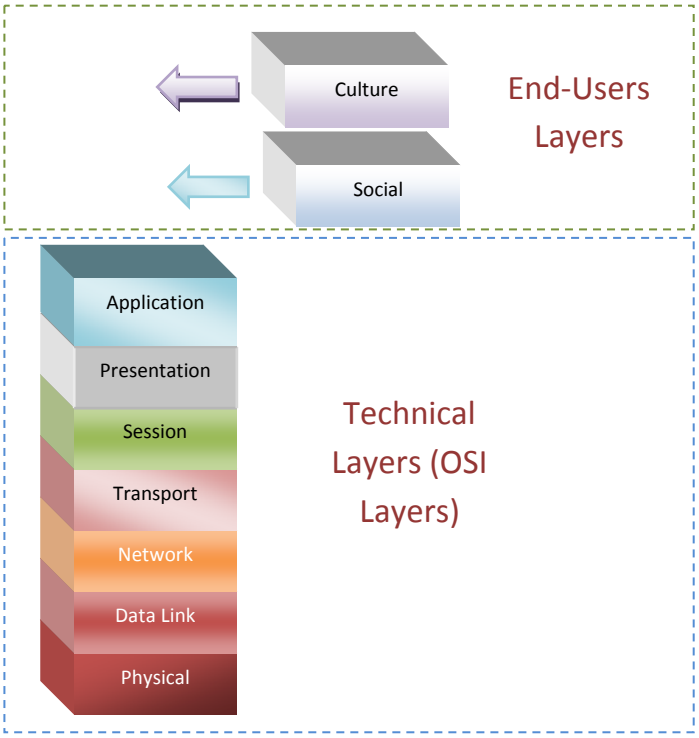


Figure 3.4 Two extension layers reside on top of the OSI 7 layers

As shown in Figure 3.4, the end-user layers represent human factor, as the end users using the devices and services that the technology offers. The motivation for the need of the extension is that the seven layers OSI reference model is incomplete because user does not directly interact with any of these layers in completing their task. The proposal of these two additional layers are based on the great deal of technical progress in recent years to enable 'open system interconnection' (OSI) in the informatics

systems, the convergence of computer technology and communication also means than new systems are providing the users opportunities to use computer system in distributed locations. Human factors in collaborative systems should aim at providing assistance in the development of the systems by ensuring that the system is usable and acceptable to the appropriate category of users. Computer aids for human interaction should be designed in heterogeneous environments with respect to the groups of users and the supporting technology used.

Layer 8 – Social layer

The social layer is the layer that connects people and support groups of people working together. This layer provides cooperation support during interaction. The social layer will include the research area of CSCW that will focus on increasing the ability of people to communicate.

Layer 9 – Cultural layer

The cultural layer is the layer that bridge people to their social cultural issues, this layer represent the communication as it is influenced through different cultural background of the people using the tools in the 8th layer.

3.4 Social Layer as the 8th Layer

The proposed extension of the 8th layer as the social layer is based on the background of the increased networking, where computer applications has expanded from tools of single users in supporting their individual task into mediums of groups of users to support their collaborative task. It is called the social layer since it represents the support for groups working together as an extension to the seven OSI layers to facilitate multi-user applications for group works.

The 8th layer as the social layer is represented by CSCW. The main function of CSCW technology serves as a mechanism of social interaction. The concept of CSCW accounts of the social context of systems use. CSCW applications are not data processing but rather mediation of communication and collaboration among people. CSCW enables and mediate social interaction beyond space-time constraints of face-to-face interaction which serves as the social layer transforming communication, coordination and cooperation among individuals and groups. CSCW tools contribute to support and improve the social process. Groupware is one of the CSCW tools. Groupware emphasize communication, social interaction, sharing of knowledge, and collaboration which are all the essentials of social systems. CSCW tries to solve real world problems of groups and organizations by the use of technology.

The research field CSCW is concerned with understanding social interaction and the design, development and evaluation of technical systems supporting social interaction in teams and communities [25]. CSCW is about understanding collaboration and about shaping socio-technical systems for supporting this collaboration [25].

3.4.1 State of the art (Why CSCW?)

The term groupware and CSCW were first coined in the mid-1980s. As shown in Figure 3.5 , the study of CSCW and groupware is defined as a middle field of research in between the study of single user

applications (HCI research) and that of applications for organizations (IS research) [131]. Groupware is placed between the single-user application and information system that supports organizations. CSCW studies the way people work in groups as well as technological solutions that pertain to computer networking with associated hardware, software, services and techniques [132]. It is concerned with human-human co-working supported by technology rather than human-computer working [133]. Areas that are researchers conducted within the field of CSCW include computer-mediated communication, awareness and coordination, and multi-user interfaces.

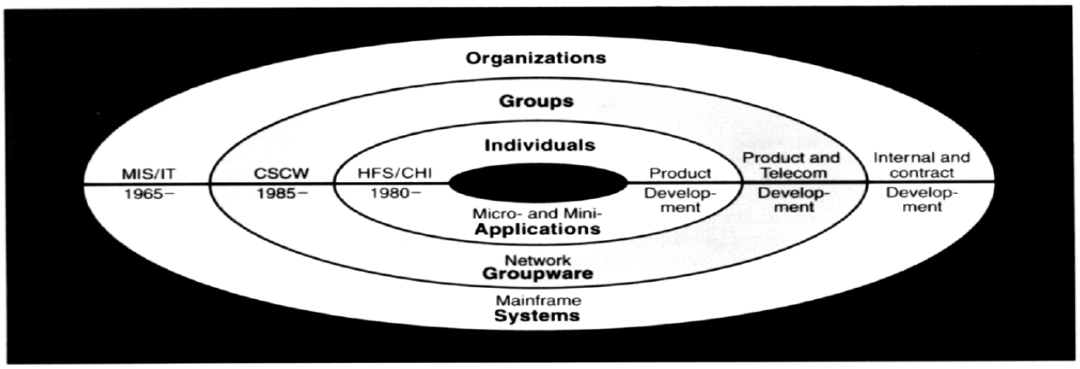


Figure 3.5 Development and research context of CSCW (source: [131])

In the late 1980, CSCW became an important issue. The design of computer-based environment was addressed by integrating networking technologies, work practices and users into offices in order to support interpersonal communication and conflict coordination of cooperative work [134], [135]. CSCW encompasses the collaboration activities that require communication of actions and coordination for managing dependencies to attain common goals using computer technology [136].The three major elements of CSCW and to develop groupware technologies are communication, cooperation and collaboration.

The main idea of collaboration is all about working together and sharing information with each other. Groupware is a collaborative application that is used by a group of users to support their social activities which includes communicative or cooperative tasks. Groupware is a social application, as groupware has more than one user. Groupware organizes cooperative relationships between numbers of users. Users of groupware influence each other through communication and cooperation. The design goal of groupware is to support groups in communicating, collaborating and coordinating their activities in the workplace [26]. Groupware technology was designed to overcome potential barriers in traditional face-to-face meeting to support the interactions among group members for reducing the time and cost in communication, as well as the impact of distance and space in coordination [137]. Groupware is widely recognized of its benefits for time saving, productivity, information sharing, etc ([26], [134], [138], [139]).

3.4.2 Related works (previous groupware applications)

Groupware technology aims to assist group members in communicating, sharing information, resources and tasks, and coordinating their responsibilities and activities through the use of networks and computers [26]. As mentioned earlier, at the Institute of Computer Engineering, University Duisburg-Essen, a synchronous groupware called PASSENGER has been developed, throughout the last years. As depicted in Figure 3.6 above, the client user interface of PASSENGER contains video

screens for each member and a whiteboard area that is divided for public window and private window. Following the WYSIWIS principle, each member has the same view for the public window, and following the implemented floor control, only one of the members can alter the document at a certain time. Each member is also equipped with a private working window to try out own ideas and to work simultaneous on an individual solution [140]. PASSENGER use client/server architecture and is designed for spatially distributed collaborative working. The server is located in the university, and the PASSENGER client consist of communication component, cooperation component and several shared tools and resources to carry out Software Engineering tasks [140]. For the aspect of group awareness, each participant is always placed into the same video screen, where each participant appears also was in the left corner of its own screen and the window screen cannot be covered by other element of other windows of the desktop. The main advantages of the synchronous groupware PASSENGER are [141] :

- combination of video, audio, and whiteboard
- support during the discussion, e.g. avoid communication breakdowns
- guaranteed fairness concerning the floor assignment
- awareness functions, e.g. history of document or display of actual roles
- support for setup of partner images
- organization of private and public workspaces

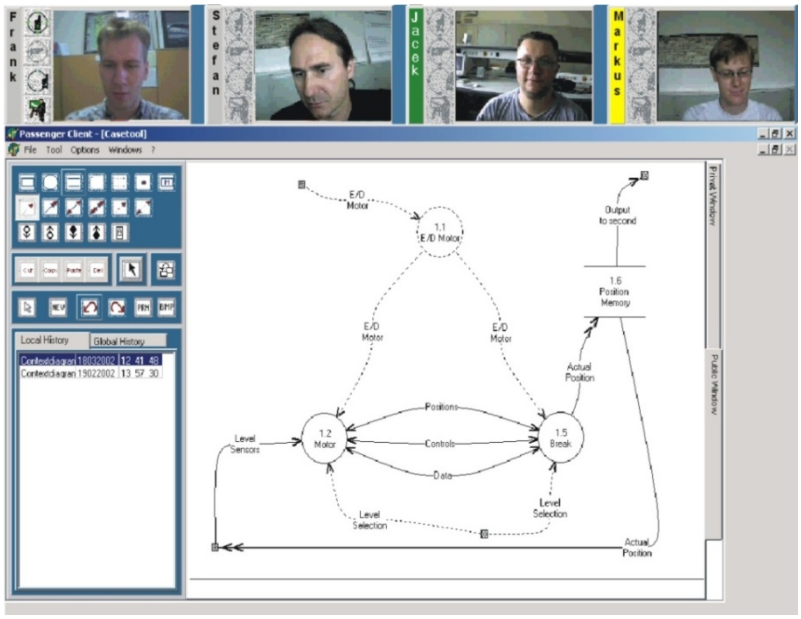


Figure 3.6 PASSENGER Client User Interface [142]

Other example of groupware systems are summarized in this table below:

Table 3.1 Example of other groupware systems

Groupware name	Groupware description
Colab	An experimental meeting room that support face-to-face meeting
NAGA	An asynchronous computer conferencing system aimed at supporting collaboration among groups in a software design project [51].
ClearBoard	Uses video fusion systems in enhancing compatibility between personally favored tools [143]. Fusion allows separate video images (i.e. a computer screen and a human face) to be overlaid like layers of transparent acetates, so that two or more incompatible applications or work environment can be used together [143].
TELEFREEK	Provides an extensible CSCW environment based on standard networked computers, which users are provided with a platform for communication and collaboration by drawing together information sources, communication mechanisms, and collaboration application [144].
Mona	A conversation based electronic mail platform [145], [146].
MILO	A tool to support asynchronous, distributed collaborative writing task [147], [148].
Oval and Lotus Notes	Application development environments, these environments integrate both communication and coordination features on a core of cooperation support by customizing the structure and functionality of the system to the task [149].
Fujitsu Desktop Conferencing	Supported synchronous working through remote application sharing, a shared electronic whiteboard/flipchart and also includes file transfer [133].
Alymod	A groupware game that was designed and implemented using a modified version of Groupkit (CSCW Toolkit) where participants compete or collaborate within a hierarchical structure to achieve a common goal (completing gaps in a text, finishing numerical series, resolving University course examination, etc) [150]. Alymod run on top of the new subgroup supporting platform added to the original Groupkit.
Groupkit	One of the most widely used CSCW toolkits which is a public domain, object oriented software package that is available for different platforms [151]. Groupkit offers a platform for fast development of prototypes and permits the simulation and study of real cooperative work scenarios and groupware applications [151].
GroupIE or group interaction environment	"Generic environment offering high-level development and run-time support for cooperative applications" [152], [153].
Suite	A "high level and flexible framework for supporting the construction of multi-user user interfaces" developed by researchers at Purdue University [154]. Suite allows user to view programs as active data that can be concurrently edited by multiple users.

This layer provides cooperation support not only in order to guarantee consistency data but to enhance concurrency approach in a way that they exist and support during interaction. Floor control protocol that guarantee fairness and social awareness that provides equality of users in an advance mode. It also provides principles and mechanisms so that different floor protocols are implemented are chosen by the system as a result of user profiles and actual system. The actual situation and user profile, how these groups can be supported on the 9th layer. The specific challenge to groupware is not to be adapted to an individual task but to offer suitable options, to present information with respect to various contexts of different users [155]. The actual use of groupware until now has not always matched the users' expectations.

3.4.3 Bridging to the 9th layer

In the virtual world as well as the in the real world environments, there is a need to enable cooperation and communication. While CSCW technologies have enabled its users to overcome the barriers of time and place in communication over distance, there is still the problem of bridging the gap across different users from different cultures. In order to compliance user needs, the design requirement of groupware should be specified accordingly whereas the system should overcome temporal, spatial and cultural barriers. The support facilitated by groupware is increasingly directed toward culturally diversified group. A critical discussion of experience with groupware discussed by Grundin (1994), rooted cultural factors as the obstacles for the success of groupware. It is important to note that the same application may be used very differently across different cultures. Technology is culture-bound [6], [156]. Groupware is also culture-sensitive. Interpersonal differences coming from different cultural background may lead to potential misunderstandings. One of the differences may be due to the differences in the expectations of the users. While the users of one culture may expect the software to perform one set of functions, another culture's users may have different expectations of the same software (De Vreede 1995).

With the inclusion of the social areas, focusing more on cultural aspect, it affects how people use the CSCW technologies. Orlikowski (1992) conducted a study on the implementation of groupware and found that the culture and organizational structure in the workplace affects the way the software is utilized by the users [55]. Grundin (1994) performed an evaluation of groupware, he pointed out that difference in personalities and politics in an organization can lead to the rejection of a good piece of software or the acceptance of a bad piece of software [131]. Therefore, the extension of the next layer representing the communication as it is influenced through different cultural background of people using the tools in the 8th layer is needed.

3.5 Cultural layer as the 9th layer

3.5.1 What is the 9th layer?

Why is the cultural layer important? The cultural layers explore the ways in which the communication in the CSCW technologies is influenced through the different cultural background of the people. In order to achieve collaboration goals, participants require to agree to the set of goals made by the team. In the process of achieving these goals, more likely are influenced by the team member cultural background and the media through which they communicate. Cultural differences may result in different perceptions and affect the effectiveness of user involvement and participation working in collaborative application. For instance, members from an individualistic and low power distance culture tend to be direct and forthright in voice disagreements, and to adopt a more confrontational style in resolving conflict. On the other hand, members from a collectivistic and high power distance culture tend to avoid voicing disagreements openly, and to avoid and withdraw during conflict resolution [157], [158].

The differences in view and approaches offer potential for multicultural to perform better, but at the same time the user's preference for social interaction differ, which make cooperative working more difficult. Previous research has shown result that although cultural differences can hindered performance [107], other researches shown that multicultural teams produced more creative results, particularly if groups participate in formal training programs [159], [160]. Therefore multicultural teams should be facilitated.

3.5.2 State of the art

Culture plays an important role in collaboration. CSCW is increasingly facing the need of accounting for cultural factors in order to understand, support and evaluate collaboration [161]. People from different cultures may have different value systems and attitudes towards the same collaborative activity; this may affect the group relationships and the group performance [161]. Olson and Olson (2000) have conducted a study that observed how remote teams misunderstand each other due to cultural differences [162]. Okamoto et al. (2002) have designed and implemented a large screen system that supports cross-cultural communication that happens synchronously with communicators either at the same location or in remote locations [163]. The idea of the system is to provide support for culture awareness to improve communication by their cultural background and shared information based on their profiles that are presented on the large screen, which include language knowledge, culture literacy and experience. Grill et al. (2003) create a culture translations agent to support cross-cultural communication information using Hofstede' definition of culture as "collective programming of the mind" that assume the different programming of the minds leads to alternative code bases in communication [164]. Dix and Mynatt (2004) conducted a research that observed the lack of consideration for different cultural perception and habits about personal space (proxemics) may have unpleasant effects in cross-cultural meetings [165]. Orlikowski (1992) examines the introduction of Lotus Notes, and her findings suggest that when an organization's structural properties (policies, norms and reward systems) are counter-cultural to groupware supporting cooperation and collaboration, the technology's purpose will be unlikely to be fulfilled [55].

Many research results also promises the effectiveness of groupware usage, it may less effective when applied directly to different cultures or cross-cultural situations. These cultures may require different forms or styles of groupware. Computer system developed for groups of user often have built-in social urgencies that need to be considered during the technology design and use. The current available groupware systems cannot fully support the social world.

3.5.3 Problems in culture (the role of culture)

Cultural differences underlying different countries are not easy to understand and to deal with. Members of different cultures interpret information differently because they apply different set of values [166]. In order for a groupware usage to be effective, individuals must understand and be aware of the cultural priorities of the other participants. For instance, in North America businesses, individuals usually make decisions, while in Japan, groups make decision. Also, in North America, a decision is made very quickly, while in some slow-paced cultures, the amount of time spent on decision making increases the value of the decision [167]. This shows that cultural differences exist between western and eastern nation. Western cultures perceived situations as problems to be solved, while Eastern cultures accept situations as they are [167], this may affect the decision quality and satisfaction with the decision, when groupware is used for decision making and to solve a task.

Groupware must first be designed to meet the real needs of group members. Supporting cross-cultural coordination represents a new challenge for groupware design. People from different cultures have different values and attitudes towards the same activity, which may affect both the work relationships and the group performance. Passenger 2, as a new innovative groupware, is intended to be use by culturally different users, as shown in Figure 3.7 below:

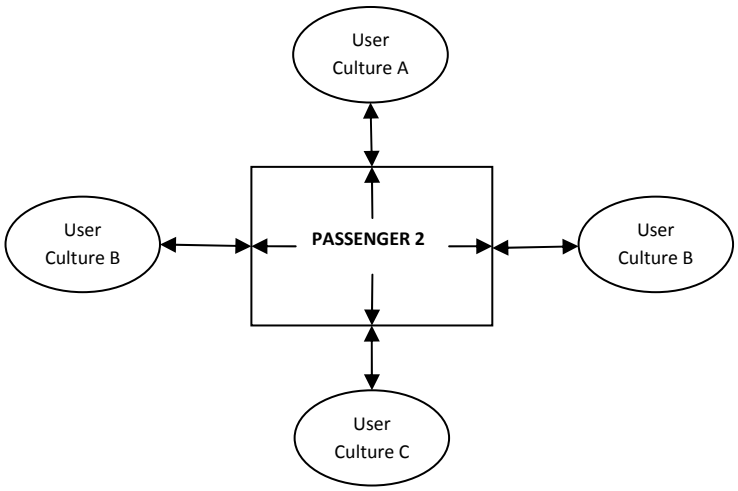


Figure 3.7 Passenger system is intended to be shared by culturally diverse users (modified from: [168])

When developing new innovative groupware application, especially designed for multicultural users as the targeted users, application software engineers have to consider many more issues than those captured by the common requirements for guiding design and evaluation of networks and their applications as in the OSI model.

The primary concerns of many previous CSCW developers were to improve the design process. Many expensive failures in developing and marketing software that is designed to support groups are not due to technical problems [131]. When problem arise through some failure of design, they ignore the important process of the social matters that arise when the technologies are implemented. Collaborative application developers must deal with the increased level of complexity during software design, a range of techniques should be utilize including scientific, engineering, and social science methodologies. Groups are different and need different type of supports. Key challenges for global collaborative software include cross-cultural bridging, which includes the establishment of common shared vision and culture-sensitive collaboration-oriented groupware [169].

CHAPTER 4

SOCIO-TECHNICAL APPROACH FOR DESIGNING GROUPWARE IN A MULTICULTURAL CONTEXT

4.1 Introduction

With the extension of the OSI layers, where social and cultural layer is added as the 8th and 9th layer, this section will apply the cultural layer to the contextual research framework that proposes guidelines for the development of groupware application supporting collaboration dynamics, so that developer has a workbench with a process design specifically using the cultural engineering approach.

What can be done to improve the performance of groupware to avoid the lack of social aspect from the previous systems? The lack of social factors can discourage collaborative work. The supporting mechanism of this system is to consider in increasing collaboration. When collaborators located distributed, communication mechanism must be used to mediate the interaction.

Groupware is a collaborative technology and impacts on the way people communicate with each other. Groupware can change the way organizations work and communicate. Successful groupware implementations require a great deal of planning, the right type of culture, a commitment to the platform, and proper staffing [170]. Groupware maximizes human interaction while minimizing technology inference, or in other words, the technology behind groupware should not be visible to the users [171]. Figure 4.1 illustrates the changing perspective from technological involvement to people involvement [171].

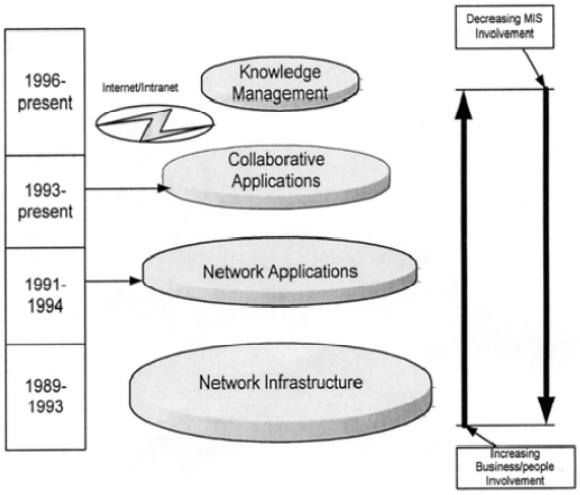


Figure 4.1 The changing perspective from technological involvement to people involvement (source: [171])

4.2 Socio-technical gap

Throughout the last 15 years, all CSCW systems grew more sophisticated. The increase popularity of groupware technologies increases both technical and cultural complexity. Technical systems are rigid in supporting the social world. Important CSCW technical mechanisms such as the floor or session control are lacking the flexibility required in the social life. The socio-technical gap is one of the major issues and one of the challenges within the field of CSCW. The gap is between the social requirements of collaborative activities and what needed to be supported by technology. Centralizing the social-technical gap as a necessary problematic in CSCW's intellectual mission is a major first step [12]. Technical researchers should understand better the social requirements needed to build a useful system. Cultural aspects are the potential solutions for this social-technical gap.

4.3 Using the Socio-technical approach as the research framework

Socio-technical approach aims to give equal weight to social and technical issues when new work systems are being designed [24]. The socio-technical approach is used in this dissertation as the foundation in specifying the requirements that will be propose to be used in Passenger 2 or in any other groupware in multicultural context. The cultural layer is expected to fill in this social-technical gap between the social requirements of CSCW and it technical mechanism. Successful collaboration requires the establishment of a shared understanding or common ground between team members [172]. By using the socio-technical approach, the quality of working life for the group is expected to be better.

Collaboration support is not only about providing technologies and tools, but also about shaping socio-technical systems. The socio-technical system approach focuses on the dependency between social systems and technical components. Why using the socio-technological system approach in developing groupware as one of the CSCW technology, below are several reasons why:

a. CSCW technology are technical systems that are highly embedded in social systems
b. The social and the technical systems should be designed in parallel to be optimized because they influence each other
c. The goal or task of the overall system which is for usage in multilateral context should be taken as the main source for the consistency of the system

In designing a groupware using the socio-technical approach (Figure 4.3), this will include social aspects, which in this research cultural factor are the social aspect that will be mainly focused on. The research framework is shown in Figure 4.2.

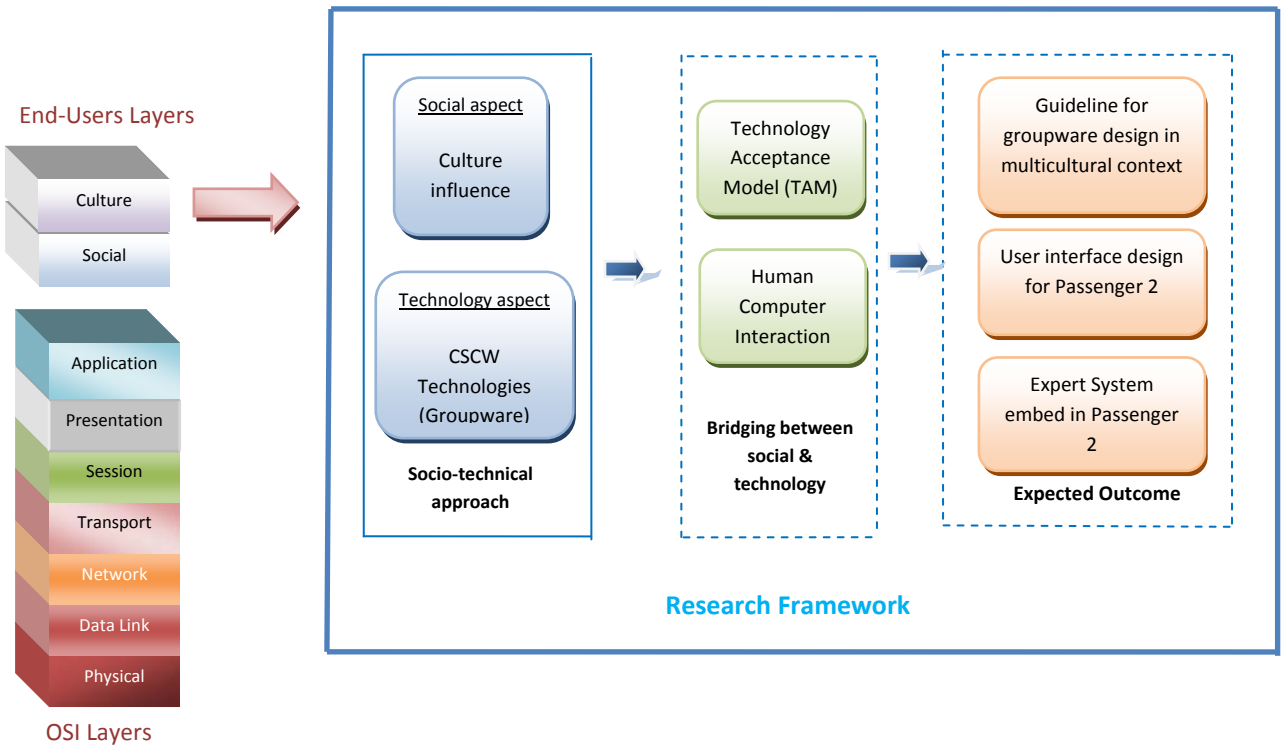


Figure 4.2 Bridging between the end user layers to the research framework

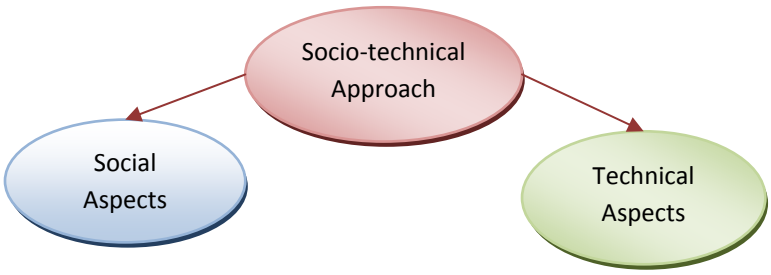


Figure 4.3 Socio-technical approaches consisting of technology and social components

The main contribution of the social aspects (Figure 4.4) in this dissertation will mainly focused on the cultural issues or cultural influencing user's perception and acceptance of groupware. The need for cultural information is related to the target group of users that the application is developed and will be used. Different cultures have different values, making difficult to prioritize requirements. Cultural dimensions are discussed as the parameters to identify these requirements, which include how different cultures affect users' preference to work and to communicate. Users' preferences on how to use groupware and how to communicate using groupware are obtained through the surveys conducted during this research. Results that were obtained are then analyzed deploying the Technology Acceptance Model (TAM) theory. The cultural analyses are used to define the rules in order to build a knowledge-based expert system. This expert system will serve as a cultural support for the users to use, since in cross-cultural environment, differences are delicate issues that can cause conflict.

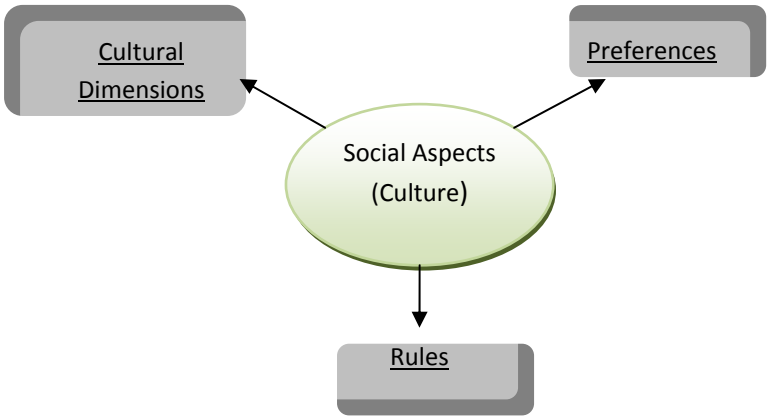


Figure 4.4 Factors associated to culture in this research

The main contributions for the technical aspects (Figure 4.5) propose in this dissertation are requirements, designs and expert system. Requirement that will serve as guidelines for developers and software engineers to follow in order to develop groupware as an intercultural collaboration tools for multicultural users. Designs will consist of the comparison of groupware designs that are available in the markets and highlight what can be learned and used for the implementation of Passenger 2. To facilitate multicultural group of users working together, knowledge based expert system is created to provide tools and features that are recommended for the group to use. This expert system is expected to be embedded in Passenger 2 as a cultural support for the users.

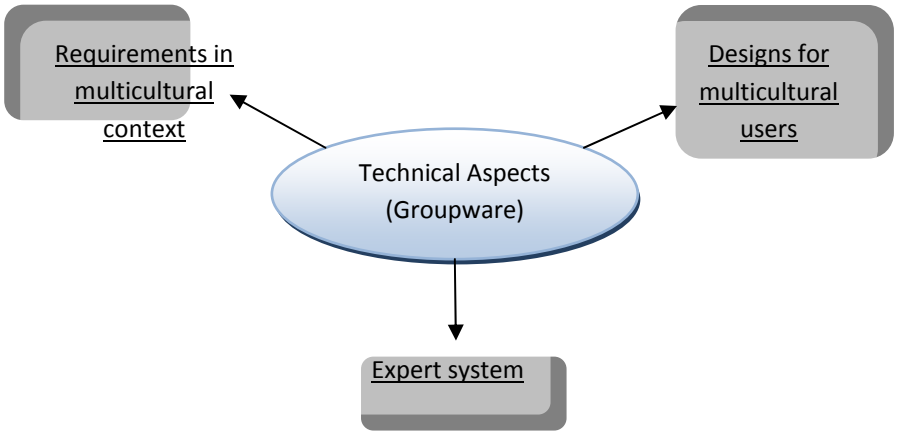


Figure 4.5 Factors associated to groupware as the product of this research

To support the social interactions in cooperative work, groupware design should focus on improving to support users, the fit of groupware in term of technology and its social gap will be discussed in the next chapter.

CHAPTER 5

CULTURAL ENGINEERING FOR PASSENGER 2

5.1 Cultural engineering for Passenger 2

One of the first steps in designing new software is to follow the software development cycle. The development cycle for Passenger 2 as a groupware in multicultural context consist of the phases of software development [173] and includes the issues that are being covered in this dissertation. Although software engineering has started addressing the human factor problems [174] but it fails to manage with the group aspects in collaborative applications since the development is organized for single-user applications [131].

In order to make social factors of software engineering more unambiguous, this dissertation focuses on the human aspects of software development. In describing why CSCW systems have failed, Grundin (1988) points to the lack of inclusion of human factors engineering in evaluating CSCW products [57], [175]. It failed to be user-centered and the formation of the social environment in the groupware application. Most groupware systems were developed by certain principles. This dissertation looks at software engineering from the perspective of agile methods and intercultural communication theory in order to point out solutions and conditions for user-centered software engineering process.

Cultural Engineering (CE) is introduced in this dissertation. It is a conceptual framework that is proposed in the groupware development influenced by cultural factors that will bridge the social gaps in making collaboration more effective and productive. The formulation of CE is based on the cycle of the software development in Software Engineering that integrates other fields of studies including CSCW, HCI and social studies which is suitable for groupware applications for multicultural users. The initiate concept of Cultural Engineering is similar to previous research performed by Fuks et al. (2002) that introduces an engineering approach based on the 3C collaboration model (communication, coordination and cooperation) and applied it to e-business [176]. This approach is proposed for the development of a new version of groupware application, currently being developed at the Institute of Computer Engineering, University of Duisburg-Essen, known as Passenger 2. The CE development cycle is depicted in Figure 5.1.

The domain analysis phase of the CE covers the human factors of groupware, particularly cultural influence. The requirements needed in order to develop groupware are elaborate in the requirement analysis phase, where the attention is centered on developing groupware for multicultural users as the target users. The design phases will cover human computer interaction field in the concept of the User Interface Design for Passenger 2. In the implementation phase, an expert system is developed and will be propose to be embedded as a useful feature for collaborative application.

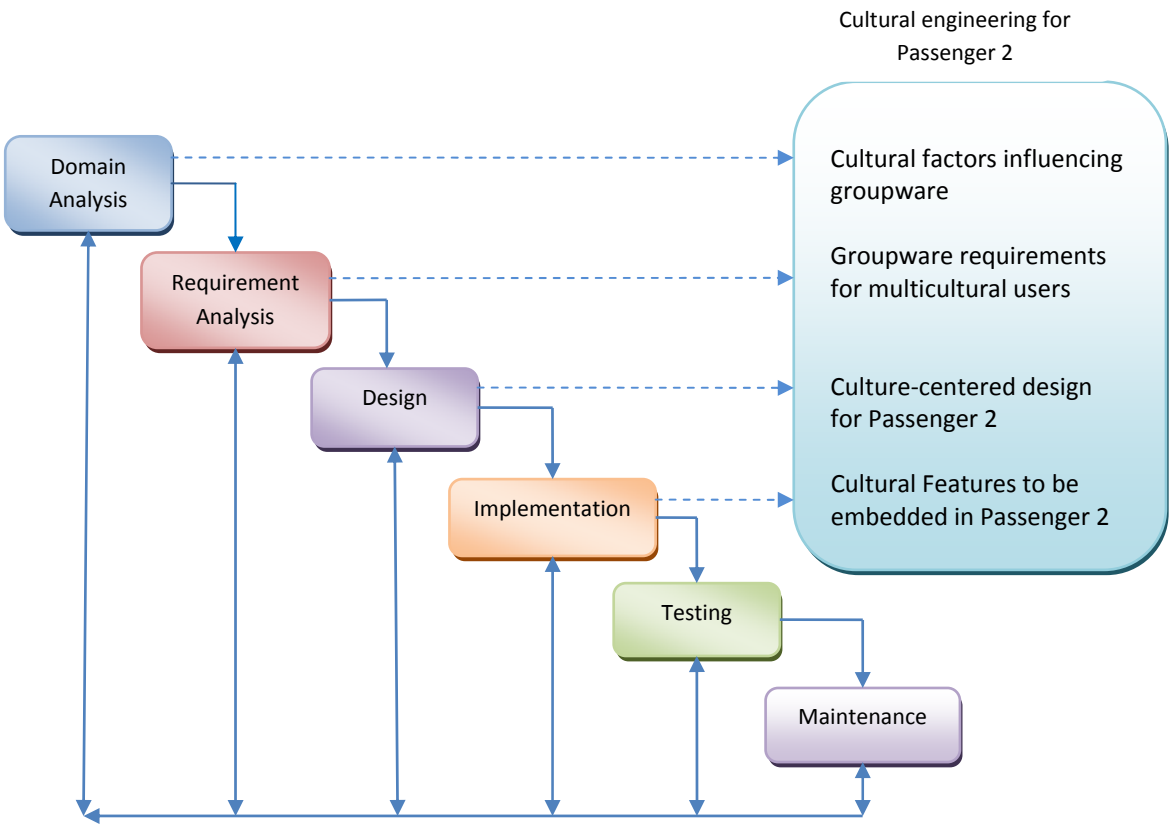


Figure 5.1 Cycle of software development in software engineering with cultural aspects for Passenger 2

CE is considered important to diminish the challenges of software process for distributed teams. The main contribution of cultural engineering is to highlight the effect of culture in designing groupware applications. One important key point is that groupware must be flexible enough to allow the dynamics of the group and the culture of the users to use it.

CHAPTER 6

CULTURAL FACTORS INFLUENCING GROUPWARE
(Field Research Studies Data collection of Users' Needs and Preferences)

6.1 Introduction

This chapter will discuss the domain analysis in the cultural engineering phase for Passenger 2 to define the cultural factors influencing groupware as shown in Figure 6.1 below:

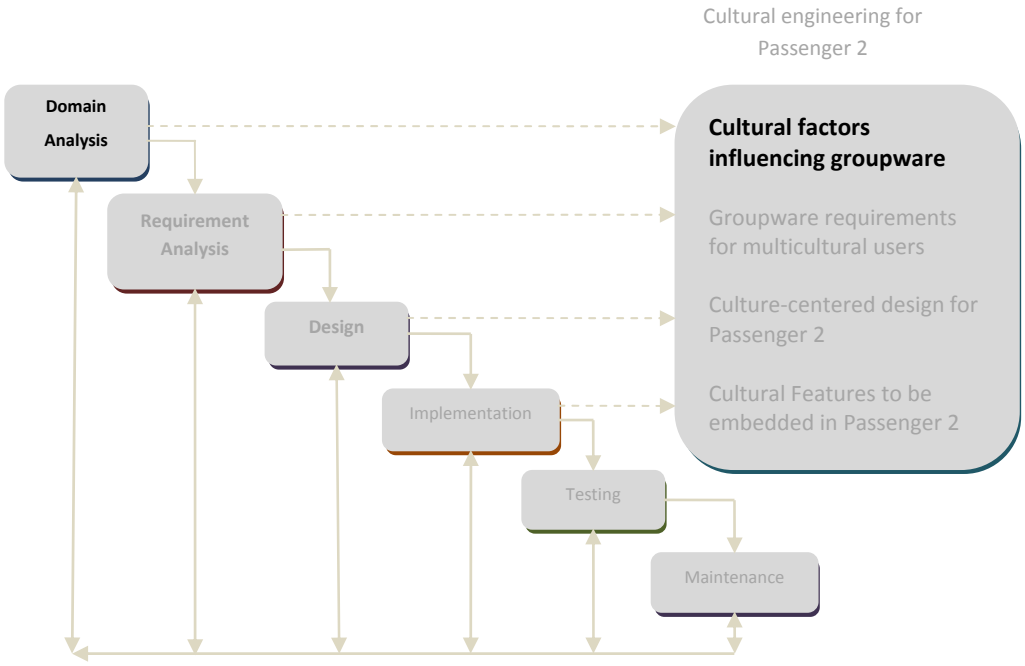


Figure 6.1 Domain Analysis

This chapter reviews the cultural factors and its relation to groupware design and development. How can a groupware be supported so that user can benefit in using the system rather than creating loss? Groupware is viewed as technology designed from a group perspective and to enhance the productivity of the group. Therefore, groupware should be able to meet the changing needs of groups, but how? How can group be supported in using a flexible groupware? Understanding what user prefers and user needs is a first step in answering these questions.

In order to carry out this research, a preliminary classification scheme was devised to organize how cultural data that was collected can be used and implemented in the development of Passenger 2 system. This proved to be a more difficult task than initially expected. The complexities of groupware and the cultural analysis have led to evaluations that cross disciplinary boundaries and that utilize methodologies which are not relevant in other areas of software design (i.e. TAM).The need to conduct this research is due to the only a small number of studies examined the cultural impact and impact of work practices in a groupware.

Usability is very important when designing an interface and a groupware system cannot succeed unless most of the target group is willing to adopt the system. This chapter will study the usability and design issues in a groupware with the target of multicultural user in order to avoid a failed system design.

Theories of cross-cultural communication and cultural dimensions are used as the core foundation and relate it to the human computer interaction principles. Survey research method and technology acceptance model (TAM) as the research model is selected in the field research work because it is well suited to obtain personal and social facts, beliefs and attitudes, which are the factors of interest in this dissertation. These theories are integrated and analyzed to attain users' collaboration preferences and techniques, as shown in the scope of field research studies in Figure 6.2, which later may be implemented and become a propose requirements set for a groupware application as an intercultural collaboration tool, which will be discussed in the next chapters.

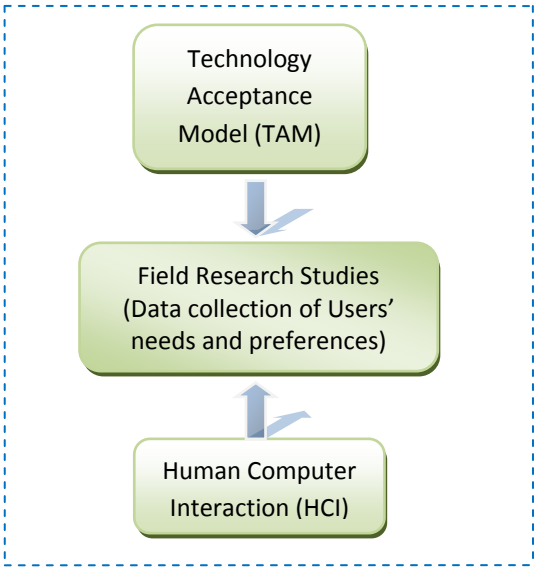


Figure 6.2 Scope of the field research studies

6.2 Bridging between social and technology

Technology Acceptance Model (TAM) is used in this study due to the consideration of TAM to be the most parsimonious model in explaining IT use. TAM was built on collective findings suggesting that the desired technology was greatly dependent on user acceptance of technology [177]. In the year 1994, Saga and Zmud identified 20 empirical studies that are aimed at exploring the factors that determine IT acceptance [178], among these 20 studies, the TAM is arguably one of the most widely cited and influential. TAM has often been used to predict the acceptance of a new technology. There were also various studies that utilize this model in successfully predicting the intentions of end users in using IT (Chin and Gopal 1995; Adams, Nelson, and Todd 1992; Szajna-Bernadette 1996). However, even though TAM has been widely used in explaining IT usage, there are not many studies explaining the acceptance of groupware by using TAM.

Individual technology aims to improve individual productivity; groupware technology on the other hand aims to facilitate group coordination and support cooperation and collaboration among a group of

users. User's acceptance of groupware is therefore different from that of individual technology due to the unique features of groupware [179]. Understanding the factors that influence user technology acceptance and adoption in different contexts continues to be a focal interest in information system (IS) research [112]. Nine cultural variables are used as the foundation theories that are related to the cultural-interface design and how this aspect relates to the user's behavior toward the usage of the groupware application. TAM was used in order to meet the objectives in: a) assessing groupware usefulness and ease of use for supporting different user's activities and b) identify user's preference and acceptance for groupware system to support intercultural collaboration.

6.3 Selection of Cultures

To determine whether culture influences user's preference and behavior toward the usage of groupware, three countries with national cultures that were different on some cultural dimensions but similar on others (maximum variation sampling) were selected. These countries are Indonesia, Malaysia, and Germany. The reason of this selection of countries is due to their dissimilarities of cultures. Selecting contrasting countries enabled this study to compare between the three countries how Eastern (Indonesia and Malaysia) versus Western (Germany), as well as comparison between the both Eastern countries (Indonesia versus Malaysia). As can be seen in Table 6.1 below, each national culture is unique and in contrast with the other in regards to Hofstede's dimensions used in this dissertation.

Table 6.1 Scores on Indonesia, Malaysia, Germany and the world's average on Hofstede's dimension

Cultural Dimension	Indonesia	Malaysia	Germany	World Average
Power Distance (PD)	78 (High)	95 (High)	30 (Low)	55
Uncertainty Avoidance (UA)	48 (Low)	30 (Low)	60 (High)	64
Individualism (IND)	14 (Low)	20 (Low)	63 (High)	43

(Source: [112])

Indonesia and Malaysia both has high value of power distance index, with the score of 78 and 95, while the average PD for the average Asian countries is 71. Germany on the other hand scored very low with 30, while the world average is 55. The uncertainty avoidance score for Indonesia and Malaysia are 48 and 30, which is considered as low compared to the greater Asian average of 58 and a world average of 64. Germany is considered as high UA culture even with a score 60 less than the world average. Indonesia and Malaysia both are categorized as collectivist cultures with Individualism score of 14 and 20, compared to the greater Asian rank of 23, and world rank of 43. Germany is considered to be an Individualist culture with its high score of 63 [112]. Hofstede's cultural dimension score for the three selected countries is shown in Figure 6.3 below:

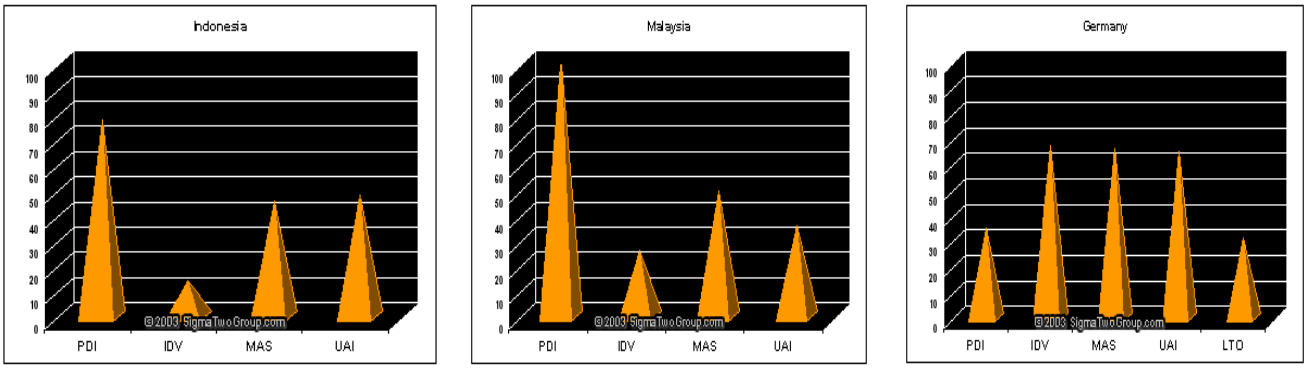


Figure 6.3 Hofstede's cultural dimension score for Indonesia, Malaysia and Germany

6.4 Research Materials

The scientific instrument used in this research is by the use of survey with questionnaire. In addition to a traditional paper-and-pen survey over face-to-face contact, an electronic survey via web-based questionnaire was also used to deliver the survey to the potential respondents and collect the survey data from actual respondents. The analysis focuses on the country differences in answers on questions about user's preference upon using a groupware application in supporting their daily office activities. In light of the multi-cultural graphic of the participants, care was taken that the language used was clear and unambiguous. The country culture dimensions were found through a cultural set of questionnaires. Questionnaires were produced in three different languages (English, German, and Bahasa Indonesia). The master version of the international questionnaires was formulated in English. The translations were made and checked by the other team researchers in the Institute of Computer Engineering, UDE. The obstacle during this point was that there were some words that were difficult to translate either to Indonesian or German in order to have the same exact meaning. Therefore some rephrasing the sentences without culturally loaded idiom were needed to be done.

Data were collected by means of a five-page questionnaire. It was distributed by two ways, web based (see Figure 3.3) and paper based (see Figure 3.4). The design choices in the questionnaire included adoption of a six-point Likert scale for the majority of the questions to prevent response centering (i.e. selection of the neutral option) by respondents that have the tendency to take a distinct position on the related question. The questionnaire was consisted of 67 Likert scale items ranging from "strongly agree" (6) to "strongly disagree" (1), and two forced choice selection. For all questions except questions dealing with demographic, the answers reflect both the person and the situation. The demographic questions served as controls. According to the content, it could be divided into four parts:

1. Part 1: Cultural specific design preference influences belief on usefulness and ease of use which lead to user's satisfaction in using the application influences user behavior on the groupware acceptance [180].
2. Part 2: Specific cultural theories applied and assessed to examine whether cultural variables influence users preference to use groupware for intercultural collaboration [19], [181].
3. Part 3: Trompenaars model is assessed in defining user's expectation of groupware application [1].
4. Part 4: HCI point of view toward the interface design.

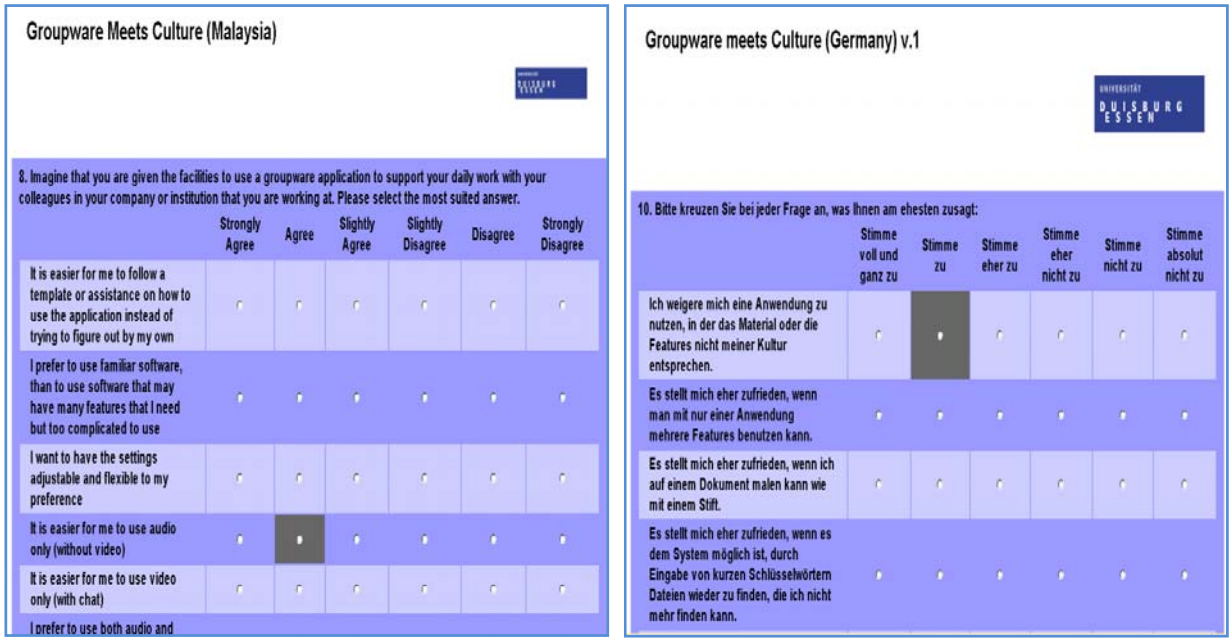


Figure 6.4 Questionnaire web-based screenshots

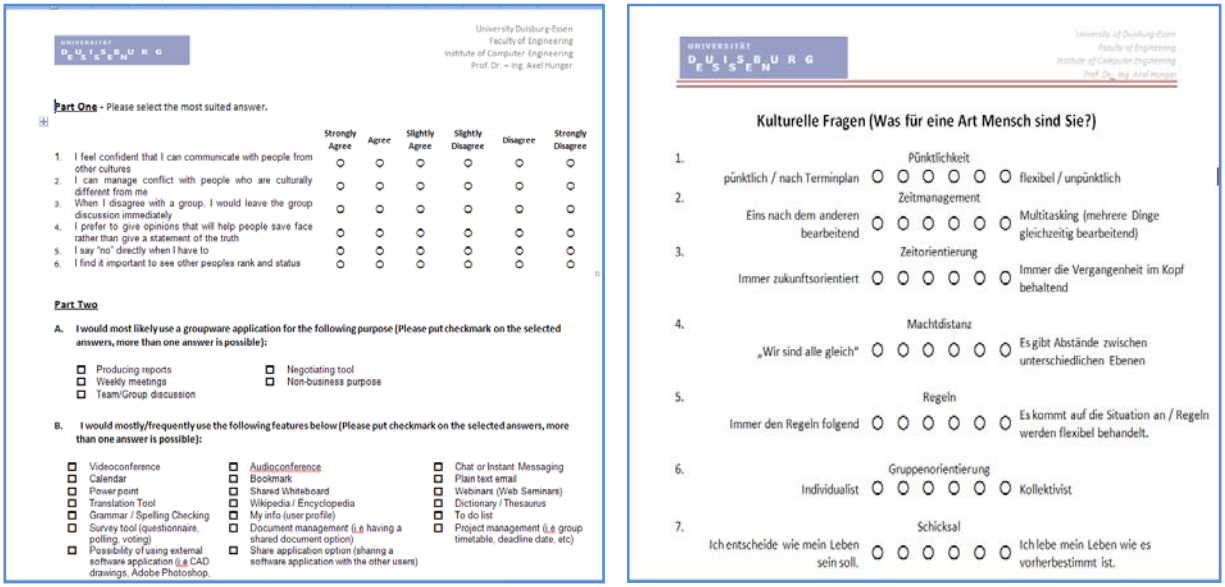


Figure 6.5 Sample of paper-based questionnaire

A different set of questionnaire with cross-cultural questions were also conducted to the same respondents. Sample of the web-based screenshot can be seen in Fig. 3.5. The cultural questions survey was conducted to find value differences among countries, to relate these characteristic of the countries and to compare the result that reflect the cultural dimension that was previously has been researched by other social scientists. The cross-country analysis is kept separate from the groupware analysis questionnaire. The questions were firstly classified into several groups according to the dimension indexes. The ideal questions for cross-cultural survey instruments are those for which answers depend as much as possible on nationality and as little as possible on anything else, and that carry the same meaning for widely different respondents [112].

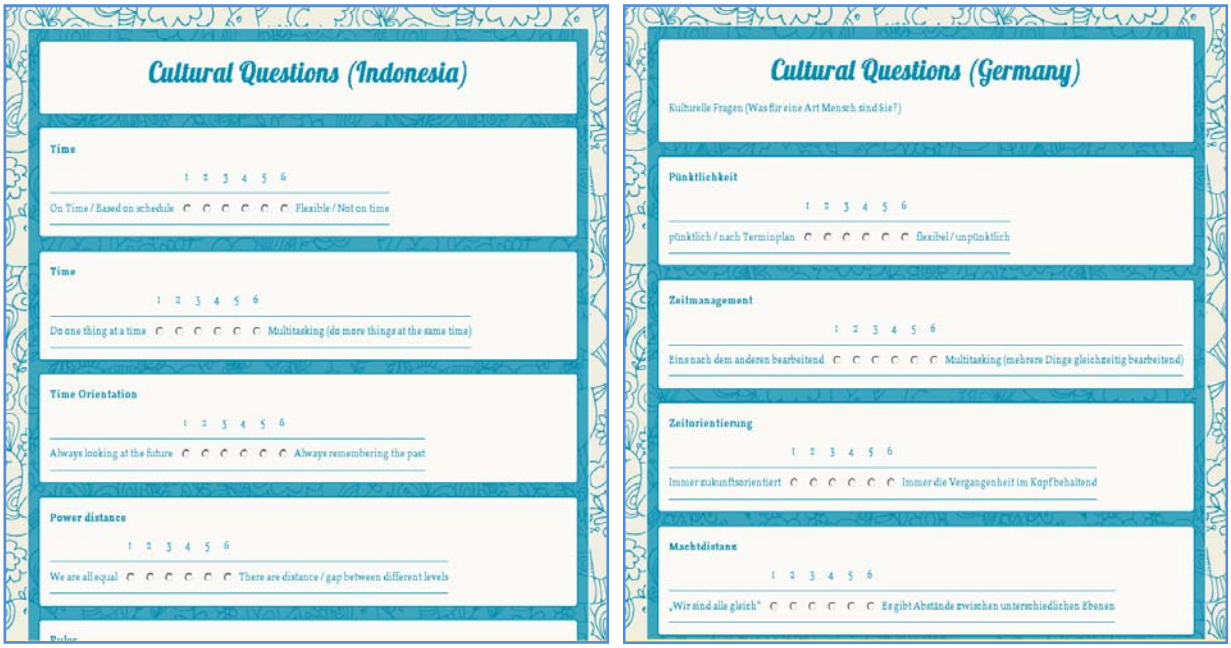


Figure 6.6 Cultural questions web-based screenshots

6.5 Procedures

A pretest survey was carried out before the questionnaire survey. The pretest survey was designed to assess the questionnaire clarity, question wording and question applicability. During the pretest session, 30 users (consisting of 10 users from Indonesia, 10 users from Malaysia and 10 users from Germany) were asked to fill in the questionnaire and were encouraged to give comment on the questionnaire items that corresponds to the constructs, wording, length of the instrument, and the format of the questionnaire. The comments received were then used as a basis for the questionnaire revision. The formal survey was conducted sequentially, firstly in Indonesia (March 2009), Malaysia (March 2010), and lastly in Germany (September 2010). The total sample for this study thus consists of workers from globalised industries. To increase the response rated of participants, snowball sampling was used, in which the participants of the survey helped in distributing the link of the survey website or make more copies of the questionnaires to recruit other participants from different globalized industries.

The survey was design as an approach in two phases: questionnaire survey and the collection of contextual data. In the first phase, survey questionnaire consisting of the 67 Likert scale questions and two forced-choice selections. The questionnaire was intended to collect information of the types of manifestation of culture each country would represent. In the second phase, personal interviews were conducted to collect "structural" data. The purpose of this phase was to find out to what extent measurable differences among the cultures of different organizations could be attributed to unique features of the organization in the question in order to collect the structural data. Culture rifts within organizations can by themselves represent essential cultural information [112]. All were collected personally, as deciding on which questions would be relevant, the questionnaire evolved during the initial interviews. A week prior to the interview, the participants received an overview of the interview by email so that they could prepare themselves. Different individuals within the same company do not necessarily give identical answers on questions about their perception of how the teamwork within the

company practices. All interviews were conducted in English, except for several Indonesian' participant, questions were translated into Bahasa Indonesia and were asked using Indonesian language. In the beginning of the interview, the participants were: (a) informed that the conversation would be kept confidential and the result will strictly be used for research and educational purposes only, (b) informed that their name or the names mentioned would not be used in any published article or made public in any other way, (c) asked permission to record the interview. This interview was written down during the interview. Several interviews were also conducted by telephone due to the difficulties to set up a meeting arrangement. Most of the interviews of the Indonesian and Malaysian participants were conducted in face-to-face setting. Interview with the German participants was made using telephone. All interviews took 30-60 minutes duration.

The actual filling out of the questionnaires was preferably done during working hours: for employees who had internet, preferably to do it using the online version. The questionnaires had an option to be anonymous but the business field/sector must be filled out. It also contains reassurance that had no attempt to identify respondent and that they were also free not to answer any question that they do not want to answer. Firstly the appointed companies were visited in order to drop off the empty questionnaire, and then appointment date was made on when the completed questionnaires will be able to be collected. Respondents in remote location have the option to fill in the web based questionnaire. Initially, data processing was done once return back in Germany. A process of correcting, decoding, and recording information was necessary in order to arrive at results that made sense. The entries into the database were coded by country.

6.6 Data Collection

6.6.1 Research Sample

The subject respondents are from Indonesia, Malaysia, and Germany. The questionnaire collected demographic data; the main criteria responsible for group differences in the survey data and that apply to all data were country, nationality, occupation, gender, and age of the respondents. Other possible criteria were experience working in team and experience working with any groupware application. Most of the participants had a strong technical background and varying degrees of work experiences. Most participants are workers working in industries or academic institutions, a total of 599 participants have been involved in this survey. Most of the participants held similar jobs in their organizations (i.e. information systems, services, sales and human resources) and had personal experience of working on a globally distributed software projects and/or as virtual members. There were difficulties in collecting German respondents; therefore several samples of the German respondents were also students (with German nationalities) that are currently studying in the University of Duisburg Essen.

Control variables were assessed to evaluate potential extraneous influences. The control variables included demographic like age, gender, and nationality. More specific were asked about experience working in team and experience working in groupware application to support group work.

The returned sample characteristics are illustrated in Table 6.2 and Table 6.3 below:

Table 6.2 Total Respondents

Country	Total Respondents
Indonesia	236
Malaysia	263
Germany	100
Total	599

Table 6.3 Profile of the Respondents

	Frequency			Percentage		
	Indonesia	**Malaysia**	**Germany**	**Indonesia**	**Malaysia**	**Germany**
Gender						
Male	107	122	79	45.34	46.39	79.00
Female	129	141	21	54.66	53.61	21.00
Total	236	263	100	100.0	100.0	100.0
Age						
< 25 years old	96	106	69	40.68	40.30	69.00
25 – 45 years old	134	138	26	56.78	52.48	26.00
>45 years old	6	19	5	2.54	7.22	5.00
Total	236	263	100	100.0	100.0	100.0
Experience working in team						
Yes	203	229	93	86.02	87.07	93.00
No	33	34	7	13.98	12.93	7.00
Total	236	263	100	100.0	100.0	100.0
Experience working with groupware						
Yes	129	56	48	54.66	21.29	48.00
No	107	207	52	45.34	78.71	52.00
Total	236	263	100	100.0	100.0	100.0

Graphs below (Figure 3.6 – Figure 3.9) show the percentage of respondents (age, gender, experience in team and working with groupware):

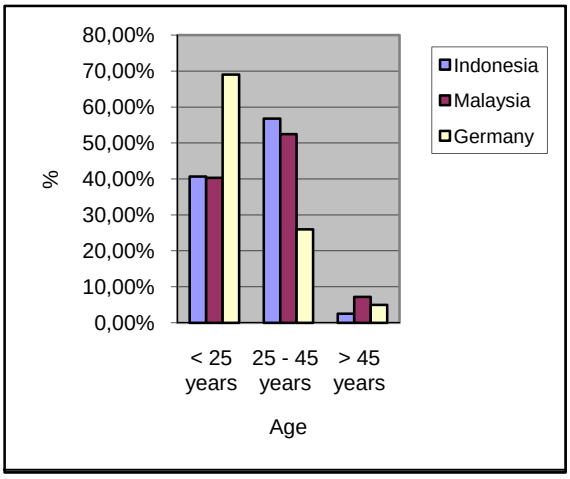


Figure 6.7 Respondent's age profile

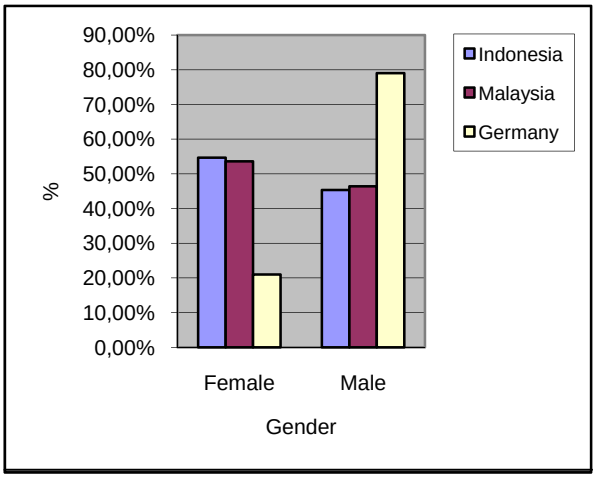


Figure 6.8 Respondent's gender Profile

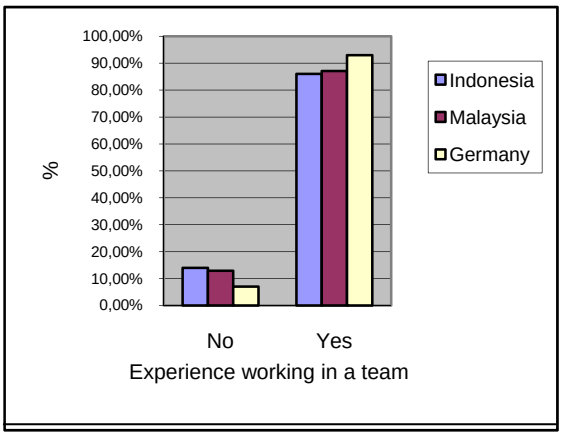


Figure 6.9 Experience working in a team

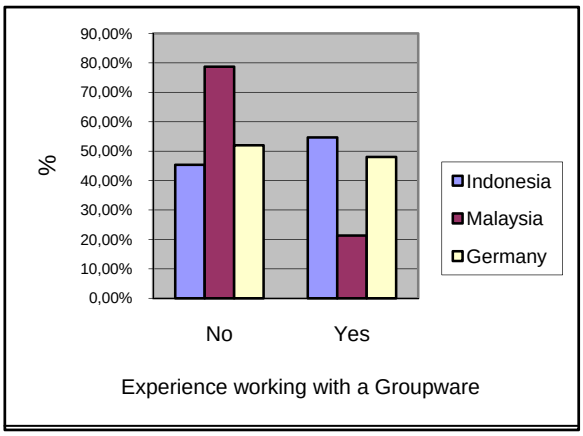


Figure 6.10 Experience working with a groupware

The average respondents for the total sample are between 25-45 years old (47.58%). From the total sample of respondents, 51.42% are male and 48.58% are female. The model designed in this study is for both experienced and inexperienced users working in a team and using groupware.

6.6.2 Instrument validation

Prior to the hypothesis testing, the measurement scales were examined in terms of the construct validity. Validity of a test means that its scores relate to outside measures of the same or related phenomena in ways predicted by the test's theory [182]. Validity implies reliability: an unreliable test cannot produce scores that meaningfully relate to outside data. To test construct validity, a principal components factor analysis for ease construct was performed. The instrument demonstrated convergent validity with factor loading exceeding 0.05 for each construct, with R-Table value of 0.0524.

Individual items in the questionnaire measuring the constructs were combined to form scale. It was then tested for reliability to assess the internal consistency of the instrument. The analysis was performed with all three countries combined (Indonesia, Malaysia and Germany). Cronbach's alpha was used for determining the reliability of the questionnaires. The reliability of all measurement scales was comfortably above the recommended minimum level of 0.70 for social science research and the accepted "desirable" level of 0.80 for social science research [118]. Given that all constructs had items with Cronbach's alpha above 0.80. The factor analysis result reflects that the questionnaires items loaded highly on the same factor and produced a Cronbach alpha measurement scale reliability coefficients calculated for each construct using SPSS is 0.89. Factor analysis and reliability tests revealed that the instruments were suitable and met the criteria of validity and reliability.

6.6.3 Cultural Variables

The research was designed to assess the cultural dimension of user's preference of a groupware design; selected cultural factors were examined to judge their impact on key constructs in the research model. Below is the cultural dimensions used in this research (Table 6.4):

Table 6.4 Cultural factors used in this research

No.	Cultural Factor	Author	Description
1.	High - Low Context (HLC)	Hall, Victor	High and low context refers to the amount of information that is in a given communication as function of the context in which it occurs
2.	Monochromic and Polychromic	Hall, Victor	Do people do one thing at a time or many things at once?
3.	Power Distance (PD)	Hofstede	How are relationships between people structured?
4.	Uncertainty Avoidance (UA)	Hofstede, Globe Studies	Whether uncertainty is perceived as threatening
5.	Collectivism - Individualism (CI)	Hofstede, Trompenaars, Globe Studies	Do people perceive themselves primarily as individuals or as members of a group?
6.	Achievement vs. Ascription	Trompenaars	Do we have to prove ourselves to receive status or is it given to us?
7.	Affective vs. Neutral	Trompenaars	Do we display our emotions?
8.	Diffuse vs. specific	Trompenaars	How far do we get involve? Whether business and personal relationships are clearly separated
9.	Particularism vs. Universalism	Trompenaars	Whether behavior is rule-based versus relationship based.

6.7 Overview of Statistical Techniques

A variety of statistical techniques were used to assess the research model and test the research hypotheses. Statistical techniques of Part 1 and Part 2 were carried out using AMOS 16.0 to test the structural model using Newton-Raphson iterative method. AMOS is a covariance-based structural equation modeling tool. Statistical techniques for Part 3, Part 4 and Cultural questions used SPSS. The validity of the scales and the coefficient alpha (Cronbach alpha) was used to assess the reliability of the questions in the questionnaires. The statistical analyses of the data for each part are presented in the next chapters.

6.8 Data Analysis and Results

This subchapter describes the sample data that has been collected for analysis, outlines the steps that have been taken to analyze the data, and then presents the result. This chapter will be divided into 5 main subchapters, consisting of the types of studies that have been conducted to obtain the data. The initial analysis will begin with the Cultural Question survey to find value differences among countries, to relate these characteristic of the countries and will be used as the basis foundation in relation to the cultural factors discussed in this dissertation. Below is the distribution of parts in the questionnaire:

1. Part 1: Cultural specific design preference influences user behavior on the groupware acceptance
2. Part 2: Selected cultural dimension influences users intention to use groupware
3. Part 3: Assessing Trompenaar's cultural model in defining user's expectation of groupware application
4. Part 4: HCI point of view toward the interface design

6.8.1 Cultural Question Survey

A cross-sectional survey was conducted to pertain each countries cultural tendencies in each cultural factors, below are the findings:

6.8.1.1 Dimension of Time-orientation

Different cultures have different attitudes to time; it varies in their sense of time as linear or as circular. In this study the dimension of time will be explored in relation to Trompenaar's "sequential vs. synchronic" dimension and Hall's "monochromic vs. polychromic" dimension.

In his work, Hall described two cultural approaches to time as monochromic and polychromic. In monochromic cultures, time is linear in nature and segmented. Polychromic cultures on the other hand are the opposite, they carry out simultaneous activities and time commitments are considered flexible, where plans may be and are changed frequently and easily. Monochromic time cultures the emphasis is on the compartmentalization of functions and people. Monochromic time is perceived as being almost tangible: people talk about is as though it were money, as something that can "spent", "saved", "wasted", and "lost". Time is viewed as a commodity; it is scheduled, managed, and arranged. It is also used as a classification system for ordering life and setting priorities. Monochromic time dominates most business in Western cultures, such as Germany. Within German culture, people will often interpret tardiness as personal insult. A polychromic time system means that several things are being done at the same time. Polychromic time is characterized by the simultaneous occurrence of many things and by a great involvement with people. Appointment will be quickly broken, schedules readily set aside, and deadlines unmet without guilt or apology when friend or family members require attention. Those who use polychromic time system often schedule multiple appointments simultaneously, so keeping "on schedule" is an impossibility that was never really a goal. Polychromic people feel that private space disrupts the flow of information by shutting people off from one another. Disadvantages, such as business lost, can occur in international business caused by monochromic and polychromic people do not understand each other or even realized that two such different times exist.

As depicted in Table 6.5 and Figure 4.1 below, dominated by German respondents, most respondents including Indonesia and Malaysia answered to have the tendency to be on time when performing their daily activities.

Table 6.5 Dimension of Time 1

Time	ALL	Indonesia	Malaysia	Germany
On Time	24,4	**35,4**	17,8	31
	28,5	24,4	**29,5**	**37,9**
	22,4	12,6	29	10,3
	11,8	10,2	13,3	6,9
	6,8	10,2	5	6,9
Flexible	6	7,1	5,4	6,9

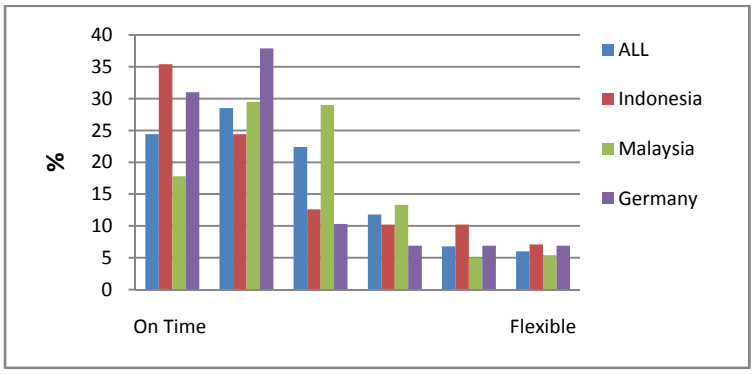


Figure 6.11 Dimension of Time 1

All cultures are conscious of time and organize themselves around their conceptions of time. Time "waits for no man", once it is gone, you lose it forever. Sequential versus synchronic cultures relates to time and the ordering of tasks. The sequential approach is to see time as a narrow band and plan accordingly. While sequential people like to do one thing at a time, synchronous people do many things at a time. Synchronic cultures see time as a wide ribbon, where multitasking is acceptable and time/deadlines are considered flexible and plans can be easily changed. Synchronous concepts of time are no guarantee of an effective culture [118]. The cultures of East Asia are, among the more synchronous [119]. This is proved by the survey result which shows that most Asian users (both Indonesia and Malaysia) have high percentage score on selecting to "do more things at the same time" rather than to "do one thing at a time" (See Figure 4.2). German users have the tendency to prefer to do one thing at a time, but surprisingly several German users also prefer do to more things at the same time with the same percentage of 27.6% (Table 6.6). Therefore, in can be concluded that for the case of groupware usage, most users from all three sample countries prefer to be able to do more thing at a time with the groupware application.

Table 6.6 Dimension of Time 2

Time	ALL	Indonesia	Malaysia	Germany
Do one thing at a time	10,1	17,3	6,6	6,9
	22,9	22	22,8	**27,6**
	13,4	9,4	14,5	20,7
	18,1	**18,9**	19,1	6,9
	20,9	15,7	**23,2**	**27,6**
Do more things at the same time	14,4	16,5	13,7	10,3

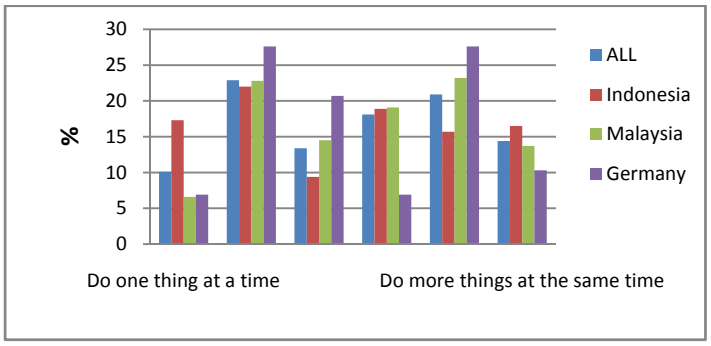


Figure 6.12 Dimension of Time 2

Trompenaars also identified that different cultures assign diverse meanings to the past, present and future [119]. People in past-oriented cultures tend to show respect for ancestors and older people and frequently put things in a traditional or historic context. People in present-oriented cultures enjoy the activities of the moment and present relationships, tend to be less motivated for planning sessions and may show resistance to follow detailed plans. People from future-oriented cultures enjoy discussing prospects, potentials and future achievements, and tend to participate actively in the planning sessions [112]. In other words, cultures vary on whether they value the now and future and the historic and the past. As depicted in Table 4.3 and the graph shown in Figure 6.7, Germany dominated the future-oriented dimension, followed by Indonesia, lastly by Malaysia.

Table 6.7 Dimension of Time 3

Time Orientation	ALL	Indonesia	Malaysia	Germany
Future-oriented	24,9	37	20,7	6,9
	31,8	**29,1**	**32,8**	31
	26,4	20,5	27,4	**48,2**
	12,6	8,7	15,4	6,9
	2,8	4,7	1,7	3,4
Past-oriented	1,5	0	2,1	3,4

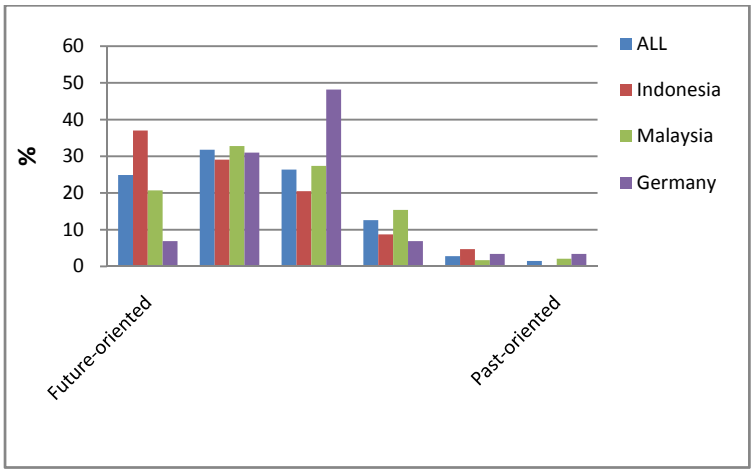


Figure 6.13 Dimension of Time 3

6.8.1.2 Power Distance (PD)

Power distance (PD) is taken from Hofstede's dimension of Power Distance. Power distance is the acceptance of inequality between a less powerful and a more powerful individual, where both belong to the same social system [183]. This dimension reflects how people react to inequality and how they accept the unequal distribution of power within their society and organizations. This acceptance can manifest itself in the way it impacts on relationships between managers, colleagues, and subordinates [112]. In other work, PD has also been referred to as hierarchy. An example of a low PD cultural norm is that all members should have equal rights, and that subordinates and superiors are equal [184]. Subordinates in low PD teams expect to be consulted by their manager before decisions are made, and that the judgment of each team member is perceived as important. Subordinates in high PD countries prefer a manager who tells them what to do [185].

Table 6.8 Countries and their power distance rank

SMALLEST	Germany	Pakistan	East Africa	India
Austria	Costa Rica	Spain	Belgium	Indonesia
Israel	Australia	Taiwan	Turkey	Ecuador
Denmark	Netherlands	Iran	Salvador	Arab countries
New Zealand	Canada	South Korea	Colombia	Venezuela
Ireland	United States	Greece	Hong Kong	Mexico
Sweden	Jamaica	Uruguay	France	Philippines
Norway	South Africa	Portugal	Brazil	Panama
Finland	Argentina	Chile	Singapore	Guatemala
Switzerland	Italy	Thailand	Yugoslavia	Malaysia
Great Britain	Japan	Peru	West Africa	**GREATEST**

Source: adapted from Hofstede (2001) and modified by Binder (2007)

According to Hofstede's result shown in Table 6.8, Malaysia has the greatest power distance index. Indonesia is also categorized under high power distance, while Germany is considered to be in the low power distance culture. Surprisingly, the result of this study (Table 6.9) shows that there might be a shift in culture, survey results shows that most Indonesian (44.9%) and Malaysian (17.4%) respondents selected that there are no distance of gap between different levels, or in other word different levels are treated to be equal, which show that the PD score for Indonesia and Malaysia should be low. Germany stays consistent with the previous findings by Hoftede (2001), in which has the tendency to be a low PD culture. The percentage graph is shown in Figure 6.14.

Table 6.9 Power Distance

Power Distance	ALL	Indonesia	Malaysia	Germany
We are all equal	25,9	**44,9**	**17,4**	13,8
	25,2	18,9	27	**34,5**
	22,9	18,9	27	6,9
	14,9	12,6	16,6	27,6
	6,8	3,1	8,3	10,3
Gap between different levels	3,3	1,6	3,7	6,9

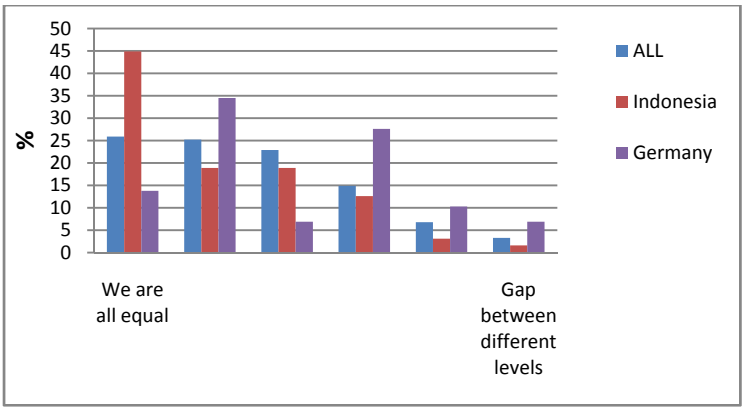


Figure 6.14 Power Distance

6.8.1.3 Uncertainty Avoidance (UA)

Uncertainty avoidance is defined as the degree to which people in certain culture prefer structured over unstructured situations [185]. Structured situations are those in which there are clear rules as to how one should behave [112]. Individuals from countries with stronger uncertainty avoidance indexes are more inclined to avoid risks, enjoy working with tight rules and control systems and resist innovation. Team members are likely to enjoy tasks requiring precision, on time/punctuality, and comfortable with detailed planning. While individuals from countries with weaker uncertainty avoidance enjoy innovation, accept higher risk levels and are comfortable with open-ended learning situations. The team members tend to resist stress better. Having a good mix of people from different countries in the team project allows the companies or organization of a brainstorming exercise. The understanding that team members may have different tolerance levels for ambiguity or uncertainty will determine the level of details required for the rules of collaboration when working as a global team. How users' behave in following the rules was also asked in this survey, the result can be seen in Table 6.10 below and the percentage graph is shown in Figure 6.15.:

Table 6.10 Attitude toward rule

Rules	ALL	Indonesia	Malaysia	Germany
Always follow the rule	9,8	11	9,5	6,9
	21,5	**21,3**	22,8	10,3
	21,2	19,7	20,7	**31**
	20,2	15	**23,7**	13,8
	16,4	17,3	14,9	24,1
Rules can be handled "flexible"	11,1	15,7	8,3	13,8

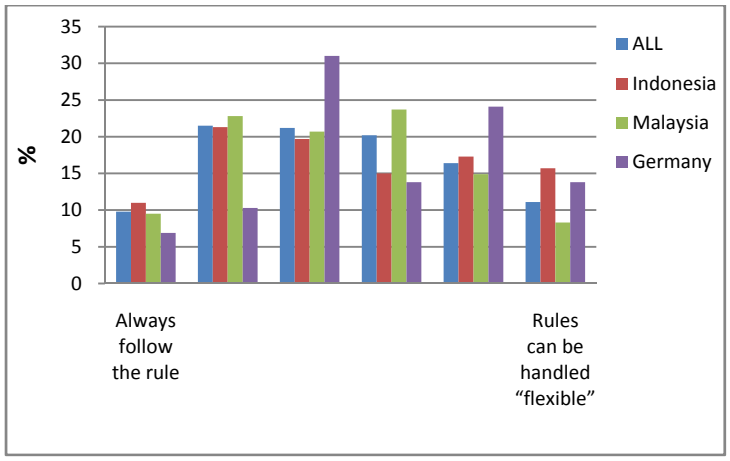


Figure 6.15 Attitude toward rule

Although, the percentage shows that most users have the tendency to always follow the rule, as predicted Germany has the highest percentage value. Malaysia, with 23.7%, has the tendency to handle rules as "flexible". Surprising, Indonesia was also predicted to handle rules flexible, but the result shows that Indonesia, with 21.3% has the tendency to always follow the rule. In relation to Hofstede's UA dimension, the result of this study is consistent with Hofstede's findings as can be seen in Table 6.11.

Table 6.11 Countries and their uncertainty-avoidance relative ranks

WEAKEST	United States	Finland	Venezuela	Spain
Singapore	Canada	Iran	Colombia	Peru
Jamaica	**Indonesia**	Thailand	Israel	Yugoslavia
Denmark	New Zealand	**Germany**	Mexico	Japan
Sweden	South Africa	Ecuador	South Korea	Salvador
Hong Kong	Norway	Arab countries	Turkey	Belgium
Ireland	Australia	Taiwan	Costa Rica	Uruguay
Great Britain	East Africa	Austria	Chile	Guatemala
Malaysia	Netherlands	Pakistan	France	Portugal
India	West Africa	Italy	Panama	Greece
Philippines	Switzerland	Brazil	Argentina	**STRONGEST**

Source: adapted from Hofstede (2001) and modified by Binder (2007)

Uncertainty avoidance is also defined by Hofstede as "the extent to which members of a culture feel treatened by uncertain or unknown situation" [112]. The survey result show's in handling risk, Germany has the highest percentage as seeing risk "as a challenge" with 41.4%, which indicates that Germany has a low UA (see Table 6.12). Meanwhile, Indonesia and Malaysia are categorized to have weak uncertainty avoidance (low UA), the result show that Indonesia (39.4%) and Malaysia (28.2%) also sees risk as a challenge, although with scores lower than Germany. The percentage graph is shown in Figure 6.16.

Table 6.12 Risk handling

Risk	ALL	Indonesia	Malaysia	Germany
As a problem	2	1,6	1,7	6,9
	7,1	2,4	9,5	6,9
	11,3	11	12,4	3,4
	21,7	17,3	24,1	20,7
	26,7	28,3	24,1	**41,4**
As a challenge	30,2	**39,4**	**28,2**	20,7

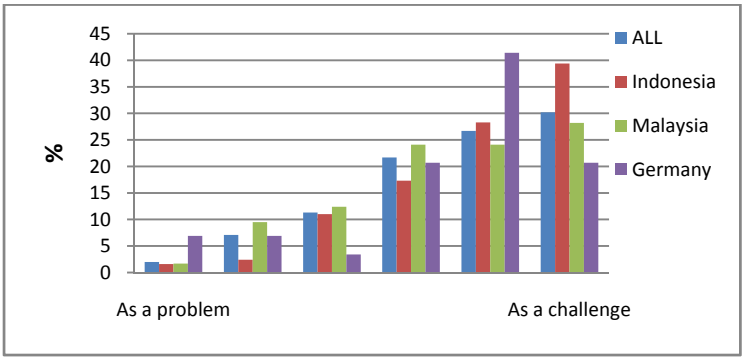


Figure 6.16 Risk-handling

UA dimension scores countries on how much uncertainty and ambiguity is tolerated and how much is perceived as comfortable. It described the extent to which a society fears and avoids uncertainty and uncertain outcomes. High UA cultures try to minimize uncertainty and are inclined to support rules and regulations, to avoid risks and are intolerant of persons with divergent ideas (Cohen, Pant, and Sharp 1996). This dimension reflects the resistance to change and the attitude to take risks of individual from different countries. In low uncertainty avoidance culture, the willingness to take risks is higher and the people are likely to experience the things and have innovative behavior. How users are willing to be open toward new application system in improving their working activities are asked through the question on how they would react toward any acceptance of changes, would they prefer to be "close toward any changes" or "open toward any changes". Indonesia and Malaysia, as countries with the tendency to belong to the low UA culture, showed that they are willing to take risks and therefore are open toward any changes as can be shown with 47.2% and 59%. Germany, although belongs to the high UA culture, with the tendency to resist change, surprisingly when asked regarding the acceptance of changes, has the highest score percentage with 62.2% with the attitude to be open toward any changes as shown in Table 6.13 and Figure 6.17.

Table 6.13 Acceptance of changes

Acceptance of Changes	ALL	Indonesia	Malaysia	Germany
Close toward any changes	1	0,8	1,2	0
	1,3	1,6	0,8	3,4
	6	5,5	6,6	3,4
	15,1	14,2	16,6	6,9
	35,4	**47,2**	**59**	**62,2**
Open toward any changes	21,2	30,7	15,8	24,1

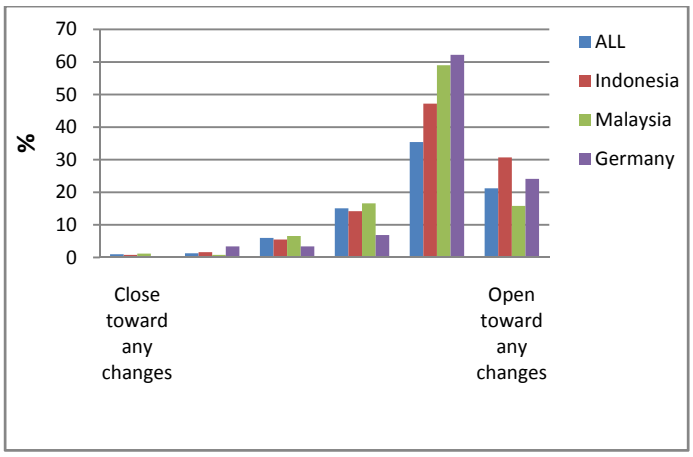


Figure 6.17 Acceptance of changes

6.8.1.4 Collectivism vs. Individualism

Hofstede's cultural dimension of Collectivism vs. Individualism classifies countries according to the relationship between individuals and societies, the importance of participating in a social group and the values attached to the working conditions. Individualism as opposed to collectivism describes by Hofstede as the relationship between the individual and the collectivity that prevails in a given society [120]. This dimension describes the relationship of the individual to groups within their society. The individualist dimension is to be part of a more loosely knit group or community; it practices norms and values relating to individual achievement. In this situation the individual see their own needs as the priority and this is reflected by their approach to how they work and their attitude to membership of an organization. Personal time, individual freedom, and individual challenge are the underlying cultural assumptions. On the other hand, collectivist societies are group-centric. Within the organization, family and society, the maintenance of harmony is considered a virtue and confrontation should be avoided. In these circumstances the word "no" is not often used as saying no is considered confrontational. Collectivistic society members, therefore, are simply not comfortable and will perform badly when expected to be individual centric [186].

Table 6.14 Individualist vs. Collectivist

Highly	France	Argentina	East Africa	Pakistan
Individualist	Ireland	Iran	Malaysia	Indonesia
United States	Norway	Jamaica	Hong Kong	Colombia
Australia	Switzerland	Brazil	Chile	Venezuela
Great Britain	Germany	Arab countries	Singapore	Panama
Canada	South Africa	Turkey	Thailand	Ecuador
Netherlands	Finland	Uruguay	West Africa	Guatemala
New Zealand	Austria	Greece	Salvador	**Highly**
Italy	Israel	Philippines	South Korea	**Collectivist**
Belgium	Spain	Mexico	Taiwan	
Denmark	India	Yugoslavia	Peru	
Sweden	Japan	Portuga	Costa Rica	

Source: adapted from Hofstede (2001) and modified by Binder (2007)

Indivualistic and collectivistic cultures can differ whether relations among individuals in the culture are horizontal or vertical [186]. In horizontal, collectivistic cultures, high value is placed on equality, but little value is placed on freedom. In Japan for example, there is a saying, "The nail that sticks out gets hammered down," which illustrates that members of the culture are not expected to stand out from other in-groups members [70]. In high individualism cultures, the ties between individuals are loose, people are expected to look after themselves, and the individual's rights are seen very important. In low individualism cultures, or in collectivism cultures, we find people are integrated into large, strong, cohesive groups. [112]. Strong associations with friends and family are considered of great importance. Earley (1999) stated that individualism potentially affects communication and coordination patterns among individual team members. Collectivistic culture are more willing to help others, make personal sacrifices and cooperate more than people from individualistic culture (McLeod, Lobel, and Cox 1996). In their research, Paul et al. (2005) concluded that a collective orientation is related to enhanced collaboration. In Hofstede's study, Germany scores high on individualism [112]. In high individualism cultures, the focus is on individual performance and responsibility. As shown in Table 4.14, Germany is categorized as an individualist country, while Indonesia and Malaysia, is categorized belonging in the collectivistic culture [120]. This is also proven to be true in this study as shown in Figure 6.18, Germany scores higher in Individualist with 24.1%, while Indonesia and Malaysia tend to be a culture with collectivist when it comes to group-oriented, with 26.8% and 27.3% consecutively (see Table 6.15).

Table 6.15 Group-orientation

Group-Oriented	ALL	Indonesia	Malaysia	Germany
Individualist	4,5	4,7	3,3	13,8
	13,4	11	13,3	**24,1**
	21,4	18,9	23,2	17,2
	18,9	17,3	19,9	17,2
	26,7	**26,8**	**27,8**	17,2
Collectivist	15,1	21,3	12,4	10,3

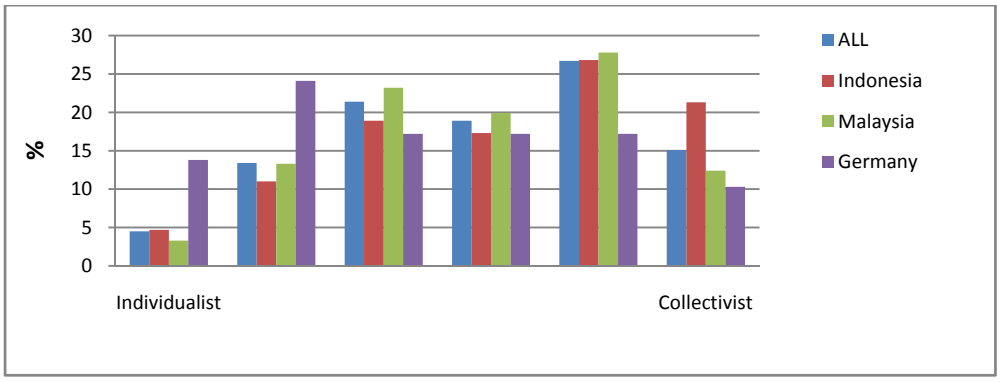


Figure 6.18 Group-orientation

6.8.1.5 Achievement vs. Ascription

Achievement vs. ascription is one of the cultural dimensions introduced by Trompenaars [119]. Trompenaars included destiny in his achievement vs. ascription dimension. In an achievement based culture status is gained from what the individual has and is capable of achieving. In an ascribed culture, status is derived from who a person is and what position or role they hold. Ascribed status is often seen as privilege and special pleading. Status is ascribed to people for many reasons, some of which are suspect; other reasons may be entirely justified. Status is ascribed to those who are "well born", of noble or royal origins. Achieved status often is not always necessitates a degree of conformity. Ascribed status is importantly connected to the foundations of business enterprise in relationships of trust and reputation for fair dealing.

As achievement vs. ascription dimension is the status in which is gained from what the individual has and is capable of achieving vs. the status of those who are "well born" or given to them, therefore respondents were asked how they would live their life, whether they "decide on how my life is going to be" is will be accounted for achievement or they will "live my live based on how it is destined to be" which will be accounted for ascription. Consistent with Trompenaar's research result as shown in Table 6.16, in which Germany belongs to the culture that has the tendency to be an achievement-oriented culture, in this study Germany has the highest percentage on "I decide on how my life is going to be" with 48.3%. Indonesia was categorized to have the tendency to be in the group of ascribed culture by Trompenaars, but the result shows that Indonesia has probably experience a shift of culture and becoming more "achievement-oriented", with the percentage score of 33.9%, still below Germany (see Table 6.17). Trompenaars did not perform a research with Malaysia, but in this study, Malaysia also shown to have the tendency to be included in the achievement-oriented culture with the percentage score lower than Indonesia, with 29.4%. Graphic of percentage is shown in Figure 6.19.

Table 6.16 Countries and their achievement-orientation

ACHIEVEMENT ORIENTED	Nigeria	France	Oman	Hungary
	Denmark	Italy	China	Bulgaria
Norway	Finland	Israel	Greece	Cuba
USA	Germany	Philippines	Japan	Spain
Australia	Portugal	Brazil	Austria	Czech Republic
Canada	Kenya	Hong Kong	Ethiopia	Argentina
Ireland	Singapore	Mexico	Indonesia	Uruguay
New Zealand	India	Russia	Poland	Nepal
UK	Thailand	Netherlands	South Korea	Egypt
Sweden	Switzerland	Venezuela	Romania	**ASCRIPTION ORIENTED**

Source: adapted from Troompenaars and Hampden-Turner (2005) and modified by Binder (2007)

This questions later on will relate to how user's will prefer the design of a groupware should be, whether they will prefer to has all the settings to be flexible and that they can configure it all according to their needs, or whether they will just simply be satisfied with all the default settings made by the developers.

Table 6.17 Destiny

Destiny	ALL	Indonesia	Malaysia	Germany
I decide on how my life is going to be	25,4	29,9	20,3	**48,3**
	29	**33,9**	**29,4**	37,9
	20,4	12,6	26,6	3,4
	13,9	14,2	14,1	10,3
	6	6,3	6,6	0
I live my live based on how it is destined to be	2,8	3,1	2,9	0

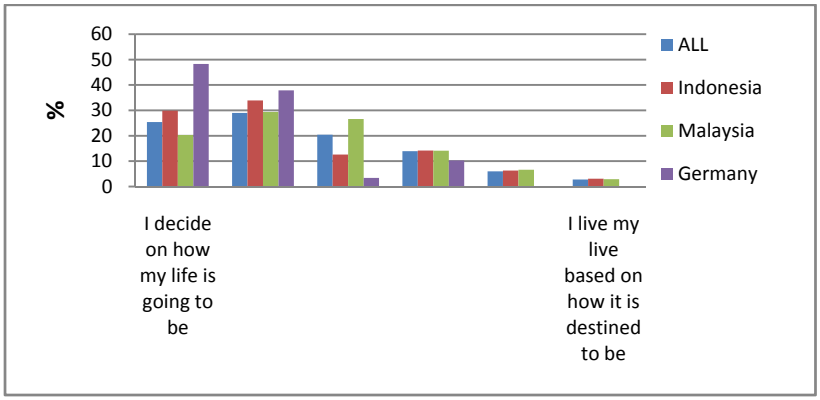


Figure 6.19 Destiny

6.8.1.6 Space

Space is one of the cultural dimensions introduced by Edward T. Hall. Space is considered by Hall as an important element and different cultures require different amount of personal space. Most people don't think about personal distance as something that is culturally patterned, foreign cues are often misinterpreted. This can lead to bad feelings which are then projected onto the people from other culture in a most personal way. When a foreigner appears passive or aggressive, this may mean only that her or his personal distance is different from us. Every person has a visible physical boundary that is surrounded by a series of invisible bound that are more difficult to define but just as real. Space communicates power. Space can also equate to power and position. In some cultures and individual's power and status can be reflected by the size and location of their office. In other culture managers are happy to be located with their subordinates. As depicted in Figure 6.20 below, German respondents have the highest percentage in needing more space compared to Indonesian and Malaysian respondents. The percentage score of the German respondents is 37.9%, followed by Malaysia with 31.5% and then Indonesia with 22.1% (see Table 6.18).

Table 6.18 Space

Space	ALL	Indonesia	Malaysia	Germany
Needs more space	12,8	11,8	12,9	17,2
	27,5	19,7	**31,5**	**37,9**
	30,3	**22,1**	34	24,1
	13,1	15	12,9	6,9
	8,8	14,2	5,4	13,8
Need little space	7,6	17,3	3,3	0

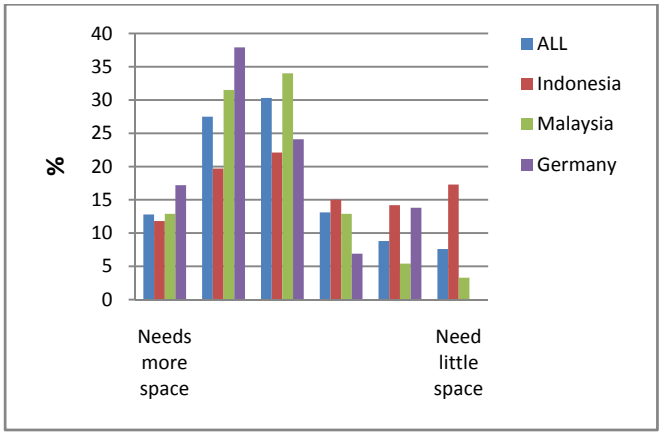


Figure 6.20 Space

6.8.1.7 Specific vs. Diffuse

One of Trompenaars' cultural dimension is specific vs. diffuse. Trompenaars researched differences in how people engage colleagues in similar or multiple areas of their lives, classifying the results into two groups: people from more specific-oriented cultures tend to keep private and business agendas separate, having a completely different relation of authority in each social group. They are usually precise, transparent and direct, preferring meetings with precise agendas and detailed plans [119], while people in diffuse-oriented cultures, the authority level at work can reflect into social areas, and employees can adopt a subordinated attitude when meeting their managers outside office hours. People from these cultures will tend to be ambiguous, evasive and act indirectly, feeling more comfortable with free-form meetings [187]. In a "specific" culture, business and home are separated and compartmentalized. "Specific" culture put task ahead of personal relationship, or in other word is more task-oriented rather than personal relationship-oriented. Specific cultural assumption put specifics ahead of relationships. Individuals from a specific culture concentrate on hard facts, standards and contract. Diffuse cultures on the other hand are the opposite and there is a large personal side to people's lives. Diffuse culture puts ahead relationship rather than task, or in other word personal relationship-oriented. This is reflected in their business relationships, it is not easy for an outsider to gain access.

Table 6.19 Countries and their relative position on cultural – diffuseness

SPECIFIC	Canada	Brazil	New Zealand	Indonesia
Sweden	Russia	United Arab Emirates	Thailand	Singapore
Netherlands	Uruguay	Poland	Greece	Kenya
Switzerland	Ireland	Israel	Cuba	Venezuela
Bulgaria	Germany	Pakistan	Saudi Arabia	Kuwait
Czech Republic	Belgium	Portugal	India	Nigeria
Finland	USA	Hong Kong	Ethiopia	Burkina Faso
Hungary	Norway	Malaysia	Austria	Nepal
Denmark	Philippines	Spain	South Korea	China
UK	Australia	Japan	Egypt	**DIFFUSE**
France	Oman	Mexico	Bahrain	

Source: adapted from Troompenaars and Hampden-Turner (2005) and modified by Binder (2007)

Based on Trompenaars' research, as describe in Table 6.19, Germany has the tendency to belong in the Specific culture, while Indonesia in Diffuse culture. Malaysia seems to be in the middle of both sides. The result of this study shows consistency with Trompenaars' study for Germany. Germany's answer shows that most users prefer to be more "task-oriented" with 32% rather than personal relationship-oriented. Indonesia, although with the percentage score of 27.6% which is lower than Germany, shows that Indonesian users are also can be considered as task-oriented rather that personal-relationship oriented. In this study, Malaysia shows the highest score out of the other countries, with 38.2% in preferring to be more task-oriented. Result is shown in Table 6.20 and graph of percentage is shown in Figure 6.21.

These different beliefs can help in explaining some problems that might occur when the Germans work with the Indonesians. Germans will typically approach a project by outlining the overall goal; will designate each of the major steps and then addressing staffing needs. The Germans approach will goes from task to people. Indonesians, on the other hand, will typically want to know who will manage the project and who will work on it. After they know who the leader will be and the hierarchy of the people involved, then they can assess the project's feasibility. Although result shows that Indonesia has the tendency to be more task-oriented, the Indonesian's approach usually goes from people to task. Before working collaborate together, both cultures will need to understand the project's goals and staffing arrangements.

Table 6.20 Task orientation

Task orientation	ALL	Indonesia	Malaysia	Germany
Task oriented	13,1	16,5	9,5	**32**
	33,3	23,6	**38,2**	30
	27,7	**27,6**	28,6	20,7
	15,6	17,3	14,9	13,8
	8,6	12,6	7,1	3,4
Personal oriented	1,8	2,4	1,7	0

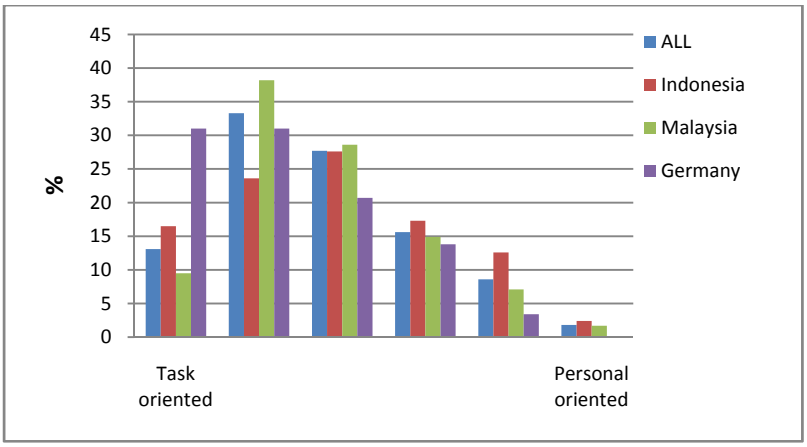


Figure 6.21 Task orientation

6.8.1.8 Affective vs. neutral

Affective vs. neutral belongs to Trompenaar's cultural dimension. This dimension is used to describe the acceptability of showing emotion. According to Trompenaars, people from neutral cultures control their feelings but can suddenly explode during stressful periods. On the other side, people from high affective cultures, use all forms of gesturing, smiling and body language to openly voice their feelings. It is acceptable for people to show their feelings in an affective culture, while in a neutral culture the expressing of feelings is controlled and individuals are not encouraged to publicly display their emotions. According to Trompenaars, as depicted in Table 6.21, Indonesia has the tendency to belong to the neutral culture, while Malaysia to be more in the affective culture. Germany is positioned in the middle.

Table 6.21 Relative positions of countries on the extent to which exhibiting emotion is acceptable

NEUTRAL	Canada	Czech Republic	Denmark	Saudi Arabia
Ethiopia	Burkina Faso	USA	Italy	Cuba
Japan	Singapore	Mexico	Switzerland	Spain
Poland	Australia	Finland	Malaysia	Oman
New Zealand	United Arab Emirates	Belgium	France	Egypt
Hong Kong	Nigeria	Brazil	Ireland	Kuwait
Austria	Portugal	Norway	Argentina	**AFFECTIVE**
China	Sweden	Thailand	Russia	
Indonesia	Netherlands	Greece	Bahrain	
India	Hungary	Israel	Philippines	
Bulgaria	UK	Germany	Venezuela	

Source: adapted from Troompenaars and Hampden-Turner (2005) and modified by Binder (2007)

In this study, how users' behave in handling conflict was asked in regard to displaying their emotions, whether users' have the tendency to belong in the affective or neutral dimension. In handling conflict, when user prefer to confront conflict, this is assumed that they belong to the affective culture, while when user prefer to avoid conflict, then this will be assumed to belong in the neutral dimension. The result of this study shows consistency with Trompenaars research. The positions of the countries shows exactly the same, where Malaysia is proved to prefer to confront conflict, therefore is assumed to be an affective culture. Germany as described above, is positioned in the middle, results also shows

the same, with Germany's percentage score of 27.6%, in between Malaysian and Indonesia's score. Indonesia has the tendency to be a neutral culture, as described by Trompenaars, by preferring to avoid conflict rather than confronting it, with the percentage of 22%. Result is shown in Table 6.22 and graph of percentage is shown in Figure 6.22.

Table 6.22 Handling conflict

Handling conflict	ALL	Indonesia	Malaysia	Germany
Confront	10,1	12,6	9,1	6,9
	22,5	15	22,8	24,1
	27	18,1	**35,3**	20,7
	14,4	21,3	9,5	**27,6**
	18,4	**22**	16,2	20,7
Avoid conflict	7,8	11	7,1	0

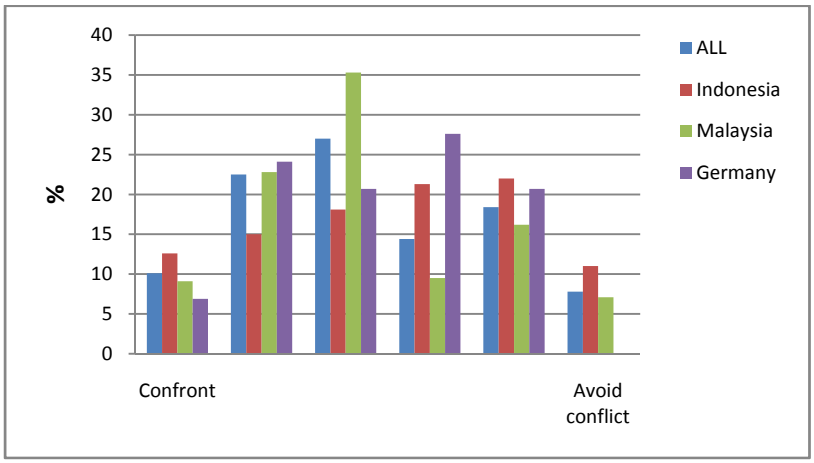


Figure 6.22 Handling conflict

6.8.1.9 High Context (HC) vs. Low Context (LC)

Hall introduced a distinction between communication, by defining the concept of high-and low-context. The concept refers to how information (a message) is stored and how it flows. In high context (HC) cultures, the information contained in the messages is mostly implicit, or in other word simple with deep meaning. On the contrary, in low context (LC) culture, the message information is explicit, in which the meaning is given in the code of the message. For example, cultures such as the United States, Germany and Switzerland are considered LC whereas cultures such as China and Japan would be HC [117]. How information flows to different locations is also considered an important element. In low context cultures, information is controlled and focused only on those who need to know. In high context cultures, information flow freely around the organization.

High-context communication implies that little has to be said or written because most of the information is either in the physical environment or internalized in the person; therefore can be concluded as an indirect and not to the point of communication style. Low-context communication implies that the mass of information is made explicit and needs more additional information described, therefore can be concluded as a communication that is direct or to the point. Germans to a greater extent rely heavily on auditory screening, particularly when they want to concentrate. High context people reject auditory screening and are open to interruptions and in tune with what goes on around them. Members of individualistic cultures who use low-context communication often assume that

indirect communication is ineffective. Communication in Germany tends to be very specific, where things need to be spelled out, which is proved by the survey result with Germany's score of 51.7% of most users answered that their communication style are considered to be "direct and to the point". Indonesia and Malaysia, which are considered to belong in the culture with the communication style to be indirect or not to the point, surprisingly most users also answered to belong in the "direct" communication style with 30.7% and 34.9% consecutively as shown in Table 6.23 and Figure 6.23. High-context communication can be effective or ineffective like low-context communication. Most high-context communication is effective. The effectiveness comes from listeners knowing how to interpret speakers' indirect messages in specific contexts.

Table 6.23 Communication Style

Communication Style	ALL	Indonesia	Malaysia	Germany
Direct, to the point	21,2	**30,7**	17,4	10,3
	33,5	26,8	**34,9**	**51,7**
	20,7	16,5	21,6	31
	13,4	15,7	13,3	3,4
	9,1	6,3	11,6	0
In direct, not to the point	2,3	3,9	1,2	3,4

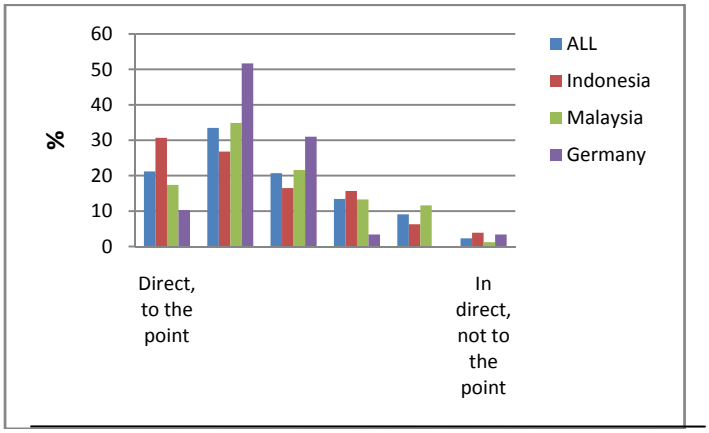


Figure 6.23 Communication style

Gudykunst and Ting-Tommey (1988) argues, which was also agreed by Hoftede, that Hall's distinction can be considered as an aspect of collectivism versus individualism: High-context communication fits the collectivist society, and low-context communication is typical for individualist cultures. This high-low context question will then be applied to explain user's preference of design variation and to suggest reasons for differences in communication pattern that should be considered in the groupware application. Graphic depicted below (Figure 6.24) shows the overall result of the three countries combined:

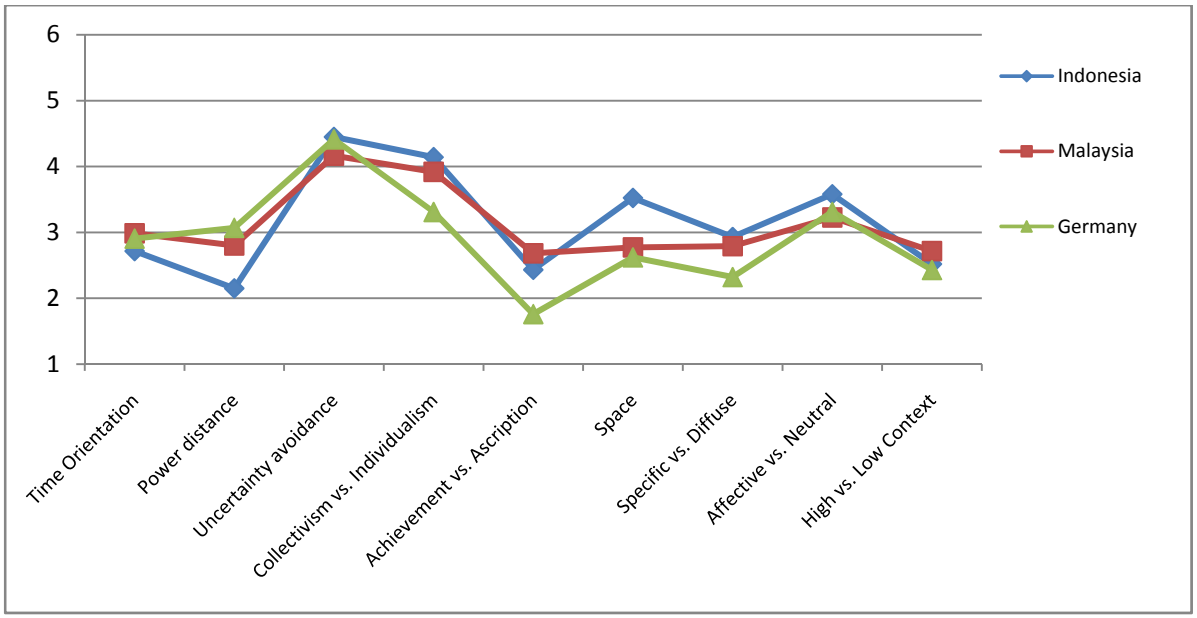


Figure 6.24 Cultural Dimension used in this research

6.8.2 Part 1: Cultural Specific Design Preference on Groupware Acceptance

6.8.2.1 Motivation and Objective of the Study

The main goal of this research is that national culture affects technology acceptance, in this case groupware acceptance, through its impact on certain key variables that are associated with the implementation process. Implementation in the interface design point of view, which more likely can enhance user's perception of usefulness, ease of use and attitudes towards use and hence to increase the technology acceptance. To achieve this study goal, a model is developed to test the relationship between a variety of cultural variables and groupware usage. A series of research propositions will explore the potential impact of differences in national culture on groupware implementation and acceptance. Specifically, this research will try to investigate the effect of culturally induced belief, including cultural dimensions introduced by Hofstede [188], Trompenaars [108], Edward T. Hall [189] and the Globe Studies [82]. This study will explore the relationship between national culture and groupware acceptance.

Individuals are conditioned by their culture; the extended version of TAM will be proposed that we can understand the mechanism by which cultural differences could explain and predict user's preference toward the use of a groupware application. Mainly given that other external variables should be included in TAM for measuring the specific technology, since they may influence the perceived ease of use and perceive usefulness of that technology [190], [191]. External variables used in this study include cultural factors that will influence user's perception of a culturally adapted interface. Ease of use was hypothesized to influence perceived usefulness and perceived usefulness was also expected to influence user's behavioral intention to use the groupware application. This study will integrate extended TAM model with cultural variables to show differences between Indonesia, Malaysia, and Germany, as sample the targeted multicultural users.

The result of this study is organized as follow: Firstly, a review of the conceptual TAM model used in this study in relation to groupware is presented. Then, the research model and hypothesis are proposed.

Next, the research method used in this study is described, followed by the data analysis and conclusion.

6.8.2.2 Research model and hypothesis

Research model used in this study is an adaptation of TAM that has been extended for the purpose of this study. The selection of TAM is expected to identify the factors that may influence user's adoption and utilization process of groupware [180] . The extended version of TAM attempts to enrich TAM's ability to explain and predict groupware usage. It will also be used to investigate the cultural influence toward user acceptance a groupware application. The diagram (Figure 6.25) depicts the theoretical model to be examined in this study.

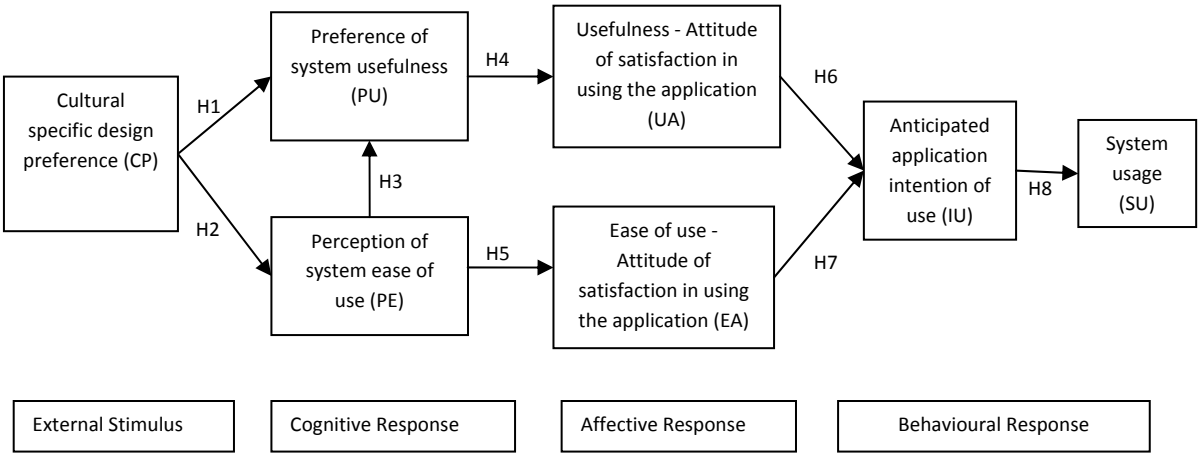


Figure 6.25 Extended version of TAM with hypotheses [180]

Previous studies have shown that there are various external factors that indirectly influence the acceptance of technology through perceived usefulness and perceived ease of use [18]. The component of cultural influence on specific design preference has been incorporated in the TAM model, and serves as an extension to TAM for measuring the acceptance of groupware application. It consists of cultural influence on specific design preference, perceived usefulness, and perceived ease of use, attitude, intention to use and system usage. The research model explains the system usage of groupware application for globalised industries.

a. Cultural Specific Design Preference (CP)

This represents what users want the system to look like and what functionality should be included. User's preference in interface design can be expected to be influenced by culture. Cultural specific design preference represents what users want the system to look like and what functionality should be included. The term cultural specific design preference was adopted from the previous research conducted by Evers (1997) [18]. User's preference in interface design can be expected to be influenced by culture. Color, for instance, have different connotations and meanings in various cultures. Cultural connotative can be deeply embedded in a society; people might not be aware of them [18], [190], [191]. Such an example of these intuitive cultural factors is the flow of information. As a result, the following hypotheses (H) are proposed:

H1: Cultural specific design preference influence user's perception on system usefulness while using groupware application

H2: Cultural specific design preference influence user's perception about system ease of use while using groupware application

b. User's perception about system usefulness (PU)

Previous studies on TAM demonstrated strong empirical support for a positive relationship between perceived ease of use and perceived usefulness [192]. The perceived usefulness for a groupware application is defined as the degree to which user believes that using groupware would enhance his/her daily work performance. This construct represents "the degree to which an individual believes that using a particular system would enhance his or her job performance" [193]. This suggests that designers/developers should be able to improve perceived usefulness by adding appropriate features and functional capabilities to the groupware application. The importance of this construct can be derived from Davis' TAM (1989), in which it is said that perceived usefulness affects attitude and behavior both directly and indirectly. When outcome of using a system is perceived to be valuable to the user, then the user will more like to accept the system. Davis (1989) showed that ease of use had a direct effect on perceived usefulness. As a result, the following hypotheses based on TAM-relationship are proposed:

H3: Perceive ease of use has a positive effect on the perceived usefulness of a groupware application

H4: User's perception on usefulness influence their attitude of satisfaction in using groupware

c. User's perception about system ease of use (PE)

User's perception about system ease of use represents "the degree to which an individual believes that using a particular system would be free of mental or physical effort" [78]. The perceived ease of use of the groupware application is defined as the degree to which the user believes that using groupware application will be free of effort. Designers and developers of groupware should be able to make the application easier to use by making it easier for users to invoke the functions. Ease of use may be defined culturally, for example, for users in the Arabic culture a right to left flow of information seems to be natural. As a result, the following hypotheses based on TAM-relationship are proposed:

H5: User's perception on ease of use influence their attitude of satisfaction in using groupware

d. Attitude of Satisfaction in using the groupware application

The TAM posits that perceived usefulness and perceived ease of use has a direct effect on attitudes towards using a new technology [82]. Attitude is the degree to which the user is interested in specific systems, which has a direct effect on the intention to use those specific systems in the future and the actual usage of the systems [194]. The attitude of satisfaction represents the degree to which a user's perceived personal needs and the need to perform specific tasks satisfactorily are met by a system [193], [195]. As a result, the following hypotheses based on TAM-relationship are proposed:

H6: User's attitudes of satisfaction in usefulness using groupware have a positive effect on the use of groupware

H7: User's attitudes of satisfaction in ease of use using groupware have a positive effect on the use of groupware

e. Anticipated system use behavior

When using a system, users' will respond to various ways to the actions of the system. The usage of the system is also affected by perceived ease of use and perceived usefulness [18], [196], [197]. As a result, the following hypotheses based on TAM-relationship are proposed:

H8: User's anticipated behavior or intention to use the application influence user's actual system usage of a groupware application

6.8.2.3 Research Method

A survey was developed to explore the TAM model across three different cultures, consisting of Indonesia, Malaysia and Germany. Data were collected by means of a five-page questionnaire (paper based and webbased). The survey instrument consisted of 39 items (Table 6.24) to assess seven constructs of the proposed research model (Figure 6.26). These items were self-created and some were adapted from previous studies [194], which then refined to make them specificly relevant to the present research. These seven constructs were measured on a six-point Likert scale ranging from (1) "strongly disagree" to (6) "strongly agree".

The questionnaire was designed to measure the following aspects:

1. Control variables: Control variables were assessed to evaluate potential extraneous influences. The control variables included demographic like age, gender, and nationality. More specific were asked about experience working in team and experience working in groupware application to support group work. Further variable include the name of company/institution to ensure that respondent are working in company or university, which is the main target subject.
2. Key research model constructs :
    a. Cultural specific preference to represent whether user would prefer to have a groupware designed in accordance to how culture might influence the interface design. How the user wants the application to look like and what features and functionality that the application should include.
    b. Beliefs about application usefulness - was measured by asking to what extent groupware application will be better in performing certain actions.
    c. Perception about application system ease of use - User perception about application system ease of use will be examined. The definition of "ease of use" differs from one person to another. It also differs from one culture to another. What is "easy" in one culture does not necessarily be the same by other. This will be measured by asking which type of interface design that user would preferably interact within a groupware application.
    d. User's attitude of satisfaction in using an application - Subjects will be asked how satisfied they would be in using culturally sensitive application. This is to examine the

degrees in which a user's personal needs and the need to perform specific tasks satisfactorily are met by a system [198].

e. Intention to use and actual system usage

Table 6.24 TAM items: perceived usefulness, ease of use, attitude, intention of use, and system usage in Study 1

Questions regarding "Cultural Specific Design Preference" (CP)
CP1 : I prefer computer software that has an interface adapted to my culture
CP2 : I find it important to have an interface that is adapted to my culture
CP3 : I refuse to use an application that has materials or features that is not suitable for my culture
Questions regarding "Perceived Usefulness" (PU)
PU1 : I prefer to use notepad or word applications for collaboration rather using the whiteboard facilities
PU2 : I prefer to use Powerpoint presentation during discussion to highlight pointers rather than a long documentation reports
PU3 : I find it important to see what my other teammates are working on
PU4 : I find it important to keep all of the history of all the previous work and keep track of all the changes done
PU5 : I would rather focus on a task than a personal relationship
PU6 : I would like to be notified when a new email / new files / chat messages comes
PU7 : I like to have an emotional awareness (mood indicator) of the other users reaction when I'm presenting a document / presentation (i.e. understand or not understand)
PU8 : I like to see a message pop up, when I did a mistake
PU9 : I like to see a message pop up, when the other users make a mistake
PU10 : I like to see users login and logout
PU11 : I prefer the bandwidth of the video conference can be adjusted (high/medium/low bandwidth)
PU12 : I find using a technology for producing work is more important than for establishing relationship
PU13 : I find it important that I perform well on the application when other people can see me working
PU14 : I get very upset when the application does something strange and I am uncertain of what to do next
Questions regarding "Ease of Use" (PE)
PE1 : I like empty spaces on the screen (i.e when I move my mouse to the sides, the toolbars will appear)
PE2 : It is easier for me to follow a template or assistance on how to use the application instead of trying to figure out by my own
PE3 : I want to have the settings adjustable and flexible to my preference
PE4 : It is easier for me to use audio only (without video)
PE5 : It is easier for me to use video only (with chat)
PE6 : I prefer to use both audio and video
PE7 : It is easier for me use the chat message than video/ audio
PE8 : I always read the user's manual
PE9 : I like to have the freedom to chose the layout / colors / size of my screen
PE10 : I do one thing at a time rather than many things at once
PE11 : I would like to have a distinction between the boss and the subordinate shown in the application (i.e the boss/project leader's has a bigger size of windows screen)
PE12 : If I found some problem when working with the application, I react to it seriously (contact administrator)
Questions regarding "Usefullness" influences "Attitude" of satisfaction (UA)
UA1 : I am more satisfied is I can run several features using only one application
UA2 : I am more satisfied if I can use a software that can display my native language
UA3 : I am more satisfied if I can record all my audio conversation / video conversation / chat conversation
UA4 : I am more satisfied if I can keep track on all the changes that has been done on the shared file
Questions regarding "Ease of Use" influences "Attitude" of satisfaction (EA)
EA1 : I prefer to use familiar software, than to use software that may have many features that I need but too complicated to use
EA2 : I am more satisfied if I can draw on a document like using a pen
EA3 : I am more satisfied if the system to be able to find it just by entering short key word when I lose a

file and cannot find it
Questions regarding user's attitude of satisfaction have a positive effect for users to use the groupware "Intention to use" (IU) IUI : I would most likely to use a groupware application for the following purpose (Group discussion/Producing reports/Weekly meetings/Negotiating tool/Non-business purpose)
Questions regarding "Intention to use" has a positive effect to "System Usage" SU1 : I refuse to use an application that has materials or features not suitable for my culture

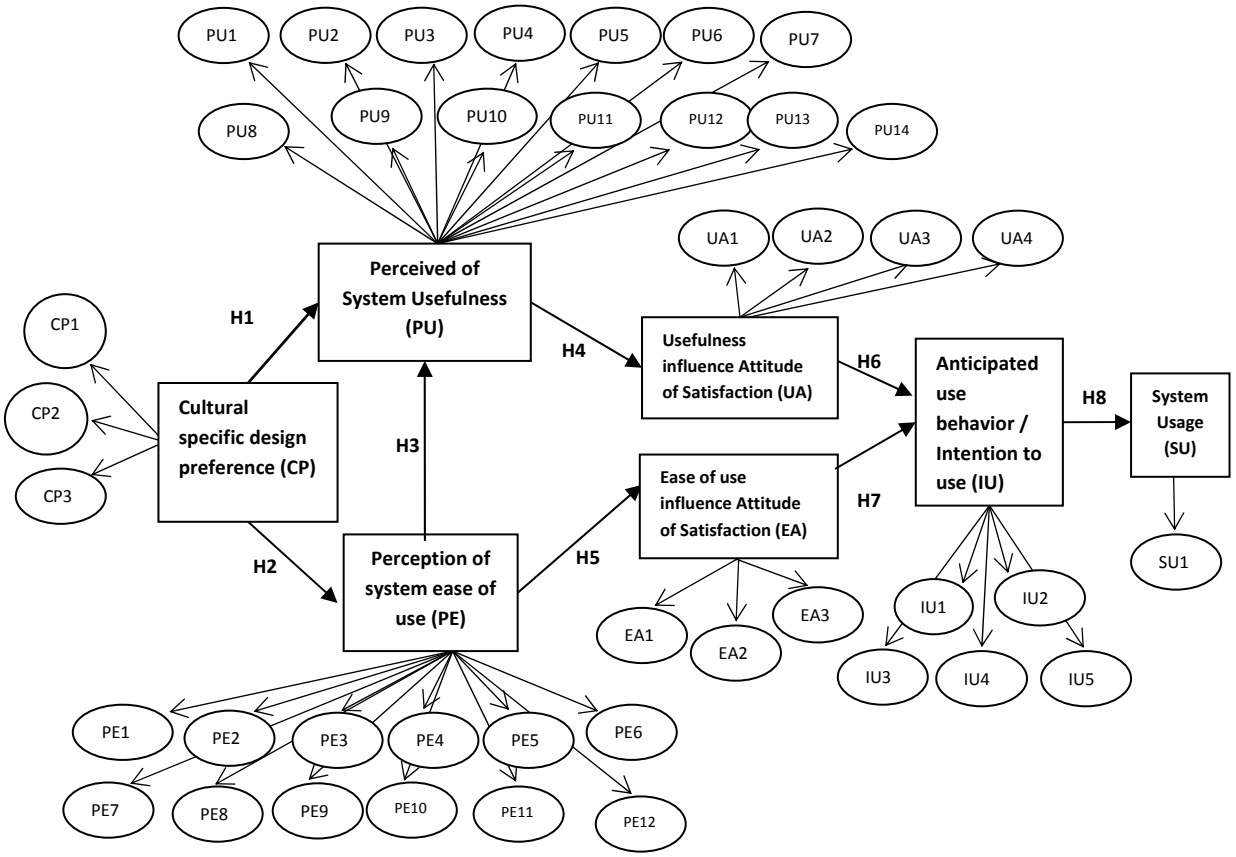


Figure 6.26 Research Model in Study 1

3. Cultural variables: The research was designed to assess the cultural factors of user's preference of a groupware design; selected cultural dimensions were examined to judge their impact on key constructs in the research model. This cultural factors impact user's perception of usefulness and perceived ease of use and will be asked through the questions in the PE and PU variable items. The list of cultural factors that are use can be seen in Table 6.25:

Tabel 6.25 Cultural Factors used in this study

Cultural Factor	Short Description	Question related
High-Low Context	The amount of information that is in a given communication	PU1: I prefer to use notepad or word applications for collaboration rather using the whiteboard facilities
		PU2: I prefer to use PowerPoint presentation during discussion to highlight pointers rather than a long documentation reports
		PE4: It is easier for me to use audio only (without video)
		PE5: It is easier for me to use video only (with chat)
		PE6: I prefer to use both audio and video
		PE7: It is easier for me use the chat message than video/ audio
Affective vs. Neutral	How important it is for user to perform well in front of others	PU3: I find it important to see what my other teammates are working on
		PU7: I like to have an emotional awareness (mood indicator) of the other users reaction when I'm presenting a document/ presentation (i.e. understand or not understand)
		PU8: I like to see a message pop up, when I did a mistake
		PU9: I like to see a message pop up, when the other users make a mistake
		PU13: I find it important that I perform well on the application when other people can see me working
Specific vs. Diffuse	Whether business and personal relationships are clearly separated	PU5: I would rather focus on a task than a personal relationship
		PU12: I find using a technology for producing work is more important than for establishing relationship
Uncertainty Avoidance (UA)	Whether uncertainty is perceived as threatening	PU6: I would like to be notified when a new email / new files / chat messages comes
		PU14: I get very upset when the application does something strange and I am uncertain of what to do next
		PE3: I want to have the settings adjustable and flexible to my preference
		PE8: I always read the user's manual
		PE9: I like to have the freedom to chose the layout / colors / size of my screen
		PE12: If I found some problem when working with the application, I react to it seriously (contact administrator)
Space	Different cultures require different amount of personal space	PE1: I like empty spaces on the screen (i.e when I move my mouse to the sides, the toolbars will appear)
Achievement vs. Ascription	Do we have to prove ourselves to receive status or is it given to us?	PE2: It is easier for me to follow a template or assistance on how to use the application instead of trying to figure out by my own
Time orientation	Do people do one thing	PE10: I do one thing at a time rather than many

	at a time or many things at once?	things at once
		UA1: I am more satisfied is I can run several features using only one application
Power Distance	How are relationships between people structured?	PE11: I would like to have a distinction between the boss and the subordinate shown in the application (i.e the boss/project leader's has a bigger size of windows screen)

6.8.2.4 Measurement Validation

Prior to the hypotheses testing, the measurement scales were examined in terms of the construct validity. In this study, construct validity and reliability were examined using SPSS v.16. Internal consistency was measured by applying the Cronbach's alpha test to each question in the constructs. In the social sciences, the index used to measure internal consistency reliability is the coefficient alpha [199]. Given that all constructs had items with Cronbach's alpha above 0.80, this exceed the minimum value of 0.70 recommended by Nunnally [200], therefore the measurement items possessed adequate reliability. The overall measures are reported in Table 6.26.

Table 6.26 Reliability Scale

Scale Items	**Cronbach's Alpha**
Cultural Preference (CP)	
CP1	0.894353
CP2	0.893892
CP3	0.895711
Perceived Usefulness (PU)	
PU1	0.896106
PU2	0.895815
PU3	0.895352
PU4	0.896208
PU5	0.896034
PU6	0.895572
PU7	0.896228
PU8	0.895465
PU9	0.895943
PU10	0.896914
PU11	0.895637
PU12	0.896897
PU13	0.895633
PU14	0.89656

Scale Items	**Cronbach's Alpha**
Ease of Use (PE)	
PE1	0.89577
PE2	0.894692
PE3	0.896249
PE4	0.897437
PE5	0.895317
PE6	0.894928
PE7	0.894954
PE8	0.894512
PE9	0.895213
PE10	0.89658
PE11	0.894863
PE12	0.896095
Usefullness influences Attitude of satisfaction (UA)	
UA1	0.896015
UA2	0.896361
UA3	0.894809
UA4	0.896077

Scale Items	**Cronbach's Alpha**
Ease of Use influences Attitude of satisfaction (EA)	
EA1	0.895007
EA2	0.895592
EA3	0.896449
Intention to use (IU)	
IU1	0.898474
System Usage (SU)	
SU1	0.895711
SU2	0.895865

6.8.2.5 Data analysis and Hypotheses Testing

The validity and reliability of the instrument has been established, the next step would be analyzing the data to determine how well the TAM model explained user's acceptance in the usage behavior of a groupware application to all countries sample and within each of the three countries sample. The collected data and the proposed structural model were analyses and examined using the Structural

Equation Modeling (SEM) approach. SEM is a comprehensive statistical approach to testing hypotheses about relations among the observed and latent variables [201]. SEM allows researchers to perform path analytic modeling with latent variables [202], which is also often referred to as a second-generation multivariate analysis technique [200] and has the ability to estimate a complete model incorporating both measurement and structural consideration [203]. The software package used in this study is AMOS 16.0 test the structural model using Newton-Raphson iterative method. AMOS is a covariance-based structural equation modeling tool similar to LISREL.

The data analysis was made to determine whether the differences between the three sample countries were significant. A minimum sample of 100 to 200 is considered adequate for structural equation modeling analysis [78]. The total collected data in this study is 599 respondents. Profile of respondents is described in Chapter 3.

The results indicate that each country was significantly different and revealed that cultural specific preference as one of the external factors in TAM model was significant in explaining usage behavior in both Indonesia and Malaysia, but not in Germany.

6.8.2.5.1 Measurement value for all sample (Indonesia, Malaysia and Germany)

The initial analysis was performed for all samples (Indonesia, Malaysia and Germany) to assess the measurement model. CMIN/degrees of freedom (D.F), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), comparative fit index (CFI), and root mean square residual (RMSR) were used to measure the model fitness. The model value is 5.255, which shows that the model is not at its maximal value but can still be tolerated. The model value described 72.6% of the sample with 0.726 GFI and after adjusting the total of sample and variable, the model can describe as much as 69.2% of sample with 0.692 AGIF. The RMSEA model value is 0.084 or ≈ 0.08, which is less than 0.1, therefore met the measurement model fitness. The c.r. value is 93.989 which is more than 2.5, this shows that the data is not normal multivariate distributed. According to Bollen (1989), estimation from Maximum Likelihood Estimation (MLE) method does not have to be normal multivariate distributed. The data is analyzed using 95% confidence level (alpha = 0,05). Most of the fitness measures were acceptable. The result of SEM is summarized in Table 6.27.

Table 6.27 Statistics of model fit measure

Model Fit Measure	Model value
CMIN/D.F	5.255
Goodness-of-fit index (GFI)	0.726
Adjusted GFI (AGFI)	0.692
Root mean square error of approximation (RMSEA)	0.084
Multivariate (kurtosis mardia c.r.)	93.989

The statistical significance for the construct “culture influence on specific preference” were examined and found that CP1 (0.794), CP2 (0.919), and CP3 (1) have positive relation with highly statistically significant p value (<0.001). This shows that for all sample countries, most users would prefer to have the groupware application to have a cultural influence on the interface design. This is supported by the positive relations constructed by the questions asked regarding the importance to have an interface that is adapted to their culture and whether they would refuse to use an application that has materials or

features that is not suitable for their culture. Therefore it can be concluded that user prefer to have the groupware interface adapted to their culture.

Perceived of System Usefulness (PU) is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" [78]. The measurement construct of "Perceived of system usefulness" were examined through the variable items (PU1 – PU14). The statistical significance were examined and found that all PU (1-14) have positive relation with highly statistically significant p value (<0.001), except for PU12 with significant p value of 0.017. This shows that for all sample countries, usefulness has high significance with the features or facilities included in the groupware application. Such examples of features and facilities to be included in the groupware are word application, power point presentation, notification alerts, and awareness (of what the other users are doing as well as emotional awareness).

Perceived Ease of Use (PE) is defined to as "the degree to which a person believes that using a particular system would be free of effort" [78].The measurement construct of "Perception of system ease of use" were examined through the following variable item (PE1 – PE 12). The statistical significance were examined and found that all PE (1-12) have positive relation with highly statistically significant p value (<0.001), except for PE9 with significant p value of 0.003. This shows that for all sample countries, ease of use has high significance with the easiness to perform certain task or functionalities. Such examples are having the setting adjustable and flexible to user's preference, having the option to use the output devices (audio/video) or chat, having the option to perform multitasking.

Attitude of Satisfaction is defined as the individual user's positive or negative feelings (evaluative affect) about performing the target behavior [107]. The measurement constructs of "usefulness influence attitude of satisfaction" and "ease of use influence attitude of satisfaction" were examined through the following variable item (UA1 – UA4) and (EA1 – EA3). The statistical significance were examined and found that all UA (1-4) and all EA (1-3) have positive relation with highly statistically significant p value (<0.001). This shows that for all sample countries, user's satisfaction is influence significantly by an application usefulness and ease of use. Such examples of an application that satisfied user's preference is when the application can run several features, display their native language, record conversations (audio, video and chat), and the ability to track changes on a shared file. Examples on how user's may be satisfied on the ease of use of an application is when the application is familiar to use and the ability to find a lost file just by entering short key words.

The measurement construct of "intention to use" and "system usage" were examined through the following variable item IU and SU. The statistical significance were examined and found that all IU and SU have positive relation with highly statistically significant p value (<0.001). This shows that for all sample countries, the variable items asked in IU and SU shows positive significant relation. IU was asked in regards to the purpose of using a groupware application, whether it is for group discussion, producing reports, weekly meetings, negotiating tools or non-business purpose. System usage was asked whether or not culture plays a role in the actual usage of the groupware. Variable item properties that construct the measurement model are shown in Table 6.28.

Table 6.28 Variable item properties of the measurement model

Variable Item	Measurement model	Significant Value (P)
CP1	0.794	<0.001
CP2	0.919	<0.001
CP3	1	<0.001
PU1	1	<0.001
PU2	1.728	<0.001
PU3	1.855	<0.001
PU4	1.891	<0.001
PU5	1.724	<0.001
PU6	2.05	<0.001
PU7	1.332	<0.001
PU8	1.881	<0.001
PU9	1.43	<0.001
PU10	1.329	<0.001
PU11	1.714	<0.001
PU12	0.647	0.017
PU13	1.403	<0.001
PU14	1.498	<0.001

Variable Item	Measurement model	Significant Value (P)
PE1	1	<0.001
PE2	1.66	<0.001
PE3	1.126	<0.001
PE4	1.909	<0.001
PE5	2.121	<0.001
PE6	1.821	<0.001
PE7	2.009	<0.001
PE8	1.584	<0.001
PE9	0.466	0.003
PE10	1.397	<0.001
PE11	2	<0.001
PE12	1.188	<0.001
UA1	1	<0.001
UA2	0.859	<0.001
UA3	1.329	<0.001
UA4	1.015	<0.001
EA1	1.7	<0.001
EA2	1.451	<0.001
EA3	1.297	<0.001
IU1	1	<0.001
SU1	1	<0.001

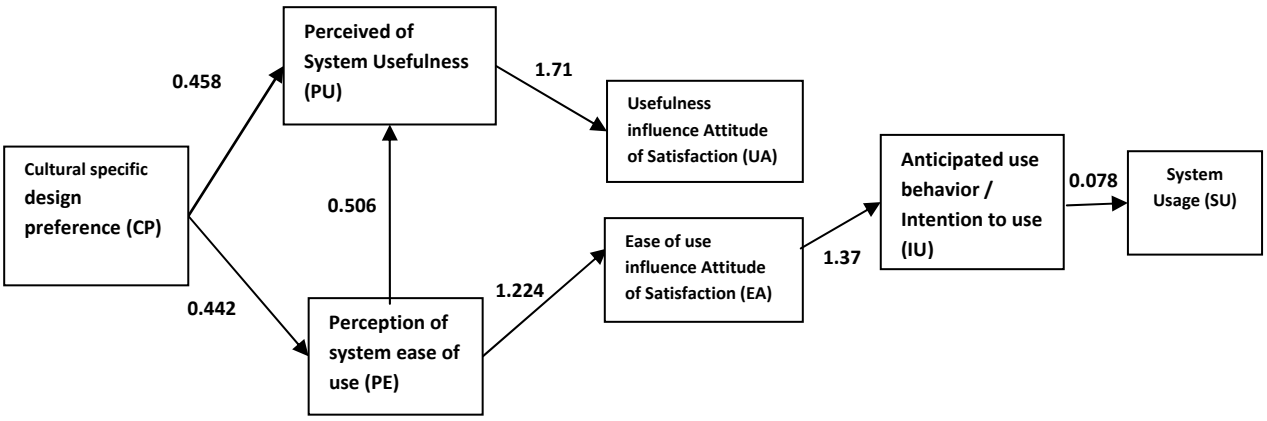


Figure 6.27 Significant relation results for all countries model

The entire model presents a good fit, which mean the collected data matches the research model. Figure 6.27 shows the causal relationship. The statistical significance were examined and found that cultural influence on specific design preference influence user's perception of system usefulness positive relation (0.458) and highly statistically significant p value (<0.001) or (β=0.458, P<0.001), hypothesis H1 was therefore supported. Cultural influence on specific design preference influences user's perception of the system ease of use (β=0.442, P<0.001), therefore hypothesis H2 is also supported. User's perception of system usefulness has a positive effect on user's perception of ease of use (β=0.506, P<0.001), therefore H3 is supported. User's belief of usefulness influence user's attitude of satisfaction in using groupware (β=1.71, P<0.001), therefore H4 is supported. User's belief on ease of user influence user's attitude of satisfaction in using groupware (β=1.224, P<0.001), therefore H5 is supported. User's attitude of satisfaction in usefulness in using groupware did not give a positive

effect on the use of groupware (β=-0.409, P= 0.42), therefore H6 is not supported. User's attitude of satisfaction in ease of use using groupware have a positive effect on the use of groupware (β=1.37, P<0.05), therefore H7 is supported. User's anticipated behavior or intention to use the application influence user's actual system usage (β=0.078, P<0.07), therefore H8 is supported. All hypotheses, H1 until H8, with an exception of H6, are fully supported. Table 6.29 describes the measurement model value.

Table 6.29 Measurement model for all countries

Causal relationship	Measurement model	Significant value
CP – PU	0.458	<0.001
CP – PE	0.442	<0.001
PE – PU	0.506	<0.001
PU – UA	1.71	<0.001
PE – EA	1.224	<0.001
UA – IU	-0.409	0,42
EA – IU	1.37	0.042
IU – SU	0.078	0.072

6.8.2.5.2 Measurement value for Indonesia sample

The data analysis was performed for only respondents from Indonesia to assess the measurement model for Indonesian users. The model value is 4.879, which shows that the model overall shows good result. This shows that the validity of the model can be trusted. The model value described 78.1% of the sample with 0.781 GFI and after adjusting the total of sample and variable, the model can describe as much as 70.1% of sample with 0.701 AGIF. The RMSEA model value is 0.124, which is less than 0.08 therefore met the measurement model fitness. The c.r. value is 22.361 which is less than 2.5, this shows that the data is not normal multivariate distributed. According to Bollen (1989), estimation form MLE method does not have to be normal multivariate distributed. The data is analyzed using 95% confidence level (alpha = 0.05). Most of the fitness measures were acceptable. The result of SEM is summarized in Table 6.30.

Table 6.30 Statistics of model fit measure for Indonesia

Model Fit Measure	Model value
CMIN/D.F	4.879
Goodness-of-fit index (GFI)	0.781
Adjusted GFI (AGFI)	0.701
Root mean square error of approximation (RMSEA)	0.124
Multivariate (kurtosis mardia c.r.)	22.361

The statistical significance for the construct "cultural influence on specific preference" were examined and found that CP1 (1) and CP2 (0.839) have positive relation with highly statistically significant p value <0.001 and 0.039, while CP3 (-1.812) has a negative relation with p value 0.009. This shows that for Indonesian sample, most users would prefer to have the groupware application with cultural influence on the interface design. This is supported by the positive relations constructed by the

questions asked regarding the importance to have an interface that is adapted to their culture, therefore it can be concluded that user prefer to have the groupware interface adapted to their culture. CP3 shows negative relation, which indicate that an application that is not suitable for Indonesian culture does not have any influence toward user's preference on the interface design. Variable item properties of the Indonesian measurement model are shown in Table 6.31.

The measurement construct of "Perceived of system usefulness" in Indonesian model were examined through the variable items (PU1 – PU14), but not all showed significant relation. Only those that show significant relation are shown in Fig. 4.18 and Table 4.27. The statistical significance were examined and found that PU1, PU2, PU4, PU6, and PU 13 have positive relation with highly statistically significant p value <0.001, 0.005 and 0.05, while PU7, PU9, PU10, PU12, and PU14 shows negative relation with significant p value >0.001. This shows that for Indonesian users, usefulness has high significance with only selected features or facilities to be included in the groupware application. Such examples of features and facilities to be included in the groupware are word application, power point presentation, notification alerts, and awareness (of what the other users are doing). Meanwhile, features such as emotional awareness or mood indicator and message alert when other users make a mistake shows negative relation. This shows that such features hold no role in determining whether the application is useful or not.

The measurement construct of "usefulness influence attitude of satisfaction" were examined through the following variable items (UA1 – UA4). The statistical significance were examined and found that all UA1, UA3, and UA4 have positive relation with statistically significant p value <0.001, 0.041, and 0.04 consecutively. This shows that for the Indonesia users, user's satisfaction is influence significantly by application usefulness. Such examples of an application that satisfied user's preference are if the application can run several features; display their native language, and the ability to track changes on a shared file. The option to record previous conversation (audio/video/chat) did not shows positive relation in users' satisfaction. Perceived of ease of use did not have any influence toward satisfaction in using a groupware application.

The measurement construct of "intention to use" and "system usage" were examined through the following variable item IU and SU. The statistical significance were examined and found that all IU and SU have positive relation with highly statistically significant p value (<0.001). This shows that for Indonesian sample, the variable items asked in IU and SU shows positive significant relation. IU was asked in regards to the purpose of using a groupware application, whether it is for group discussion, producing reports, weekly meetings, negotiating tools or non-business purpose. System usage was asked whether or not culture plays a role in the actual usage of the groupware.

Table 6.31 Variable item properties of the Indonesian model

Variable Item	Measurement model	Significant Value (P)
CP1	1	<0.001
CP2	0.839	0.039
CP3	-1.812	0.009
PU1	1	<0.001
PU2	0.837	<0.001
PU4	0.741	0.001
PU6	0.541	0.005
PU7	-1.347	<0.001

PU9	-1.84	<0.001
PU10	-1.929	<0.001
PU12	-1.533	<0.001
PU13	0.4	0.05
PU14	-1.871	<0.001
UA1	1	<0.001
UA2	-3.002	0.041
UA3	-2.98	0.04
IU1	1	<0.001
SU1	1	<0.001

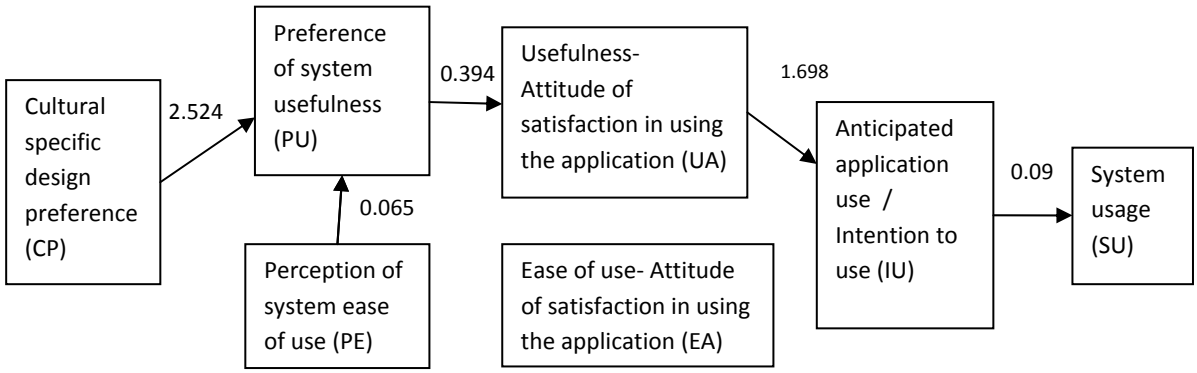


Figure 6.28 Significant relation results for Indonesian model

The entire model presents several data results did not completely match the research model. The causal relationship of each construct is shown in Figure 6.28. The statistical significance were examined and found that cultural influence on specific design preference influence user's perception of system usefulness (β=2.524, P=0.003), hypothesis H1 was therefore supported. Cultural influence on specific design preference influences user's perception of the system ease of use (β=0.043, P=0.893), therefore hypothesis H2 is not supported. User's perception of system usefulness has a positive effect on user's perception of ease of use (β=0.065, P< 0.05), therefore H3 is supported. User's belief of usefulness influence user's attitude of satisfaction in using groupware (β=0.394, P<0.05), therefore H4 is supported. User's belief on ease of user influence user's attitude of satisfaction in using groupware (β=0.075), therefore H5 is not supported. User's attitude of satisfaction in usefulness in using groupware give a positive effect on the use of groupware (β=1.689, P=0.095), therefore H6 is supported. User's attitude of satisfaction in ease of use using groupware did not have a positive effect on the use of groupware (β=0.2), therefore H7 is not supported. User's anticipated behavior or intention to use the application influence user's actual system usage (β=0.09, P=0.046), therefore H8 is supported. Table 6.32 describes the measurement model value of the significant relation only.

Table 6.32 Measurement model for Indonesia

Causal Relationship	Measurement model	Significant value
CP – PU	2.524	0.003
PE – PU	0.065	0.05
PU – UA	0.394	0,05
UA – IU	1.698	0.095
IU – SU	0.09	0.046

6.8.2.5.3 Measurement value for Malaysia sample

The data analysis was performed for respondent from Malaysia to assess the measurement model for Malaysian user. The model value is 3.216, which shows that the model overall shows good result. This shows that the validity of the model can be trusted. The model value described 68.4% of the sample with 0.684 GFI and after adjusting the total of sample and variable, the model can describe as much as 64.1% of sample with 0.641 AGIF. The RMSEA model value is 0.092, which is less than 0.08 therefore met the measurement model fitness. The c.r. value is 62.452 which is more than 2.5, this shows that the data is not normal multivariate distributed. According to Bollen (1989), estimation form MLE method does not have to be normal multivariate distributed. The data is analyzed using 95% confidence level (alpha = 0.05). Most of the fitness measures were acceptable. The result of SEM is summarized in Table 6.33.

Table 6.33 Statistics of model fit measure for Malaysia model

Model Fit Measure	Model value
CMIN/D.F	3.216
Goodness-of-fit index (GFI)	0.684
Adjusted GFI (AGFI)	0.641
Root mean square error of approximation (RMSEA)	0.092
Multivariate (kurtosis mardia c.r.)	62.452

The statistical significance were examined and found that all three CP have high positive relation, with CP1 (0.988), CP2 (1.008), CP3 (1) and highly statistically significant p value <0.001. This shows that for Malaysian sample, most users would prefer to have the groupware application to have a cultural influence on the interface design. This is supported by the positive relation constructed by the questions asked regarding the importance to have an interface that is adapted to their culture, therefore it can be concluded that user prefer to have the groupware interface adapted to their culture, including most likely user would refuse to use an application that is not suitable for the Malaysian culture. Variable item properties of the Malaysian measurement model are shown in Table 6.34.

The measurement construct of "perceived of system usefulness" were examined through the variable items (PU1 – PU14). The statistical significance were examined and found that all PU (1-14) have positive relation with highly statistically significant p value (<0.001), except for PU2 shows no significant relation, therefore not shown. This indicates that for Malaysian user, usefulness has high significance with the features or facilities included in the groupware application. Such examples of features and facilities to be included in the groupware are word application, power point presentation, notification alerts, and awareness (of what the other users are doing as well as emotional awareness).

The measurement construct of "Perception of system ease of use" were examined through the following variable item (PE1 – PE 12). The statistical significance were examined and found that all PE (1-12) have positive relation with highly statistically significant p value (<0.001), except for PE9 which shows negative relation. This indicates that for Malaysian user, ease of use has high significance with the easiness to perform certain task or functionalities. Such examples are having the setting adjustable and flexible to user's preference, having the option to use the output devices (audio/video) or chat, having the option to perform multitasking.

The measurement constructs of "usefulness influence attitude of satisfaction" and "ease of use influence attitude of satisfaction" were examined through the following variable item (UA1 – UA4) and (EA1 – EA3). The statistical significance were examined and found that all UA (1-4) and all EA (1-3) have positive relation with highly statistically significant p value (<0.001). This shows that for Malaysian users, user's satisfaction is influence significantly by an application usefulness and ease of use. Such examples of an application that satisfied user's preference are if the application can run several features, display their native language, record conversations (audio, video and chat), and the ability to track changes on a shared file. Examples on how user's may be satisfied on the ease of use of an application is when the application is familiar to use and the ability to find a lost file just by entering short key words.

The measurement construct of "intention to use" and "system usage" were examined through the following variable item IU and SU. The statistical significance were examined and found that all IU and SU have positive relation with highly statistically significant p value (<0.001). This shows that for Malaysian sample, the variable items asked in IU and SU shows positive significant relation. IU was asked in regards to the purpose of using a groupware application, whether it is for group discussion, producing reports, weekly meetings, negotiating tools or non-business purpose. System usage was asked whether or not culture plays a role in the actual usage of the groupware.

Table 6.34 Variable item properties of the Malaysian measurement model

Variable Item	Measurement model	Significant Value (P)
CP1	0.988	<0.001
CP2	1.008	<0.001
CP3	1	<0.001
PU1	0.938	<0.001
PU2	0.91	<0.001
PU3	0.874	<0.001
PU4	0.701	<0.001
PU5	0.951	<0.001
PU6	1	<0.001
PU7	0.822	<0.001
PU8	0.711	<0.001
PU9	1.045	<0.001
PU10	0.951	<0.001
PU11	0.469	0,001
PU12	1.016	<0.001
PU13	1.09	<0.001

Variable Item	Measurement model	Significant Value (P)
PE1	1	<0.001
PE2	0.796	<0.001
PE3	0.795	<0.001
PE4	1.605	<0.001
PE5	0.906	<0.001
PE6	1.197	<0.001
PE7	1.395	<0.001
PE8	0.676	0,002
PE10	1.281	<0.001
PE11	1.259	<0.001
PE12	0.835	<0.001
UA1	1	<0.001
UA2	0.996	<0.001
UA3	0.908	<0.001
UA4	0.916	<0.001
EA1	1.575	<0.001
EA2	1.339	<0.001
EA3	1.483	<0.001
IU1	1	<0.001
SU1	1	<0.001

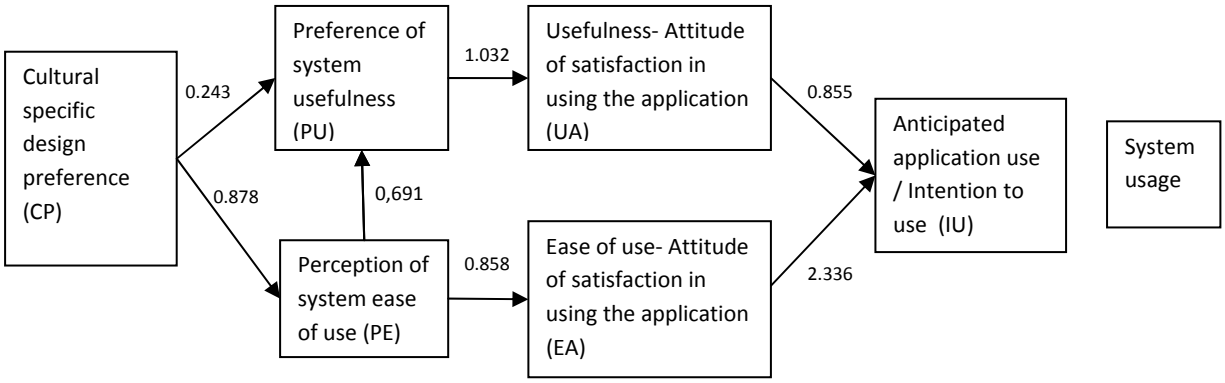


Figure 6.29 Significant relation results for Malaysian model

The entire model presents a good fit, which mean the collected data matches the research model. Figure 6.29 shows the causal relationship. The statistical significance were examined and found that cultural influence did show significance between specific design preference and user's perception of system usefulness (β=0.243, P=0.115), hypothesis H1 was therefore supported. Cultural influence on specific design preference influences user's perception of the system ease of use (β=0.878, P<0.001), therefore hypothesis H2 is supported. User's perception of system usefulness has a positive effect on user's perception of ease of use (β=0.649, P<0.05), therefore H3 is supported. User's belief of usefulness influence user's attitude of satisfaction in using groupware (β=1.032, P<0.001), therefore H4 is supported. User's belief on ease of user influence user's attitude of satisfaction in using groupware (β=0.858, P<0.001), therefore H5 is supported. User's attitude of satisfaction in usefulness in using groupware give a positive effect on the use of groupware (β=0.855, P= 0.114), therefore H6 is supported. User's attitude of satisfaction in ease of use using groupware have a positive effect on the use of groupware (β=2.336, P=0.013), therefore H7 is supported. User's anticipated behavior or intention to use the application did not show any significance on user's actual system usage (β=0.046, P=0.356), therefore H8 is not supported. Table 6.35 describes the measurement model value of the significant relation only.

Table 6.35 Measurement model for Malaysia

Causal Relationship	Measurement model	Significant value
CP – PU	0,243	0,115
CP – PE	0,878	<0.001
PE – PU	0,691	<0.001
PU – UA	1,032	<0.001
PE – EA	0,858	<0.001
UA – IU	-0,855	0,114
EA – IU	2,336	0,013

6.8.2.5.4 Measurement value for German sample

The data analysis was performed for the users from Germany to assess the measurement model for the German respondents. The model value is 2.634, which shows that the model overall shows good result. This shows that the validity of the model can be trusted. The model value described 83.0% of the sample with 0.83 GFI and after adjusting the total of sample and variable, the model can describe as much as 73.9% of sample with 0.739 AGIF. The RMSEA model value is 0.128, which is more than 0.08 therefore met the measurement model fitness. The c.r. value is 3.606 which is more than 2.5, this shows that the data is not normal multivariate distributed. According to Bollen (1989), estimation form MLE method does not have to be normal multivariate distributed. The data is analyzed using 95% confidence level (alpha = 0.05). Most of the fitness measures were acceptable. The result of SEM is summarized in Table 6.36.

Table 6.36 Statistics of model fit measure for German model

Model Fit Measure	Model value
CMIN/D.F	2.634
Goodness-of-fit index (GFI)	0.83
Adjusted GFI (AGFI)	0.739
Root mean square error of approximation (RMSEA)	0.128
Multivariate (kurtosis mardia c.r.)	3.606

The statistical significance for the constructs "cultural influence on specific preference" were examined and found that CP1 (0.363), CP2 (0.672), and CP3 (1) have positive relation with highly statistically significant p value (<0.001). This shows that for Germany's model, positive relations were constructed by the questions asked regarding the importance to have an interface that is adapted to their culture and whether they would refuse to use an application that has materials or features that is not suitable for their culture. Variable items properties of the German measurement model are shown in Table 4.33.

The measurement construct of "perception of system ease of use" were examined through the following variable items (PE1 – PE 12). The statistical significance were examined and found that only PE7 (2.879) and PE10 (1) have positive relation with statistically significant p value 0.005 and <0.001, P4 also shows positive relation but with not too strong significant p value of 0.022. This shows that for German users, the construct ease of use is formed by only the easiness to perform certain task or functionalities, such as the use of audio, chat message and having the option to perform multitasking. Results show that P9 has a relation toward user's perception of ease of use but negatively. This represents the question asked regarding the freedom to choose the layout/color/size of user's screen, negative relation show that user's ability to change the layout/color/size of the screen has a negative effect toward the easiness of a system.

The measurement construct of "usefulness influence attitude of satisfaction" and "ease of use influence attitude of satisfaction" were examined through the following variable item (UA1 – UA4) and (EA1-EA3). The statistical significance were examined and found that all UA (1-4) positive relation with highly statistically significant p value (<0.005) and only EA3 has a positive relation with highly statistically significant p value (<0.001). This shows that for German sample, user's satisfaction is influence significantly mostly by an application usability rather than its ease of use. Such examples of an application that satisfied user's preference are if the application can run several features, display

their native language, record conversations (audio, video and chat), and the ability to track changes on a shared file. Examples on how user's may be satisfied on the ease of use of an application is when the application is familiar to use and the ability to find a lost file just by entering short key words.

The measurement construct of "intention to use" and "system usage" were examined through the following variable item IU and SU. The statistical significance were examined and found that all IU and SU have positive relation with highly statistically significant p value (<0.001). This shows that for German sample, the variable items asked in IU and SU shows positive significant relation. IU was asked in regards to the purpose of using a groupware application, whether it is for group discussion, producing reports, weekly meetings, negotiating tools or non-business purpose. System usage was asked whether or not culture plays a role in the actual usage of the groupware.

Table 6.37 Variable item properties of the German measurement model

Variable Item	Measurement model	Significant Value (P)
CP1	0.363	<0.001
CP2	0.672	<0.001
CP3	1	<0.001
PE4	1.281	0.022
PE7	2.879	0.005
PE9	-2.636	0.004
PE10	1	<0.001
UA1	1	<0.001
UA2	1.024	0.003
UA3	0.935	0.005
UA4	1.258	0.002
EA3	1	<0.001
IU1	1	<0.001
SU1	1	<0.001

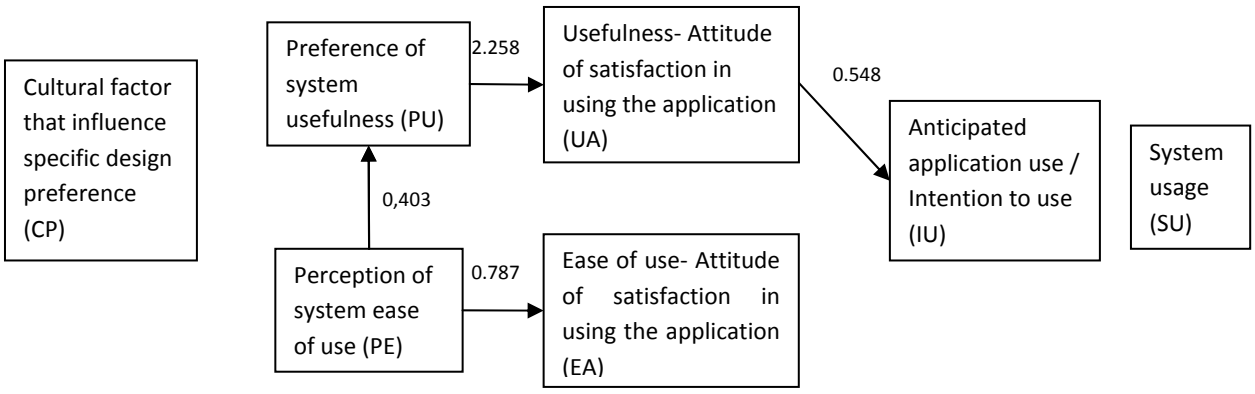


Figure 6.30 Significant relation results for Germany

The entire model presents a good fit, but did not exactly matches the entire research model. Figure 6.30 shows the causal relationship. The statistical significance were examined and found no significance between cultural influence on specific design preference influence user's perception of system usefulness (β=-0.001, P=0.99), hypothesis H1 was therefore not supported. Cultural influence

on specific design preference shows no significance with user's perception of the system ease of use (β=0.082, P=0.281), therefore hypothesis H2 is also not supported. User's perception of system usefulness has a positive effect on user's perception of ease of use (β=0.403, P= 0,007), therefore H3 is supported. User's belief of usefulness influence user's attitude of satisfaction in using groupware (β=2.258, P=0.089), therefore H4 is supported. User's belief on ease of user influence user's attitude of satisfaction in using groupware (β=0.787, P=0.104), therefore H5 is supported. User's attitude of satisfaction in usefulness in using groupware give a positive effect on the use of groupware (β=0.548, P= 0.137), therefore H6 is supported. User's attitude of satisfaction in ease of use using groupware does not have a positive effect on the use of groupware (β=-0.13, P=0.86), therefore H7 is not supported. User's anticipated behavior or intention to use the application shows no significant to user's actual system usage (β=-0.051, P=0.6), therefore H8 is not supported. Table 6.38 describes the measurement model value of the significant relation only.

Table 6.38 Measurement model for Germany

Causal relationship	Measurement model	Significant value
PE – PU	0.403	0,007
PU – UA	2.258	0,089
PE – EA	0.787	0,104
UA – IU	0.548	0,137

6.8.2.6 Summary of Result

The findings of this study suggest that cultural influence play an important role in determining the acceptance and usage behavior in adapting new groupware technologies. The result of this empirical study validates the proposed research model and hypotheses, and demonstrates that the hypotheses can be supported. Cultural specific design preference influences user's preference of system usefulness and user's perception of system ease of use. When users get greater satisfaction with culturally design interface system (e.g., it is interesting, not too hard, and meets the needs of users at different levels), the stronger their feelings about its usefulness and ease of use. In term of ease of use, it is when the system design is developed in a more culture-friendly form, users will feel more comfortable and find the system familiar and easier to use.

The result of the study finds strong support for the use of a modified TAM in groupware usage for multicultural users. The data showed that culturally adapted interface has a significant direct effect on perceived ease of use and usefulness, while perceived ease of use and usefulness are the dominant factor affecting the attitude of users using groupware application. The result indicates the importance of perceived ease of use and perceived usefulness in mediating the relationship of users' preference with attitude and groupware application usage. Culturally specific design preference related significantly with system usefulness (H1). The relation seems to be strongest for the Indonesian users. There are significant relation between system usefulness and ease of use (H3) and significant relations between system usefulness and attitude of satisfaction (H4), but there are significant relation between ease of use influence attitude of satisfaction and intention to use (H7). There are also significant relation between intention to use and system usage (H8).

In the Malaysian model, culturally specific designed preference relate significantly to both, perception of system usefulness (H1) and system ease of use (H2). Significant relation can also be seen between system usefulness and ease of use (H3). Significant relation was also found between system usefulness and attitude of satisfaction (H4), as well as between ease of use and attitude of satisfaction (H5). Significant relation can also be found between usefulness in influencing user's attitude of satisfaction (H6) and ease of use in influencing attitude of satisfaction (H7) which then leads to user's intention of use. However, there is no significant relation between anticipated application use behavior and system usage (H8).

A different path of model was found as the result for the German users, whereas it turns out that culturally specific design preferences did not relate significantly with system usefulness (H1) and system ease of use (H2). However, there are significant relation between system usefulness and ease of use (H3) and significant relations between system usefulness and attitude of satisfaction (H4), as well as between ease of use and attitude of satisfaction (H5). Only significant relation between usefulness influence attitude of satisfaction and intention of use (H6) was found. No significant relation between ease of use influence attitude of satisfaction and intention to use (H7) and no significant relation between intention to use and system usage (H8) was obtained from the executed model.

When the total population of countries' sample is combined, the result achieved is the most optimal model; this proved that cultural factors influence the acceptance of groupware application. Culturally specific design preferences relate significantly with system usefulness (H1) and system ease of use for the total sample (H2). Significant correlation was found between system usefulness and ease of use (H3). Significant relations between system usefulness and attitude of satisfaction (H4), as well as between ease of use and attitude of satisfaction (H5) also was found. However, there is no significant relation between usefulness influence attitude of satisfaction and intention of use (H6) and between intention to use and system usage (H8), but there are significant relation between ease of use influence attitude of satisfaction and intention to use (H7). The summary of the hypotheses' result is shown in Table 6.39.

Table 6.39 Summary for all countries sample

Hypothesis	**Result (supported / not supported)**			
	Total Sample	**Indonesia**	**Malaysia**	**Germany**
H1 : Cultural specific design preference influence user's perception on system usefulness while using groupware application	Supported	Supported	Supported	Not supported
H2 : Cultural specific design preference influence user's perception about system ease of use while using groupware application	Supported	Not supported	Supported	Not supported
H3 : Perceive ease of use has a positive effect on the perceived usefulness	Supported	Supported	Supported	Supported
H4: User's belief on usefulness influence their attitude of satisfaction in using groupware	Supported	Supported	Supported	Supported
H5: User's belief on ease of use influence their attitude of satisfaction in using groupware	Supported	Not Supported	Supported	Supported
H6: User's attitude of satisfaction in usefulness using groupware have a positive	Not supported	Supported	Supported	Supported

effect on the use of groupware				
H7: User's attitude of satisfaction in ease of use using groupware have a positive effect on the use of groupware	Supported	Not Supported	Supported	Supported
H8: User's anticipated behavior or intention to use the application influence user's actual system usage	Supported	Supported	Not supported	Not supported

6.8.2.7 Conclusion

Study 1 show that TAM provides explanation for groupware adoption and usage in all three countries studied, although with less effect for Germany. Relationships among primary TAM constructs found in this research are largely consistent with those typical in previous TAM research. The only finding in this research that is inconsistent with previous TAM research concerns the perceived usefulness and how it affects users' satisfaction in using the application. The impact of usefulness in user's attitude of satisfaction on user's anticipated application use behavior is not as strong as that of user's belief on ease of use in user's attitude of satisfaction in using groupware. It shows that user's would be more intended to use a system that is easy to use rather that useful but complicated to use, especially since modern applications are becoming more and more sophisticated. The differences found in each culture can be concluded that culture does play an important role in determining users' preference in working with groupware applications.

6.8.3 Part 2: Selected Cultural Dimension Influences User's Intention to Use Groupware

6.8.3.1 Motivation and Objective of the Study

This study will propose TAM to be broadened by incorporating selected cultural dimensions that extend the variables originated by Davis (1989). These cultural dimensions will then develop theoretical arguments in order to demonstrate how TAM can be use to demonstrate user's preference toward the usage and the acceptance of a groupware application [181]. The purpose of this study is to devise a TAM model that includes cultural dimension which explains in more detail the influence of cultural factors on user's acceptance behaviour of a groupware application. TAM tends to predict user adoption of new technologies in positive perspective. A theoretical model is proposed by extending TAM with four cultural dimensions as the external variables. Users will have the tendency to use a system or application if it is designed accordingly to their needs and their preference of usage. It is believed that the feedback information provided by users will be critical to develop and design a synchronous groupware application in order to meet users' demand.

6.8.3.2 Cultural dimension used in this Study

Cultural dimensions model attempt to measure and compare different cultures, with the use of cultural factors. Each dimension is authored by social scientist that has researched and written extensively on his model. In this study, Hofstede's cultural dimension is used to demonstrate how it affect user's acceptance using groupware by implementing TAM. Hofstede defined culture as a set of shared assumptions that result in a common frame of reference by members of a society or more simply as 'mental software' [107], [204]. Hofstede's cultural dimension is often used since he successfully linked his dimensions of culture to managerial practices [205]. Three out of five Hofstede's dimension

is used in this study, which are: power distance, uncertainty avoidance, and collectivism vs. individualism. Another cultural dimension used in from Edward T. Hall, namely the High – Low Context. Cultural factors used in Study 2 are provided in Table 6.40.

Table 6.40 Cultural factors used in Part 2

Cultural factor	Description
Individualism vs. Collectivism	Described the extent to which people of a country see themselves as individualist or as an integral part of a social group (collectivist)
Uncertainty avoidance	Described the extent to which people of a country shows feeling of uneasy or threatened by situations that are uncertain or ambiguous
Power distance	Described the extent to which people of a country accept unequal distribution of power, such as between senior managers and lower-rank workers.
Low vs. High Context Communication	Differentiates cultures on the basis of the communication that predominates in the culture

Several reasons that leads to investigate user's preference through these four factors are: (1) these four factors rely on the variables that are more directly linked to the social and organizational process, that focus on human values; (2) the three factors (Collectivism vs. Individualism, UA, PD) used are taken from Hofstede's cultural dimensions, since Hofstede's work has become the standard against which new work on cultural differences is validated; (3) the fourth factor, Low- and High-context, cross cultural studies of styles of communication reveal a divergence between the societies in several aspects of communication and provide evidence sustaining Hall contention.

6.8.3.3 Research model and hypothesis

Each items of the cultural factors, will try to show how culture influence variables in the implementation process that affect perceived usefulness, perceived ease of use and attitudes toward groupware usage. Explaining the influence of culture in this was will lead to two main benefits. First, it will suggest how the implementation process can be tailored in order to take account of the cultural differences between users from different culture. Second, this modified version of TAM model highlights the unique effects of each cultural factor, which later define a set of hypothesized relationships that will be examined in this research. The effect of culture on groupware acceptance can be described as a linkage between specific patterns of belief, implementation issues and attitude toward the acceptance of the system.

This research uses the modified technology acceptance model that has been proposed by [206], consist of:

a. *Cultural factor* - consist of the selected cultural dimension that will be use to test user preferences. It represent how the user wants the application to look like and what features and functionality that the application should include.
b. *Beliefs about application usefulness* - to examine "the degree to which an individual believes that using a particular system would enhance his or her job on performance" [206].

c. *Perception about application system ease of use* - user perception about application system ease of use to examine "the degree to which an individual believes that using a particular system would be free of mental or physical effort" [108].
d. *User's attitude of satisfaction in using an application* - to examine the degree in which user's personal needs as well as the need to perform specific tasks satisfactorily are met by a system.

6.8.3.3.1 High – Low Context (HLC)

The dimension of High – Low context was firstly introduced by Edward T. Hall [108]. A high-context communication or message is one in which "most of the information is either in the physical context or internalized in the person, while very little is in the coded, explicit, transmitted part of the massage." A low-context communication or message is one in which "the mass of information is vested in the explicit code" [207]. Members of low context, individualistic cultures tend to communicate in a direct fashion, while members of high-context, collectivistic culture tend to communicate in an indirect fashion [107]. In low-context cultures, open confrontation of ideas and direct, issue-oriented discussion are valued modes of human expressiveness. This relates to the usage of tools in groupware, whereas in low context culture, user would prefer to be able to use external tools to express their creative ideas while working. Users belonging in the high-context culture are often indirect when stating a purpose. This will affect the timing of the session in a groupware. The session should not be given a strict ending time and flexible. Users belonging to high-context culture would probably use emoticons more often than people from low-context culture. High context culture would also prefer to use video conference to coordinate within a group and the tendency to make use of PowerPoint during discussion to highlight pointers rather than a long documentation reports. Indonesia has the tendency to belong in the high-context culture. On the contrary, users belonging in the low-context culture are the "straight to the point" type of user. Time is used as effective and efficient as it should be. Therefore each session should be given a limitation of time. Low-context cultures have the tendency to use notepad, and word applications for collaboration. Hall's (1976) description of low-and high-context cultures can also be argued that there is greater need for coordination of activity in high-context cultures than in low-context cultures. It can also be assumed that user belonging in the high-context cultures will make use of the groupware for collaboration activities rather than user belonging in the low-context cultures. As a result, the following hypotheses are proposed:

H1: High – Low Context influence users perceived of usefulness of a groupware application

H2: High – Low Context influence user's perceived ease of use of a groupware application

6.8.3.3.2 Individualism vs. Collectivism (IC)

The individualism vs. collectivism dimension refers to the extent that individuals' self-interests are prioritized over the concerns of the group. Individualism is defined to as the degree to which people in a country prefer to act as individual rather than as members of groups [116]. In individualistic culture, "people are supposed to look after themselves and their immediate family only," while in collectivistic cultures, "people belong to in-groups or collectivities which are supposed to look after them in exchange for loyalty" [117]. Hofstede (1980) argued that cultures high on individualism tend to promote individual decision making over group consensus. On the contrary, culture high on collectivism, the group becomes the primary source of an individual's identity and individuals seek

approval, status and support through group affiliation [208]. Workers in countries that score low on individualism may be more inclined to use media such as face-to-face rather than computer-based media since the former can more readily transmit social situation cues which are deemed important and desirable for collectivist cultures [209]. Low individualism possibly predisposes a culture against computer-based communication because these media mute the group effect [105].

One of the effects of individualism is the tendency to emphasize an individual's interests over those of the group. This may lead to a low perceived of usefulness for technologies, such as groupware application, the goal of which is to increase collaboration in the organization. On the other side, in collectivist societies emphasizing the technology's effects on the interests of the group may be essential. In particular, this research section will argued that the level of individualism/collectivism influences whether people are more likely to see the groupware application in the context of their own tasks or the work of the group as a whole. Instead, they may choose a medium of high social presence such as face-to-face communication. Therefore, users in the individualistic culture may perceive groupware technologies as one of communication technologies to be less useful. Hofstede scored Indonesia as a country belonging to the collectivistic culture. Indonesia has one of the lowest world rankings for Individualism with a 14, compared to the greater Asian rank of 23, and world rank of 43. The score on this dimension indicates the Indonesian society is Collectivist as compared to Individualist [106]. Comparative research on Asian and European cultures suggests that the two cultures represent well the collectivistic and individualistic cultures respectively [210]. Thus, the following hypothesis is proposed:

H3: Collectivism – Individualism influence user's perceived usefulness of a groupware application

In individualistic cultures, perceived ease of use is more likely to be based on the skill levels of the most successful users. On the other side, in collectivistic cultures will likely to value and reward an individual's IT fluency. Therefore, in collectivistic culture, groupware will have the tendency to be more likely used. Thus, the following hypothesis is proposed:

H4: Collectivism – Individualism influence user's perceived ease of use of a groupware application

6.8.3.3.3 Uncertainty Avoidance (UA)

Uncertainty avoidance culture relates to how individuals in a society respond to ambiguousness and unstructured situations. UA focuses on "the extent to which people feel threatened by uncertain or unknown situation" [211]. In culture that has the tendency to be high on uncertainty avoidance, individuals tend to experience discomfort when faced with uncertain situation. According to Hofstede (1980) such individuals show a strong preference for greater structure, clear rules and standardized operating procedures. Therefore culture with high UA, will have the tendency to follow the rule and have the personality of a bit inflexible than those individuals in low UA. High UA culture will tend to allow follow the entire given situation without putting much effort to change the situation (i.e. follow the template; change the windows layout, etc.). On the other hand, in low uncertainty avoidance cultures there is greater likelihood that uncertainty will be tolerated. Users in this culture will be more flexible and ease of use with undefined and unfamiliar situation, and at the end more likely to demonstrate a greater tolerance for new and different ideas, concept and approaches. Users belonging in low UA culture will be more open in accepting new application system. In a culture high on uncertainty avoidance are more likely to avoid learning new technologies introduced into their workplace because of the uncertainty and ambiguity involved [212]. Consequently, people in high

uncertainty avoidance culture will be less oriented to use IT than individuals in low uncertainty avoidance cultures.

The second highest Hofstede ranking for Indonesia is UAI at 48, compared to the greater Asian average of 58 and a world average of 64. This reflects a more moderated influence of this dimension within the Indonesian society. In a context where users are higher in uncertainty avoidance, it may lead to the difficulty of users to be involved in designing new technologies. A participative design process, particularly when it involves an unfamiliar technology may be very difficult for those who desire avoiding uncertainty [3].

Cultural differences in uncertainty avoidance can play a part on how individuals choose media for their communication tasks. The effect on media choice is that cultures in which individuals tend to avoid uncertainty (high UA) are expected to use electronic media less often since this media is not well suited to uncertainty reduction as face-to-face and other rich channels [208]. In a country with low uncertainty characteristic, societies are open toward changes or ready to accept changes. Individuals in high uncertainty avoidance cultures are more likely to consider computer-based media less useful and harder to use than those in low uncertainty avoidance cultures [107]. Users belonging to the high UA culture are tend to be more rigid type of people and would have the tendency to work using the default setting. Users belong to this type of culture resist change more, therefore would like everything to do in order and using the default settings, and also insist to have clear instructions. Therefore manuals or guidelines should really be available for users to refer to. On the other hand, users belonging in the low UAI culture are more of the loosely type of people and more a risk taker. User of this type would prefer to be able to configure or set up the configuration manually based on their taste and preference. This type of users will have the tendency to ignore rules; therefore all settings should be made as flexible as it can be. Since low UAI culture are risk takers, then user are more of the "experiment" type. Users of this type will have the tendency to use the most of the provided tools available in the groupware. Users of this type also have the tendency to negotiate; therefore groupware may be useful for as a negotiating tool. Thus, the following hypothesis is proposed:

H5: Uncertainty avoidance influence user's perceived ease of use of a groupware application

6.8.3.3.4 Power Distance (PD)

Power distance is defined as the degree of inequality among people which the population of a country considers as normal: from relatively equal (small power distance) to extremely unequal (large power distance) [116]. Hofstede described PD by "the extent to which less powerful members of institutions and organization accept that power is distributed unequally" [112]. In high power distance culture, individuals are not supposed to disagree with their superiors. Subsequently, they are more likely to rely on other's opinion to form their decisions. In a society in which people are separated by a large power distance, the leveling effects of certain communication technologies are not desirable. Instead, they may chose media with high social presence such as face-to-face interaction [211].

Power distance is a potent factor in technology acceptance because the greater the level of power distance in a society the greater the influence of the social elite, such as senior managers, on attitudes toward change [211]. In low power distance cultures, it may be important for users to participate actively in the system design and implementation process, thereby empowering them to decide on system features and functionality [116]. In Power Distance Index (PDI) dimension, Indonesia scored

78. It indicates that in Indonesia, there is a far distance between those who have high power to those who have the least power in the society. The average PDI for the greater Asian countries is 71 [78]. In cultures with low power distance, bosses and subordinates work closely together and consult with each other. In culture with high power distance, the relationship between the boss and the subordinate is strictly ruled and dependent on the decision of the boss. This affects the usage of the user profile in a groupware application. Rank and status is important for this type of user, therefore user would like to be able to see other user's profile in other to be more respected by the other users. This also affects the communication style in a groupware, as the boss, usually would want to have more special treatment. This will affect the video screen window on the groupware interface layout. The boss' screen should be different from its subordinates, for instance the size of the window would only be accepted if it is made larger. Individuals in high power distance cultures being more relaxed and open to accept changes compared to their low power distance counterparts. Most respondents are willing to try and accept new application that enables them communicate and coordinate better with their colleagues or with the other companies. Although in term of web-based application, the bandwidth should also be increased considering the infrastructure in Indonesia to avoid delay of the system. Thus, the following hypothesis is proposed:

H6: Power distance influence users' perception of ease of use of a groupware application

6.8.3.3.5 Attitude of satisfaction and intention to use the groupware application

The TAM posits that perceived usefulness and perceived ease of use has a direct effect on attitudes towards using a new technology [82]. Attitude is the degree to which the user is interested in specific systems, which has a direct effect on the intention to use those specific systems in the future and the actual usage of the systems [194]. The attitude of satisfaction represents the degree to which a user's perceived personal needs and the need to perform specific tasks satisfactorily are met by a system [193], [195]. When using a system, users' will respond to various ways to the actions of the system. The usage of the system is also affected by perceived ease of use and perceived usefulness [64]. As a result, the following hypotheses based on TAM-relationship are proposed:

H7: Perceived usefulness influences the attitudes toward the use of groupware application
H8: Perceived ease influences users' attitudes toward the use of groupware application
H9: Attitude towards groupware has a positive effect on the intention to use the application

Based on the description above, we draw our research model (shown in Figure 6.31).

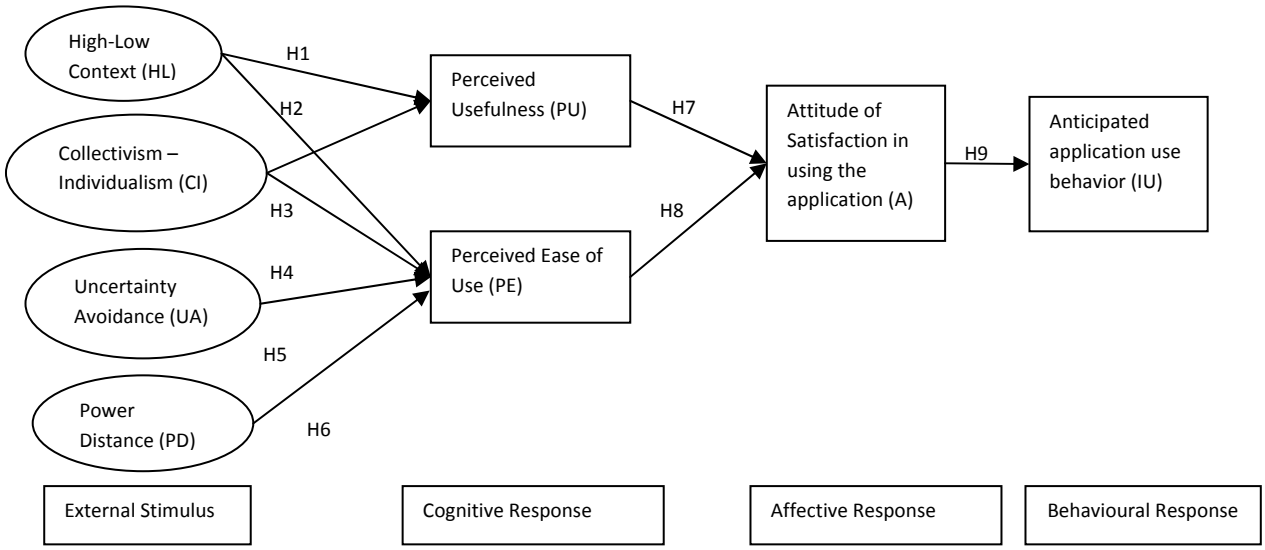


Figure 6.31 Research model in Study 2

6.8.3.4 Research Method

In this study, 34 questions of validated items (see Table 6.41) were self-developed and were then used to examine the theoretical constructs. The questionnaire, using a structured format, consisted of users' related demographic characteristics and questions related to users' preference of perceived usefulness and perceived ease of use of a groupware application. The demographic characteristics involved gender, age, experience working in team and experience working with groupware. The factor-related items collected some constructs, such as perceived usefulness, perceived ease of use, attitude of satisfaction, intention of using and four cultural dimensions that influence user's preferences. All construct consisted of multiple items that were measured on a six-point Likert-type scale, ranging from 1 representing "strongly disagree" to 6 representing "strongly agree".

Table 6.41 TAM items: perceived usefulness, ease of use, attitude, and intention of use in Study 2

Questions regarding "High-Low Context" (HLC) HLC1 : It is easier for me to use audio only (without video) HLC2 : It is easier for me to use video only (with chat) HLC3 : I prefer to use both audio and video HLC4 : It is easier for me to use the chat message than video/audio
Questions regarding "Collectivism - Individualism" (CI) CI1 : Before the session begin, I would like to be able to adjust the number of users participating in the video conference CI2: I will not allow a non-invited user to enter and join a session (I prefer to lmit the user joining the session)
Questions regarding "Uncertainty Avoidance Index" (UAI) UAI1 : I get very upset when the application does something strange and I am uncertain of what to do next UAI2 : If I found some problem when working with the application, I react to it seriously (contact administrator)
Questions regarding "Power Distance" (PD) PD1 : I would like to have a distinction between the boss and the subordinate shown in the application (i.e

the boss/project leader's has a bigger size of windows screen) PD2 : I find it important to see other peoples rank and status
Questions regarding "Perceived Usefulness" (PU) PU1 : Before the session begin, I would like to be able to adjust the number of users participating in the video conference PU2: I will not allow a non-invited user to enter and join a session (I prefer to limit the user joining the session) PU3: I will not allow late-joiners (joining the discussion when the session has already started) or early leavers (leaving the discussion even when it is not finish) when I have a discussion PU4: During a meeting discussion, I prefer to have a moderator that control the flow of the meeting
Questions regarding "Ease of Use" (PE) PE1 : I would like to have a distinction between the boss and the subordinate shown in the application (i.e the boss/project leader's has a bigger size of windows screen) PE2 : I want to have the settings adjustable and flexible to my preference PE3 : It is easier for me to use audio only (without video) PE4 : I like to have a private chat option (to chat with certain users) during discussion group PE5 : I prefer to use notepad or word applications for collaboration rather than using the whiteboard facilities PE6 : I like to use the shared whiteboard (virtual whiteboard available in the application) to share my ideas PE7 : I prefer to use both audio and audio PE8 : It is easier for the use both audio and video PE9 : I like to use emoticons to express my emotion (e.g smileys)
Questions regarding "Usefulness" and "Ease of Use" influences "Attitude" of satisfaction (A) A1 : I am more satisfied if I can run several features using only one application A2 : I am more satisfied is I can draw on a document like using a pen A3 : I am more satisfied if the system is able to find just by entering short key word when I lose a file and cannot find it A4 : I am more satisfied if I can use a software that can display my native language A5 : I am more satisfied if I can record all my audio/video/chat conversation A6 : I a more satisfied if I can keep track on all the changes that has been done on the shared file
Questions regarding user's attitude of satisfaction have a positive effect for users to use the groupware "Intention to use" (IU) IU1: I would most likely to use a groupware application for the following purpose: (Producing reports/ Weekly meetings/ Team or Group discussion / Negotiating tool / Non-business purpose)

6.8.3.5 Measurement Validation

Internal consistency in this study was measured by applying the Cronbach's alpha test to the individual scales. The overall measures are reported in Table 6.42. As all the items had an alpha above the standard guideline of 0.70, the scales can be used for analysis with acceptable reliability.

Table 6.42 Reliability Scale in Study 2

Scale Items	Cronbach's Alpha
High-Low Context (HLC)	
HLC1	0.897437
HLC2	0.895317
HLC3	0.894928
HLC4	0.894954
Collectivism - Individualism (CI)	
CI1	0.895928

Scale Items	Cronbach's Alpha
Perceived Usefulness (PU)	
PU1	0.895928
PU2	0.896277
PU3	0.895879
PU4	0.896054
Ease of Use (PE)	
PE1	0.894863

Scale Items	Cronbach's Alpha
Attitudeof satisfaction (A))	
A1	0.896015
A2	0.895592
A3	0.896449
A4	0.896361
A5	0.894809
A6	0.896077

CI2	0.896277
Uncertainty Avoidance (UA)	
UA1	0.89656
UA2	0.896095
Power Distance (PD)	
PD1	0.894863
PD2	0.898474

PE2	0.896249
PE3	0.897437
PE4	0.896828
PE5	0.896106
PE6	0.896463
PE7	0.894928
PE8	0.895465
PE9	0.895465

Intention to use (IU)	
IU1	0,898474

6.8.3.6 Data Analysis and Hypothesis Testing

By extending TAM with cultural factors consisting of four selected cultural dimensions by Hofstede and Hall, the research model was proposed. In the research model, four key constructs are direct determinants for actual usage and user satisfaction, namely: perceived usefulness, perceived ease of use, attitude of satisfaction in using the application and anticipated application used behavior. Cultural differences with the four cultural dimensions, namely High-Low context, Collectivism-Individualism, Uncertainty Avoidance, and Power Distance have an indirect effect on actual usage and user's satisfaction via the four key constructs.

SEM was applied to evaluate the strength of the hypothesized relationship among the constructs in the theoretical model developed by this study. SEM is a statistical technique that incorporates and integrates factor analysis and path analysis. It is utilized in this study to model multivariate causal relationships and to the multivariate hypothesis. The measurement models specify how hypothetical constructs are measured in terms of the observed variables. It is often necessary to omit a number of indicators to produce a suitable measurement model. Similar to the previous study, the structural model specifies causal relationships among the latent variables. The result from fit statistics indicated that the goodness-of-fit (GFI) and adjusted-goodness-of-fit (AGFI) implied that both the measurement model and structural model have a good fit. The result provided substantial support for most of the proposed hypotheses and showed the significance of the extended constructs.

Variable item properties of the measurement model for all state are shown in Table 6.43. The HLC construct was examined by four items, CI construct was examined by two items, UA construct was examined by two items, and PD constructs was examined by two items.

Table 6.43 Variable item properties of the measurement model

Variable Item	All		Indonesia		Malaysia		Germany	
	Measurement model	Significant value	Measurement model	Significant value	Measurement model	Significant value	Measurement model	Significant value
HLC1	1.058	<0.001	1.501	<0.001	0.726	<0.001	1	<0.001
HLC2	1.4	<0.001	1.734	<0.001	0.816	<0.001		
HLC3	0.421	<0.001	0.26	0.035	0.716	<0.001	-1.119	0,006
HLC4	1	<0.001	1	<0.001	1	<0.001	0.589	0,005
CI1	1.362	<0.001	1	<0.001	0.685	<0.001	1	<0.001
CI2	1	<0.001	-0.454	0.018	1	<0.001		
UA1	1	<0.001			1	<0.001		
UA2	2.987	0.007	1	<0.001	0.875	<0.001	1	<0.001
PD1	1	<0.001	1	<0.001	1	<0.001		
PD2			-1.108	0.359	0.731	0.002	1	<0.001
PU1	1	<0.001	1	<0.001	1	<0.001		
PU2	0.608	<0.001			0.94	<0.001		
PU3	0.81	<0.001	0.749	<0.001	0.757	<0.001		

PU4	0.677	<0.001	0.723	<0.001	0.426	<0.001	1	<0.001
PE1	1	<0.001	1	<0.001	1	<0.001		
PE2	0.962	<0.001	0.655	<0.001	1.221	<0.001	-0.691	0.025
PE3	0.671	<0.001	1.581	<0.001	0.563	0.046	1.855	0.007
PE4	1.147	<0.001	1.068	0,003	0.987	0.003		
PE5	1.079	<0.001	1.401	<0.001	0.675	0.015		
PE6	0.918	<0.001	0.805	0.004	0.981	<0.001		
PE7	1.595	<0.001	0,98	<0.001	1.678	<0.001	-1.741	0.007
PE8	1.335	<0.001	1.811	<0.001	1.088	0.003		
PE9	1.225	<0.001	-1.22	0,001	1.097	<0.001		
PE10			1.019	<0.001	1.58	<0.001		
PE11			-0.881	0.007	0.844	0.01		
PE12			-0.794	0.007	0.905	0.004	1	<0.001
A1	1	<0.001			1	<0.001	1	<0.001
A2	1.121	<0.001			0.963	<0.001	0.693	0.025
A3	1.409	<0.001	0.637	<0.001	1.167	<0.001	0.968	0.003
A4	1	<0.001			1.04	<0.001	1.293	<0.001
A5	1.691	<0.001	0.862	<0.001	0.961	<0.001	1.201	0.001
A6	1.423	<0.001	1	<0.001	1.087	<0.001	1.083	<0.001
IU1	1	<0.001	1	<0.001	1	<0.001		
IU2	0.585	0.015			0.857	0.008	1	<0.001
IU3	0.65	0.005						
IU4	0.517	0.015			0.625	0.016		

6.8.3.6.1 Measurement value for all sample (Indonesia, Malaysia and Germany)

The initial analysis was performed for all countries sample (Indonesia, Malaysia and Germany) to assess the measurement model. CMIN/degrees of freedom (D.F), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), comparative fit index (CFI), and root mean square residual (RMSR) were used to measure the model fitness. The model overall shows good result with CMIN/DF= 4.205, which is <5 that shows that the validity of the model can be trusted. The model value described 87% of the sample with 0.87 GFI and after adjusting the total of sample and variable, the model can describe as much as 84.3% of sample with 0.843 AGIF. The RMSEA model value is 0.073, which is less than 0.08 that shows that it has a low error level and therefore met the measurement model fitness and the multivariate value (c.r.) is 41.345 which is more than 2.5, this shows that the data is not normal multivariate distributed. According to Bollen (1989), estimation form MLE method does not have to be normal multivariate distributed. The data is analyzed using 95% confidence level (alpha = 0.05). Most of the fitness measures were acceptable. The result of SEM is summarized in Table 6.44.

Table 6.44 Statistics of model fit measure

Model Fit Measure	Model value
CMIN/D.F	4.205
Goodness-of-fit index (GFI)	0.87
Adjusted GFI (AGFI)	0.843
Root mean square error of approximation (RMSEA)	0.073
Multivariate (kurtosis mardia c.r.)	41.345

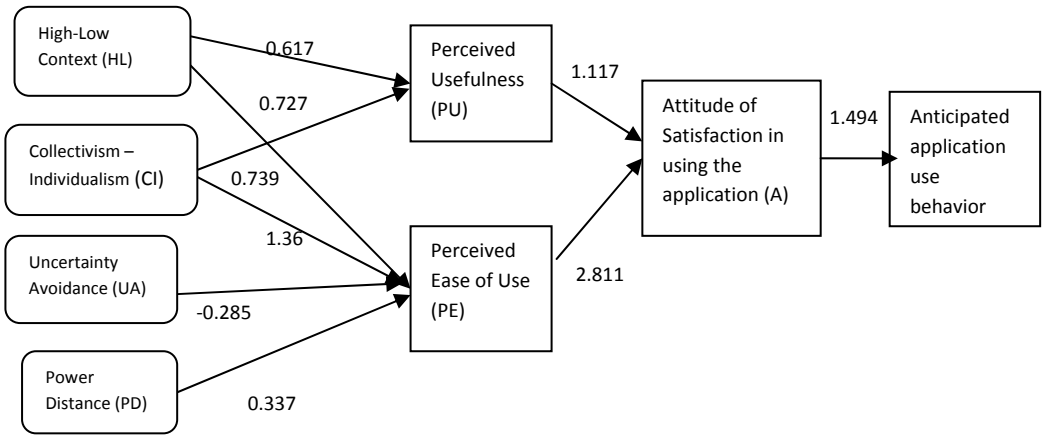


Figure 6.32 Significant relation results for all countries sample

The entire model presents a good fit, which mean the collected data matches the research model. Figure 6.32 shows the causal relationship. The statistical significance were examined and found that high-low context influence user's perception of system usefulness positive relation (0.727) and highly statistically significant p value (<0.001) or (β=0.727, P<0.001), hypothesis H1 was therefore supported. High-Low context also influence users' perception of ease of use in groupware application (β=0.617, P<0.001), therefore hypothesis H2 is supported. Collectivism-individualism influences both user's perceived of usefulness (β=0.739, P<0.001) and perceived ease of use (β=1.36, P<0.001) in groupware application, the result shows positive relation therefore H3 and H4 is supported. The dimension of uncertainty avoidance showed negative relation toward the influence of users' easiness in using a groupware application (β=-0.285, P<0.005), therefore H5 is supported also with negative relation result. Power distance was also assumed to have influenced in the usage of groupware application, the result was β=0.337 with high significant p value (<0.001), therefore H6 is supported. Preposition H7 and H8 were proposed that perceived usefulness and perceived ease of use will influence user's attitude in using the groupware, H7 (β=1.117, P<0.001) and H8 (β=2.811 and P<0.001) shows positive relation with high positive relation value therefore H7 and H8 are both supported. H9 proposed that user's attitude towards groupware will have a positive effect on users' intention to use the application, results shows positive relation value and high significant p value (β=1.494, P<0.001), therefore H9 is supported. The summary result can is shown in Table 6.45.

Table 6.45 Summary result of hypothesis for all sample countries

Hypothesis	Relation	Result	Relation Value	Significant Value
H1	HLC – PU	Supported	0.727	<0.001
H2	HLC – PE	Supported	0.617	<0.001
H3	CI – PU	Supported	0.739	<0.001
H4	CI – PE	Supported	1.36	<0.001
H5	UA – PE	Supported	-0.285	0,005
H6	PD – PE	Supported	0.337	<0.001
H7	PU – A	Supported	-1.117	<0.001
H8	PE – A	Supported	2.811	<0.001
H9	A – IU	Supported	1.494	<0.001

6.8.3.6.2 Measurement value for Indonesian model

The data analysis was performed for Indonesian sample to assess the measurement model. The Indonesian model overall shows good result with CMIN/DF= 2.743, which is <5 that shows that the validity of the model can be trusted. The model value described 83.9% of the sample with 0.839 GFI and after adjusting the total of sample and variable, the model can describe as much as 79.6% of sample with 0.796 AGIF. The error model is 0.086 but may still be tolerated and multivariate with 25.479. The result of SEM is summarized in Table 6.46.

Table 6.46 Statistics of model fit measure for Indonesian model

Model Fit Measure	Model value
CMIN/D.F	2.743
Goodness-of-fit index (GFI)	0.839
Adjusted GFI (AGFI)	0.796
Root mean square error of approximation (RMSEA)	0.086
Multivariate (kurtosis mardia c.r.)	25.479

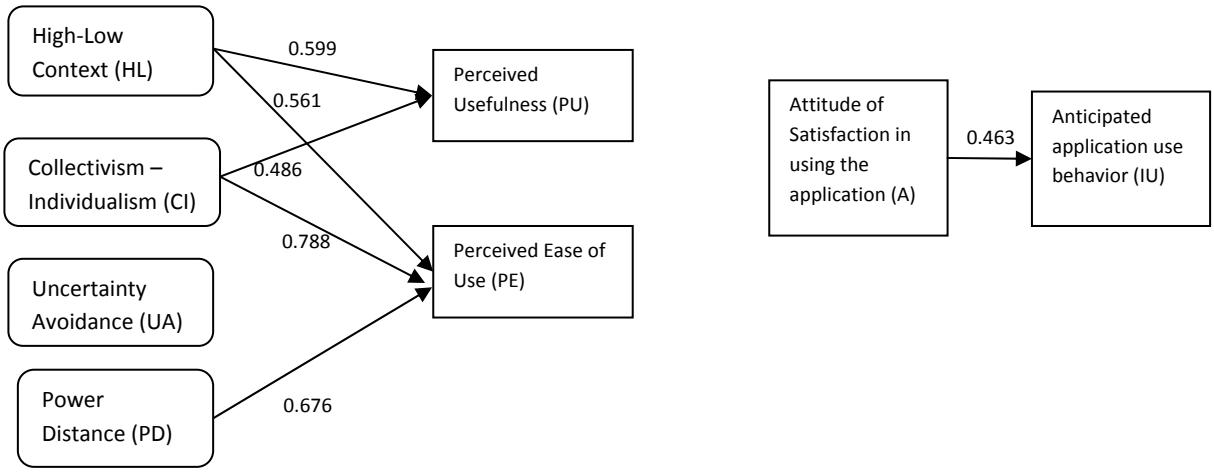


Figure 6.33 Significant relation results for Indonesia

The Indonesian model did not exactly match the research model. Figure 6.33 shows the causal relationship. The statistical significance were examined and found that high-low context influence user's perception of system usefulness positive relation (0.599) and highly statistically significant p value (<0.001) or (β=0.599, P<0.001), hypothesis H1 was therefore supported. High-Low context also influence users' perception of ease of use in groupware application (β=0.561, P<0.001), therefore hypothesis H2 is supported. Collectivism-individualism influences both user's perceived of usefulness (β=0.486, P=0.011) and perceived ease of use (β=0.788, P<0.001) in groupware application, the result shows positive relation therefore H3 and H4 are supported. The dimension of uncertainty avoidance did not show any relation toward the influence of users' easiness in using a groupware application (β=0, P=0.975), therefore H5 is not supported. Power distance was also assumed to have influenced in the usage of groupware application, the result was β=0.676 with significant p value (0.017), therefore H6 is supported. Hypothesis H7 and H8 proposed that perceived usefulness and perceived ease of use will influence user's attitude in using the groupware, H7 shows negative relation with (β=-42.351, P=0.831), while H8 shows positive relation value with β=73.865 but with very low significant p value

P=0,829, therefore H7 and H8 are both not supported. H9 proposed that user's attitude towards groupware will have a positive effect on users' intention to use the application, results shows positive relation value and high significant p value (β=0.463, P<0.05), therefore H9 is supported. The summary result is shown in Table 6.47.

Table 6.47 Summary result of hypothesis for Indonesia model

Hypothesis	Relation	Result	Relation Value	Significant Value
H1	HLC – PU	Supported	0.599	<0.001
H2	HLC – PE	Supported	0.561	<0.001
H3	CI – PU	Supported	0.486	0.011
H4	CI – PE	Supported	0.788	<0.001
H5	UA – PE	Not supported	0	0.975
H6	PD – PE	Supported	0.676	0.017
H7	PU – A	Not supported	-42.351	0.831
H8	PE – A	Not supported	73.865	0.829
H9	A – IU	Supported	0.463	0.05

6.8.3.6.3 Measurement value for Malaysian model

The data analysis was performed for Malaysian sample to assess the measurement model. The Malaysian model overall shows good result with CMIN/DF= 2.615, which is <5 that shows that the validity of the model can be trusted. The model value described 81.7% of the sample with 0.817GFI and after adjusting the total of sample and variable, the model can describe as much as 78.2% of sample with 0.782AGIF. The error model is 0.079, less than 0.08 which shows that it has a low error level and multivariate 31.944. The result of SEM is summarized in Table 6.48.

Table 6.48 Statistics of model fit measure for Malaysian Model

Model Fit Measure	Model value
CMIN/D.F	2.615
Goodness-of-fit index (GFI)	0.817
Adjusted GFI (AGFI)	0.782
Root mean square error of approximation (RMSEA)	0.079
Multivariate (kurtosis mardia c.r.)	31.944

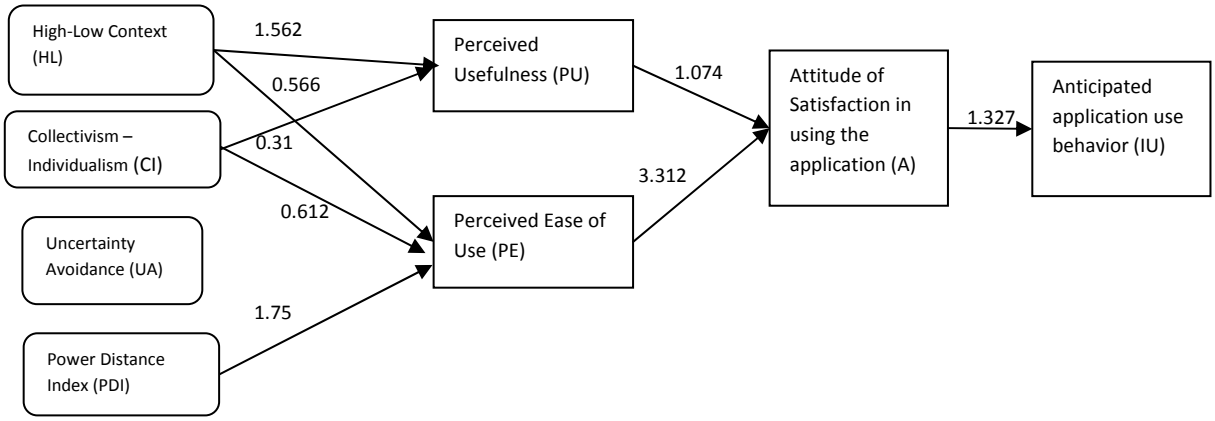


Figure 6.34 Significant relation results for Malaysia

The Malaysian model presents a good fit, which mean the collected data matches the research model. Figure 6.34 shows the causal relationship. The statistical significance were examined and found that high-low context influence user's perception of system usefulness positive relation (1.562) and highly statistically significant p value (<0.001) or (β=1.562, P<0.001), hypothesis H1 was therefore supported. High-Low context also influence users' perception of ease of use in groupware application (β=0.566, P<0.001), therefore hypothesis H2 is supported. Collectivism-individualism influences both user's perceived of usefulness (β=0.31, P<0.001) and perceived ease of use (β=0.612, P<0.001) in groupware application, the result shows positive relation therefore H3 and H4 is supported. The dimension of uncertainty avoidance did not show any relation toward the influence of users' easiness in using a groupware application (β=-0.675, P=0.331), therefore H5 is not supported. Power distance was also assumed to have influenced in the usage of groupware application, the result was β=1.75 with significant p value (0.109), therefore H6 is supported. Hypothesis H7 and H8 proposed that perceived usefulness and perceived ease of use will influence user's attitude in using the groupware, H7 (β=1.074, P<0.001) and H8 (β=3.312, P<0.001), both shows positive, therefore H7 and H8 are both not supported. H9 proposed that user's attitude towards groupware will have a positive effect on users' intention to use the application, results shows positive relation value and high significant p value (β=1.327, P<0.001), therefore P9 is supported. The summary result is shown in Table 6.49.

Table 6.49 Summary result of hypothesis for Malaysia model

Hypothesis	Relation	Result	Relation Value	Significant Value
H1	HLC – PU	Supported	1,562	<0.001
H2	HLC – PE	Supported	0,566	<0.001
H3	CI – PU	Supported	0,31	<0.001
H4	CI – PE	Supported	0,612	<0.001
H5	UA – PE	Not supported	-0,675	0,331
H6	PD – PE	Supported	1,75	0,109
H7	PU – A	Supported	1,074	<0.001
H8	PE – A	Supported	3,312	<0.001
H9	A – IU	Supported	1,327	<0.001

6.8.3.6.4 Measurement value for German model

The data analysis was performed for German sample to assess the measurement model. The German model overall shows good result with CMIN/DF= 2.335, which is <5 that shows that the validity of the model can be trusted. The model value described 84.1% of the sample with 0.841 GFI and after adjusting the total of sample and variable, the model can describe as much as 76.1% of sample with 0.761 AGIF. The error model is 0.116 which is low and multivariate with 5.043. The result of SEM is summarized in Table 6.50.

Table 6.50 Statistics of model fit measure for German Model

Model Fit Measure	Model value
CMIN/D.F	2.335
Goodness-of-fit index (GFI)	0.841
Adjusted GFI (AGFI)	
Root mean square error of approximation (RMSEA)	0.116
Multivariate (kurtosis mardia c.r.)	5.043

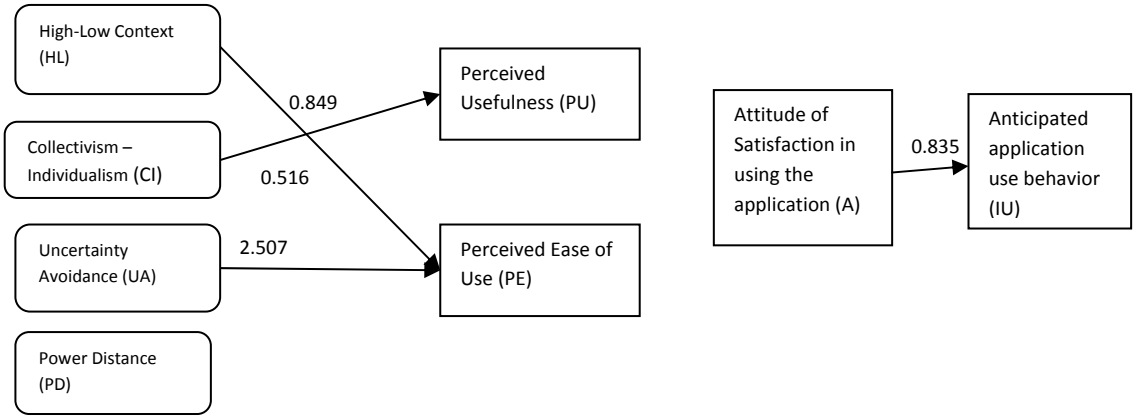


Figure 6.35 Significant relation results for Germany

The German model did not show a good fit, which did not exactly match the research model. Figure 6.35 shows the causal relationship. The statistical significance were examined and found that most cultural dimension did not have play big role in user's perception of usefulness and ease of use. High-low context did not have any influence toward user's perception of system usefulness (β=-0.038, P=0.799), hypothesis H1 was therefore is not supported. High-Low context influence users' perception of ease of use in groupware application (β=0.849, P<0.05), therefore hypothesis H2 is supported. Collectivism-individualism influences user's perceived of usefulness (β=0.516, P=0.19), therefore H3 is supported, but this cultural dimension did not influence user's perceived ease of use (β=11.657, P=0.894) in groupware application, therefore H4 is not supported. The dimension of uncertainty avoidance show positive relation toward the influence of users' easiness in using a groupware application (β=2.507, P=0.225), therefore H5 is supported. Power distance was also assumed to have influenced in the usage of groupware application, the result was β=-0.004 with significant p value (0.995), therefore H6 is not supported. Hypothesis H7 and H8 proposed that perceived usefulness and perceived ease of use will influence user's attitude in using the groupware, H7 (β=-35.633, P=0.933) and H8 (β=-6.795, P=0.926), both shows negative relation with insignificant value, therefore H7 and H8 are not supported. H9 proposed that user's attitude towards groupware will have a positive effect on users' intention to use the application, results shows positive relation value and significant p value (β=0.835, P=0.224), therefore P9 is supported. The summary result is shown in Table 6.51.

Table 6.51 Summary result of hypothesis for German model

Hypothesis	Relation	Result	Relation Value	Significant Value
H1	HLC – PU	Not supported	-0,038	0,799
H2	HLC – PE	Supported	0,849	0,05
H3	CI – PU	Supported	0,516	0,19
H4	CI – PE	Not supported	11,657	0,894
H5	UA – PE	Supported	2,507	0,225
H6	PD – PE	Not supported	-0,004	0,995
H7	PU – A	Not supported	-35,633	0,933
H8	PE – A	Not supported	-6,795	0,926
H9	A – IU	Supported	0,835	0,224

6.8.3.7 Conclusion

The result indicates that cultural dimensions have influence users' acceptance of groupware application. This study measures directly with the selected cultural dimensions, therefore it can be said that there is a link between cultural factors and groupware acceptance has been empirically established.

6.8.4 Part 3: Trompenaars model in defining user's expectation of groupware

6.8.4.1 Motivation and Objective of the Study

In order for the new groupware system to be able adopted by globalized industries around the world, the design and interface of the groupware should be able to be used by all cultures across the world. A great attention should be given for the cultural element in creating products and interfaces that are culture "fit" to its users. The objective of this study sets is to find out what role culture plays in user's preference on features and facilities that should be included in a collaborative application from the Human Computer Interaction (HCI) point of view, more specifically: (1) to understand the relationship between cultural influence and how user interact with groupware product; (2) To identify cross-cultural differences in interaction with groupware product.

Communicating with people from different cultures can sometimes be harder than it is expected, since there are not only language barriers but also the lack of understanding of social norms and background. Different cultures have different approaches in interacting with the computers. Problems that might occur during collaborations within multicultural users are explored in this study. Examining the influence of culture on the relationship between cultural variables is necessary to establish a groupware as an intercultural collaboration for multicultural users. Integrating theories from cultural studies and CSCW may lead to an adaptable groupware application designed accordingly with user's preference.

6.8.4.2 Research hypothesis

Previous research argued that internationalization is the simple action to overcome cultural problems, since it concentrates on separating the cultural elements of a product from the rest of it, and localization is the process of adopting this cultural element for a specific target culture. This process is known as culturalization. Trompenaars (1994) stated that internationalization will create, or at least will lead to, a common culture worldwide. On the other hand, some researchers take the cultural problems very seriously and argue that is may enforce a new kind of imperialism. Many software designers treat this cultural issues as inconvenience that will cost a lot of money to deal with and therefore this differences that may occur between users working with the software is then ignored [18]. Intercultural perspectives in HCI have not been ignored but the majority of the intercultural research focused on its effort to improve the marketability of software products overseas [198]. Days (1991) argued that cultural factors must be taken into account in order for human-computer interfaces to be effective.

The main purpose of this study is to understand user's preference and attitude toward a groupware application and to define which interface elements are culturally more problematic for the groupware users. As an initial state, two hypotheses are proposed:

1. Users from different cultures will have different preferences with the features and items used in the groupware application
2. Users will expect designers to design interface that will suitable to their preference of usage

6.8.4.3 Measurement Validity

Prior to the hypotheses testing, the measurement scales were examined in terms of the construct validity. In this study, construct validity and reliability were examined using SPSS v.16. Internal consistency was measured by applying the Cronbach's alpha test to each question in the constructs. In the social sciences, the index used to measure internal consistency reliability is the coefficient alpha [199]. Given that all constructs had items with Cronbach's alpha above 0.80, this exceed the minimum value of 0.70 recommended by Nunnally [119], therefore the measurement items possessed adequate reliability. The overall measures are reported in Table 6.52.

Table 6.52 Reliability Scale

Scale Items	Cronbach's Alpha
Trompenaars Questions	
Q1	0,896015
Q2	0,894692
Q3	0,894353
Q4	0,893892
Q5	0,895865
Q6	0,898046
Q7	0,895352
Q8	0,895465
Q9	0,895943
Q10	0,896828
Q11	0,896034
Q12	0,895007

Scale Items	Cronbach's Alpha
Q13	0,896565
Q14	0,89577
Q15	0,896228
Q16	0,895633

User's Expectation Questions	
Q1	0,895711
Q2	0,896361
Q3	0,894809
Q4	0,894353
Q5	0,893892

6.8.4.4 Data Analysis and Hypotheses Testing

Data were collected by means of a questionnaire (paper-based and web-based). This instrument consisted of 6 Likert scale items. The design choices in the questionnaires included adoption of a six-point Likert scale for the majority of the questions to prevent response centering (i.e selection of the neutral option) by respondents that have the tendency to take a distinct position on the related question. Questions were created to understand specific cultural issues and problems related to user's preference in using groupware application. The survey has three main sections. The first section was to gather user's demographic data, the second section contains the research questions and the third section asked users' expectation of a groupware application. In the second section, 16 Likert scale questions were based on the Trompenaar's seven dimension model. In the third section, 5 Likert scale questions were created to understand users' expectation to HCI problems and groupware designs. The entries into the database were coded by country. The data was first tabulated in MS Excel and then transferred to SPSS to analyze.

Working in a collaborative application with users from different cultures may not be an easy task. It requires the ability to shift between multiple identities, establish and maintain cross-cultural

friendships and working relationships, and to communicate effectively verbally and non-verbally. To deal with the consequences of different cultures, it is important for developers and designer to explore and understand the culture of which users will be using the system. In this research, 16 Likert scale question related with Trompenaars' seven dimensions model levels will be analyzed.

A. Dimension of Time and Nature

Synchronic vs. sequential perception: Prefer to do several things at once or one thing after another

Q1: I am more satisfied if I can run several features using only one application

The aim of the question is to understand whether user prefers to do several things at a time in parallel or one thing after another. Table 4.49 shows that respondents from the three countries have almost similar mean value which can be interpreted that most of the respondents from the three countries agree that they would be more satisfied if the groupware application is designed in a way that it would be able to run several features. As seen from the result, we may argue that synchronic behavior in running several features in one application becomes a common cultural element.

Ascription vs. achievement: the way we seek to have control over our own lives and over our destiny or fate

Q2: It is easier for me to follow a template or assistance on how to use the application instead of trying to figure out by my own

The aim of the question above is to determine whether user wants to be in full control to configure and adapt the application or just accept the application as provided by the developer. Respondents from Indonesia and Malaysia find it easier for them to follow a template when using the application rather than exploring on figuring out how to do it by themselves. This is on the contrary with the German respondents, they prefer not to use the template and design it by themselves, which shows that user wants to be in full control to configure and adapt the applications (See Table 6.53).

Table 6.53 Dimension of time and nature

Cultural Dimension		Indonesia		Malaysia		Germany	
		Mean	SD	Mean	SD	Mean	SD
Time	**Q1**	4,54	0,9	4,77	0,89	4,43	0,87
Nature	**Q2**	4,74	0,87	4,83	0,84	4	1,17

B. The Dimension of People

Universalism vs. Particularism

Q3: I prefer computer software that has an interface adapted to my culture
Q4: I find it important to have an interface that is adapted to my culture
Q5: I think it is harder to use culturally adapted software compared to the same design for everybody in the world

The objective of questions above is to determine whether some culture prefer a universal interface of a particular design.

Table 6.54 Dimension of Individualism vs. Particularism

Universalism vs Particularism	Indonesia		Malaysia		Germany	
	Mean	SD	Mean	SD	Mean	SD
Q3	4,55	0,96	4,67	0,90	3,46	1,16
Q4	4,45	0,93	4,51	0,94	3,02	1,12
Q5	4,33	0,89	4,43	1,00	3,85	1,30

Indonesia and Malaysia respondents find it important to have an interface that is adapted to their culture and prefer to have an interface to be adapted to their culture. This can be predicted, since Indonesia and Malaysia belongs to the particularist culture [33], although they also thinks that culturally adapted software would take more time to learn rather than universal software design for everybody in the world. The result of the German respondents on the contrary, respondents did not agree to have software that has an interface adapted to their culture since it is not an important matter to have such an interface. This is probably since Germany has the tendency to belong to the Universalism culture, that's why the German respondents prefer to have a universal interface rather than an interface designed particularly for them. Result is shown in Table 6.54.

Individualism vs. communitarism (collectivism): Do we function in a group or as an individual

Q6: When I disagree with a group, I would leave the group discussion immediately
Q7: I find it important to see what my other teammates are working on
Q8: I like to see a message pop up, when I did a mistake
Q9: I like to see a message pop up, when the other users make a mistake

The set of questions above were designed to understand whether users prefer to work in groups or prefer to work alone. When misunderstanding occurs in a group or team, conflict may arise. Respondents were asked if such matter do occur, how they would most likely to react. Will they immediately leave the discussion group or not? All respondents from the three countries answered that they will not leave the discussion group immediately. Result is shown in Table 6.55.

Table 6.55 Dimension of Universalism vs. Collectivism

Individualism vs. Collectivism	Indonesia		Malaysia		Germany	
	Mean	SD	Mean	SD	Mean	SD
Q6	2,51	1,14	2,78	1,29	2,13	0,98
Q7	4,68	0,92	4,61	0,97	4,02	1,09
Q8	4,76	0,92	4,81	0,78	4,19	1,18
Q9	4,07	1,28	4,36	1,09	3,26	1,27

One important concept defined in groupware application, is the concept of awareness. With awareness, user will be able to increase communication opportunities in a distributed workspace. Awareness is defined as an understanding of activities by other users, which also may provides a context for your own activity [119]. This context is used to ensure that each individual contribution of users is relevant to the group activities and to evaluate actions of each individual with respect to the groups' progress and goal. In term of this awareness concept, users were asked whether it is important to see what the other teammates are working on, respondents from Indonesia and Malaysia agree that it is important, but German respondents slightly disagree. Respondents from Indonesia and Malaysia mostly agreed that they would like to see a message pop-up when they perform a mistake, while German respondents

prefer not to be notified when they perform mistakes by a show of a pop-up message. This reaction is also similar to when other user perform a mistake, respondents from Indonesia and Malaysia also mostly prefer to be notified, and the German respondents on the contrary.

Specific vs. diffuse cultures: how far do we get involved?

Q10: I like to have a private chat option (to chat with certain users) during discussion group
Q11: I would rather focus on a task than on a personal relationship
Q12: I prefer to use familiar software, than to use software that may have many features that I need but too complicated to use

The set of questions above were used to understand whether business and personal relationships are clearly separated.

Table 6.56 Dimension of Specific vs. Diffuse

Specific vs Diffuse	Indonesia		Malaysia		Germany	
	Mean	SD	Mean	SD	Mean	SD
Q10	4,49	1,30	4,27	1,09	4,11	1,46
Q11	4,29	1,39	4,68	0,94	3,61	1,20
Q12	4,58	1,24	4,73	0,95	3,74	1,29

In terms of specific vs. diffuse cultures, Trompenaars researched differences in how people engage with colleagues in similar or multiple areas of their lives, classifying the results into two groups: people from more specific-oriented cultures tend to keep private and business agendas separate, having a completely different relation of authority in each social group [120]. Germany is defined by Trompenaars, as a culture that has the tendency to be specific [120]. Most German respondents answered slightly disagree to have a private chat option in order to chat with certain users to during discussion group, perhaps they would most likely differentiate between business and personal matters during working discussion session. But surprisingly, when asked regarding user's opinion on the statement "I would rather to focus on a task than a personal relationship", most German respondents slightly disagree to this statement. Therefore, it can be assumed that they would value personal relationship rather that task. This is also similar to the question asked regarding user's opinion on the statement "I find using a technology for producing work is more important than for establishing relationship", the mean value for German respondents is the lowest among the other countries, which explains that for German respondents establishing relationship is more important than producing work.

Diffuse cultures tend to have a large personal side to people's lives. This is reflected in their business relationships. Diffuse cultures put personal relationship ahead of task or business matters. Table 6.56 shows Indonesia and Malaysia as diffuse cultures, they would like to have a private chat option (to chat with certain users) during discussion group. Diffuse culture will tend to prioritize personal relationship rather than business. Surprisingly result for Q12 shows differently, Indonesia (4,29) and Malaysia (4,68) scored higher in agreeing to rather focus on a task than a personal relationship, in which Germany as a specific culture scored the lowest (3,61). Most Indonesian (4,58) and Malaysian (4,73) respondents, in comparison to the German (3,74) respondents, preferred to use familiar software than to use software that may have many features that they need but too complicated to use.

Affective vs. neutral: do we display our emotions?

Q13: I prefer to give opinions that will help people save face rather than give a statement of the truth
Q14: I like to use emoticons to express my emotions (e.g. smiley)

Q15: I like to have an emotional awareness (mood indicator) of the other users' reaction when I'm presenting a document / presentation (i.e. understand or not understand)
Q16: I find it important that I perform well on the application when other people can see me working

The four questions above were used to understand whether users will have the tendency to display their emotions about usability problems. The dimension of affective vs. neutral is used to describe the acceptability of showing emotion. Trompenaars defined Indonesia has the tendency to be in the neutral culture, while Malaysia to be an affective culture, and Germany is positioned in the middle [118]. In terms of emotions, most Indonesia and Malaysia respondents agreed that they would prefer to give opinions that will help people save face rather than give a statement of the truth. German respondents mostly disagreed and would prefer to give a statement of truth despite of the fact that the statement may offend the other party. Indonesia respondents showed the most in strongly agreeing to use emoticons to express their emotions (e.g. smiley) in comparison to Malaysia and Germany. In an affective culture, it is acceptable for people to show their feelings, while in a neutral culture the expressing of feelings is controlled and individuals are not encouraged to publicly display their emotions. According to Trompenaars [18], people from neutral cultures control their feelings but can suddenly explode during stressful periods. While people from high affective cultures, use all forms of gesturing, smiling and body language to openly voice their feelings. Most respondent answered agree to have an emotional awareness (mood indicator) of the other user's reaction when they are presenting a document or presentation. An example of an emotional awareness is when an indicator is present that shows whether or not the other users understand or doesn't understand to the material being presented. No significant difference was also shown by the respondents in the question asked regarding the importance of performing well on the application when other people can see then working. Result is shown in Table 6.57 and the overall graphic percentage for the Dimension of People is shown in Figure 6.36.

Table 6.57 Dimension of Affective vs. Neutral

Affective vs Neutral	Indonesia		Malaysia		Germany	
	Mean	SD	Mean	SD	Mean	SD
Q13	3,39	1,33	3,84	1,16	2,56	1,38
Q14	5,18	0,98	4,66	0,93	4	1,63
Q15	4,57	1,047	4,55	0,90	4,45	0,98
Q16	4,41	0,97	4,43	1,00	4,17	1,18

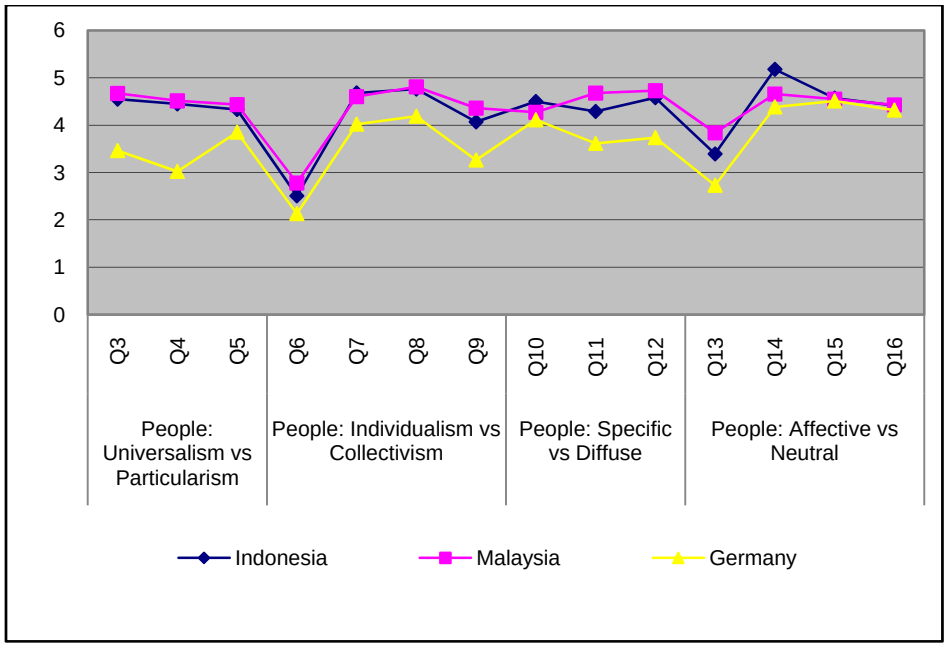


Figure 6.36 Dimensions of People

C. User's expectation on a groupware application

Q1: I refuse to use an application that has materials or features not suitable for my culture

Q2: I am more satisfied if I can use software that can display my native language

Q3: I am more satisfied if I can record all my audio conversation/video conversation/chat conversation

Q4: I am prefer computer software that has an interface adapted to my culture

Q5: I find it important to have an interface that is adapted to my culture

The result in Table 6.58 shows that most Indonesia and Malaysia users agree, while most German users slightly disagree, to have an interface that is adapted to their culture. This may be related to Trompenaar's dimension of Universalism vs. Particularism, in which Indonesia and Malaysia has the tendency to belong to the Particularism culture that often searches for differences, for unique and exceptional forms of distinction that render phenomena incomparable and or matchless quality. It shows different result of user's expectation since each country also answered differently on how they find it important to have an interface that is adapted to their culture. Indonesia and Malaysia shows almost similar result, in which most respondents agree, on the other hand, German users mostly answered slightly agree. Most Indonesian and Malaysian users agree that they will refuse to use an interface that has materials or features that is not suitable for their culture. German respondents show that they disagree, they will not refuse an application that is not suitable for their culture, and this may be understood well. According to Trompenaars, Germany has the tendency to belong to the Universalism culture.

Table 6.58 User's Expectation of a Groupware

User expectation	Indonesia		Malaysia		Germany	
	Mean	SD	Mean	SD	Mean	SD
Q1	3,44	1,31	4,22	1,18	2,48	1,13
Q2	4,62	0,98	4,58	1,02	4,68	1,09
Q3	5,08	0,78	4,74	0,89	4,11	1,09
Q4	4,55	0,96	4,67	0,90	3,46	1,16
Q5	4,45	0,93	4,51	0,94	3,02	1,12

All respondents from the three countries agreed that they will be more satisfied if they can use software that can display their native language and have the ability to record all of their audio/video/chat conversation. Although results shown that most German users slightly disagree to have an interface that is adapted to their culture, when asked about interface that is adapted to their culture most respondents from all three countries (which means including Germany) agreed that they prefer to have such an interface. Also result shows that most respondents from the three countries agreed that it is important to have an interface that is adapted to their culture. Figure 6.37 shows the graphic result of user's expectation of groupware based on cultural issues as noted above the numerical results correspond to a Likert scale from 1 (strongly disagree) to 6 (strongly agree).

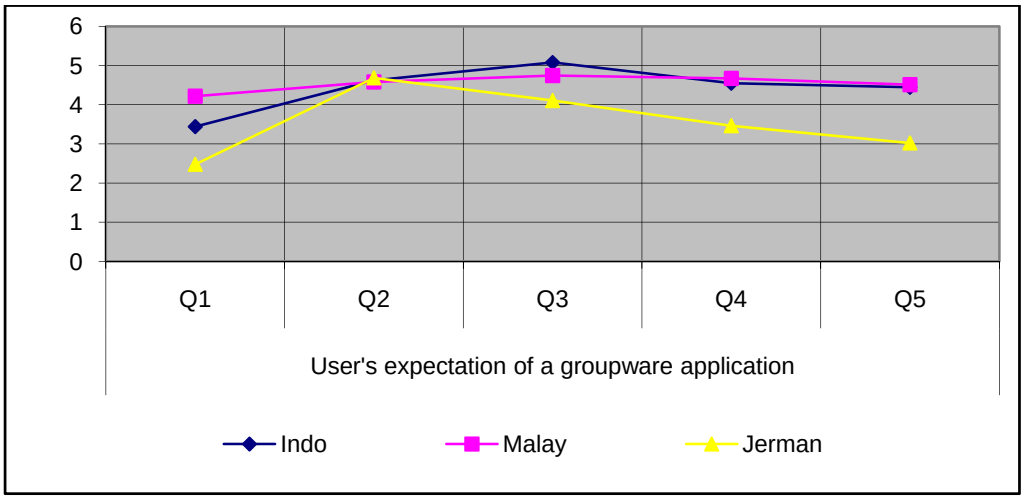


Figure 6.37 User's expectation of a groupware percentage graph

6.8.4.5 Conclusion

One of the failures of the previous groupware application is that the system was not build or was not well designed for the target users. Previous research stated that most people must adapt to the technology rather than adapting to its needs [213]. The result of this study shows that user's would actually prefer an application or more specifically a groupware application that has cultural aspects adapted in its design. This research shows that culture does influence user preferences in the interface acceptance of a groupware application.

6.8.5 Part 4: HCI Point of View toward the Interface Design

6.8.5.1 Motivation and Objective of the Study

One of the most important influences on interface design is globalization, in which "culture" is one of the key factors to make a product successful (Lee 2000). The extent to which culture influence user preferences in a groupware interface design will be examined in this study. It is mainly focused on a belief that culture plays an important role on interface acceptance and that globally software application should accommodate users' cultural differences. A range of cross-cultural elements that need to be considered by the interface designers are text, number, date and time formats, images, symbols, colors, flow and functionality [54], [60], [69]. This study will review whether these influences are consistent with the previous established theories of cultural orientation [54], [60], [69].

6.8.5.2 Data Analysis

This study contains two parts. The first part asked about interface design and the second part asked about intercultural communication questions.

6.8.5.2.1 Interface design questions

The numerical results correspond to a Likert scale from 1 (strongly disagree) to 6 (strongly agree). Questions were adapted and modified from its original version by Evers (1997), asked regarding the following items to user: (1) Strong bright colors; (2) Soft colors like pastel; (3) Many different colors; (4) Icons, buttons, images; (5) Windows that divide screen into areas ; (6) Pop-up menus that appear when user clicks on a particular area of the screen ; (7) Pull down menus that are dragged down from the top of the screen; (8) Multiple windows (one window on top of the other); (9) Online help; and (10) User Manual/Documentation. Screenshot of the paper based questionnaire may be seen in Figure 6.38.

A. I like the interface design of a system with:

		Strongly Agree	Agree	Slightly Agree	Slightly Disagree	Disagree	Strongly Disagree
1.	Strong bright colors	O	O	O	O	O	O
2.	Soft colors like pastel	O	O	O	O	O	O
3.	Many different colors	O	O	O	O	O	O
4.	Icons, buttons, images	O	O	O	O	O	O
5.	Windows that divide screen into areas	O	O	O	O	O	O
6.	Pop-up menus that appear when user clicks on a particular area of the screen	O	O	O	O	O	O
7.	Pull down menus that are dragged down from the top of the screen	O	O	O	O	O	O
8.	Multiple windows (one window on top of the other)	O	O	O	O	O	O
9.	Online help	O	O	O	O	O	O
10.	User Manual/Documentation	O	O	O	O	O	O

Figure 6.38 Screenshot of paper-based questionnaire in study 3

Following data entry using SPSS v.16, univariate statistics were generated for all questions in this survey. The average response between 4 ("slightly agree") and 5 ("agree") seems overall a cautiously positive result, where many subjects responded very positively. In terms of user's expectation, the average respondents slightly agree to have an interface design with strong bright colors (3.78) and would prefer to have soft colors (4.58) with many different colors (4.15) in comparison to only

conventional black and white. The average respondents prefer to have icons, buttons and images (4.83) rather than having only text or command based. Although the average respondents like to have a pull down menus that are dragged down from the top of the screen (4.52), result shows that the respondents seems to like pop-up menus that appear when user click on a particular area of the screen (4.63) more. Multiple windows with one window on top of the other (4.26) are also preferred by users. Result shows that the average respondents would like to have online help (4.60) and user manual/documentation (4.51) available. Table 4.55 shows the summary of user's interface design preference for all users.

Table 6.59 Interface design preference for all sample countries

Interface design features	N	Mean	Std. Deviation	Variance
Strong bright colors	599	3,7845	1,17834	1,388
Soft colors like pastel	599	4,5794	0,97855	0,958
Many different colors	599	4,1518	1,2878	1,658
Icons, buttons, images	599	4,8355	0,8186	0,67
Windows that divide screen into areas	599	4,5659	0,91877	0,844
Pop-up menus that appear when user clicks on a particular area of the screen	599	4,6287	0,8634	0,745
Pull down menus that are dragged down from the top of the screen	599	4,5245	0,93439	0,873
Multiple windows (one window on top of the other)	599	4,2614	1,11516	1,244
Online help	599	4,5968	0,97654	0,954
User Manual/Documentation	599	4,5144	1,14419	1,309

Data is analyze with level of reliability 95% (alpha = 0.05). Variable items with sig<0.05 indicates that mean value shows different result, while variable items with sig>0.05 indicates that mean value of each countries show similar mean value. The average Asian's respondent for both Indonesia and Malaysia, prefer to have strong bright colors for the interface design of a groupware application. On the other hand respondents from Germany, prefer not to have strong bright colors.

Respondents from the three countries, all agreed to prefer to soft colors like pastel in comparison to strong bright colors for their interface design. Asian respondents, both Indonesian and Malaysian, like many different colors in comparison to German respondents. All respondents have the same preference for having windows that divide screen into areas and have online help available at all times. Indonesian and Malaysian respondents also agree that they prefer to have pop-up menus that appear when user clicks on a particular area of the screen, whereas German respondents answered to only slightly agree. Most respondents, although with different level of agreement, mostly agree to have pulled down menus that are dragged down from the top of the screen. Indonesia and Malaysia as countries that has the tendency to be included in the Polychromic culture, which tend to do things more than one simultaneously, agree to prefer to have an application that can show multiple windows. As predicted, Germany as a country that has the tendency to belong to the Monochromic culture, disagree to have multiple windows while working on an application. Table 6.60 shows the summary of user's interface design preference for each country.

Table 6.60 Interface design preference for all countries (Indonesia vs. Malaysia vs. Germany)

Interface design features	Indonesia		Malaysia		Germany		F	Sig.
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation		
Strong bright colors	3.74	1.1631	3.93	1.1767	3.49	1.16882	5.254	0.005
Soft colors like pastel	4.81	0.8757	4.63	0.9208	3.88	1.04301	36.534	0
Many different colors	4.32	1.3404	4.33	1.1168	3.28	1.23423	30.455	0
Icons, buttons, images	5.07	0.6869	4.82	0.7627	4.33	0.99887	31.82	0
Windows that divide screen into areas	4.65	0.8651	4.51	0.9649	4.48	0.90858	1.943	0.144
Pop-up menus that appear when user clicks on a particular area of the screen	4.63	0.9079	4.71	0.7378	4.40	1.01821	4.629	0.01
Pull down menus that are dragged down from the top of the screen	4.69	0.9184	4.53	0.87	4.12	1.00973	14.763	0
Multiple windows (one window on top of the other)	4.46	1.0082	4.38	1.0563	3.47	1.17715	33.565	0
Online help	4.68	1.0028	4.67	0.9035	4.2	1.01105	10.216	0
User Manual/Documentation	4.93	0.9226	4.61	0.8624	3.26	1.36998	103.762	0

German users did not score very high on the color selection of interface design, and especially very low on the selection of many different color. German users mostly disagree to have multiple windows (one window on top or the other); this is consistent on the German's cultural dimension of monochromic culture.

Asian users, both Indonesia and Malaysia, seems to prefer soft colors like pastel, with icons, buttons, and images on the interface design, and pull down menus that are dragged down from the top of the screen. Indonesian and Malaysia users also prefer to have the user manual or documentation to be available.

In regards to the interface design with strong bright color, Indonesia and Malaysia shows no difference in their design preference of choice, but Malaysia and Germany shows difference of preference as can be shown by its mean difference (0.43). Mean difference was also attained from the selection of soft colors such as pastel between Germany and both Asian countries. The graphic of users' interface design preference is shown in Figure 4.29, as noted above the numerical results correspond to a Likert scale from 1 (strongly disagree) to 6 (strongly agree).

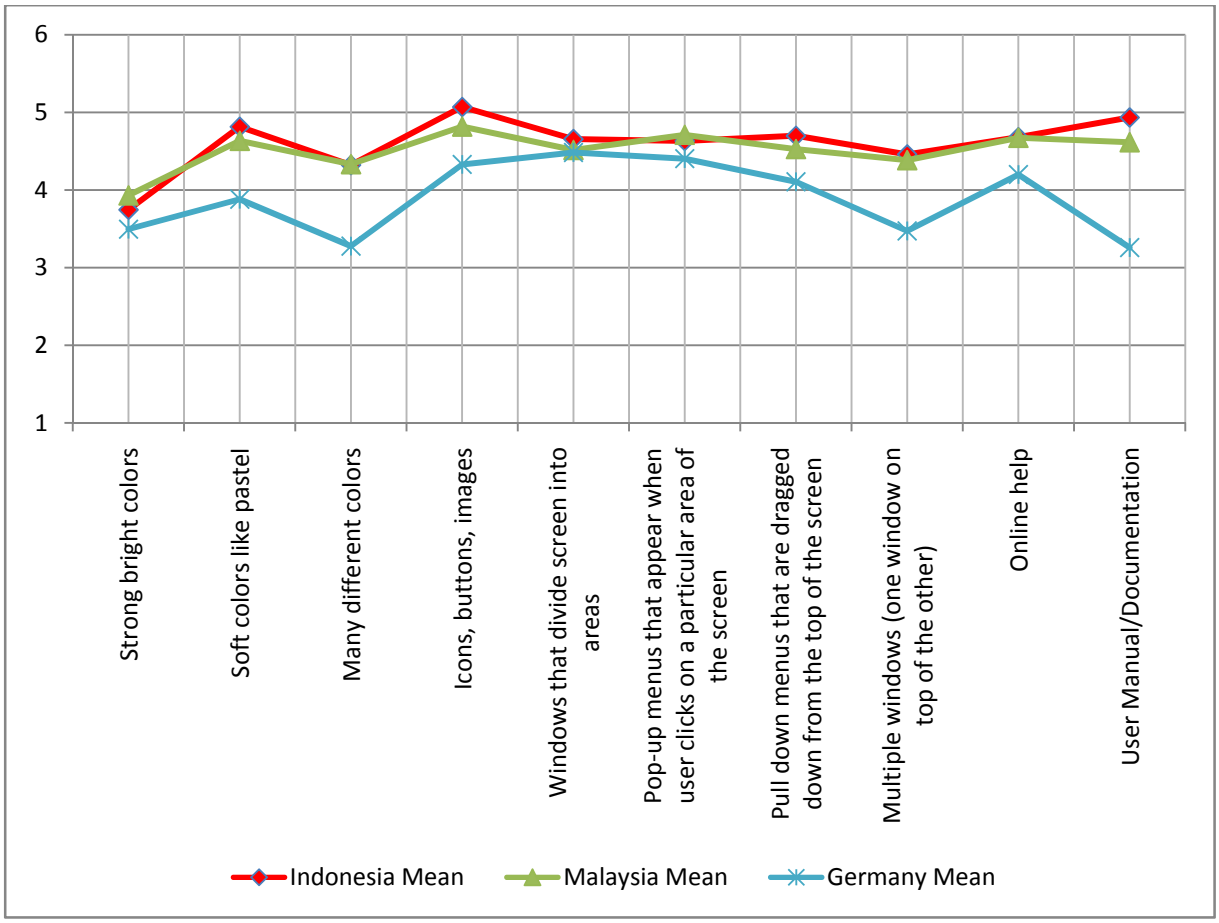


Figure 6.39 Graphic of user's interface design preference

All variables may be further analyzed using Kaiser Meyer Olkin (KMO) and Bartlet's test (see Table 6.61). The KME measure of sampling adequacy is 0.789 which is more than 0.5 and sig. value is 0 which is less than 0.05, this shows that all variables has the potential to be further analyzed if necessary.

Table 6.61 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0,789
Bartlett's Test of Sphericity	
Approx. Chi-Square	1083
d.f.	45
Sig.	0

Table 6.62 shows that all variable items have correlation value more than 0.5, which shows that all variable are reliable.

Table 6.62 Anti-Image Matrices

Interface design features		1	2	3	4	5	6	7	8	9	10
Anti-image Correlation	1	.569(a)	0,16	-0,304	-0,024	0,015	-0,083	0,003	-0,058	-0,03	0,046
	2	0,16	.762(a)	-0,066	-0,17	-0,063	0,071	-0,109	-0,082	0,014	-0,111
	3	-0,304	-0,066	.728(a)	-0,1	-0,017	0,001	-0,041	-0,11	0,063	-0,203
	4	-0,024	-0,17	-0,1	.829(a)	-0,191	-0,196	-0,067	0,06	-0,005	-0,153
	5	0,015	-0,063	-0,017	-0,191	.827(a)	-0,188	-0,136	-0,104	-0,093	0,083
	6	-0,083	0,071	0,001	-0,196	-0,188	.816(a)	-0,272	-0,089	-0,097	-0,025
	7	0,003	-0,109	-0,041	-0,067	-0,136	-0,272	.850(a)	-0,091	-0,063	-0,175
	8	-0,058	-0,082	-0,11	0,06	-0,104	-0,089	-0,091	.849(a)	-0,143	-0,01
	9	-0,03	0,014	0,063	-0,005	-0,093	-0,097	-0,063	-0,143	.767(a)	-0,404
	10	0,046	-0,111	-0,203	-0,153	0,083	-0,025	-0,175	-0,01	-0,404	.750(a)
a Measures of Sampling Adequacy(MSA)											

Analysis of Variance (ANOVA) test was performed to examine whether users' from different countries will have differences in selecting the user's interface design. Table 6.63 shows the sig value less than 0.005, therefore it can be concluded that user's from different countries has different selection in selecting the interface design in accordance to their preference of choice.

Table 6.63 Anova test in Study 4

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	107,288	2	53,644	65,154	0
Within Groups	490,712	597	0,823		
Total	599	599			

6.8.5.2.2 Intercultural communication questions

Users were asked in regards to intercultural communications questions. Most respondents from the three countries answered that they are confident in communicating with people from other cultures as shown in mean value 5.07 and can manage conflict with people that are culturally different from them. Most respondents did not agree to leave the group discussion immediately when they disagree with their group and also slightly disagree to give opinion that will help people save face rather than give a statement of truth. Most respondents agree to say "no" directly when necessary and find it not that important to see other people rank and status. Summary of result is shown in Table 6.64.

Table 6.64 Intercultural communication questions result for all users

Variable	N	Mean	Std. Deviation	Variance
I feel confident that I can communicate with people from other cultures	599	5,07	0,76027	0,578
I can manage conflict with people who are culturally different from me	599	4,67	0,8405	0,706
When I disagree with a group, I would leave the group discussion immediately	599	2,56	1,20489	1,452
I prefer to give opinions that will help people save face rather than give a statement of the truth	599	3,48	1,28969	1,663
I say "no" directly when I have to	599	4,29	1,2311	1,516
I find it important to see other peoples rank and status	599	3,56	1,32819	1,764

The result is then break-down into each country which then compared to see whether there are differences in answers. Users from Indonesia, Malaysia and Germany have similar answers to the question asked regarding their confidence in communicating with other cultures; most respondents agree that they feel confident; therefore working with multicultural team will not become a barrier in term of confidence. Similar response was also attained regarding users' conflict management with people that are culturally different from them. Most respondents from each countries answered agree that they have not difficulty in managing such conflict. Most users answered disagree that they would immediately leave the group discussion when misunderstanding occurs. Users were asked their opinion in the statement "I prefer to give opinions that will help people save face rather than give a statement of the truth", German respondents disagree (2.73) with that statement, while Indonesia slightly disagree (3.39) and Malaysia slightly agree (3.83). Indonesia (4.30) and Malaysian (4.14) respondents mostly answered slightly agree, while German respondent agree with high mean value (4.67), that will directly say "no" when they have to. Malaysian respondent has the highest mean value (3.96) in agreeing that it is importat to see other people's rank or status, Germany with mean value (3,44) and Indonesia with mean value (3.12). Result is shown in Table 6.65.

Table 6.65 Intercultural communication questions for Indonesia, Malaysia and Germany

Variable item	Indonesia		Malaysia		Germany		F	Sig
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation		
I feel confident that I can communicate with people from other cultures	5,18	0,6688	4,97	0,8097	5,1	0,79772	5,082	0,006
I can manage conflict with people who are culturally different from me	4,71	0,7785	4,56	0,8904	4,88	0,80754	5,592	0,004
When I disagree with a group, I would leave the group discussion immediately	2,50	1,1378	2,78	1,2945	2,13	0,97084	11,234	0
I prefer to give opinions that will help people save face rather than give a statement of the truth	3,39	1,3273	3,84	1,1611	2,73	1,17082	30,289	0
I say “no” directly when I have to	4,30	1,3002	4,14	1,1693	4,68	1,1444	7,134	0,001
I find it important to see other peoples rank and status	3,13	1,2885	3,96	1,2005	3,55	1,424	26,585	0

The intercultural communication questions graph is shown in Figure 6.40, as noted above the numerical results correspond to a Likert scale from 1 (strongly disagree) to 6 (strongly agree).

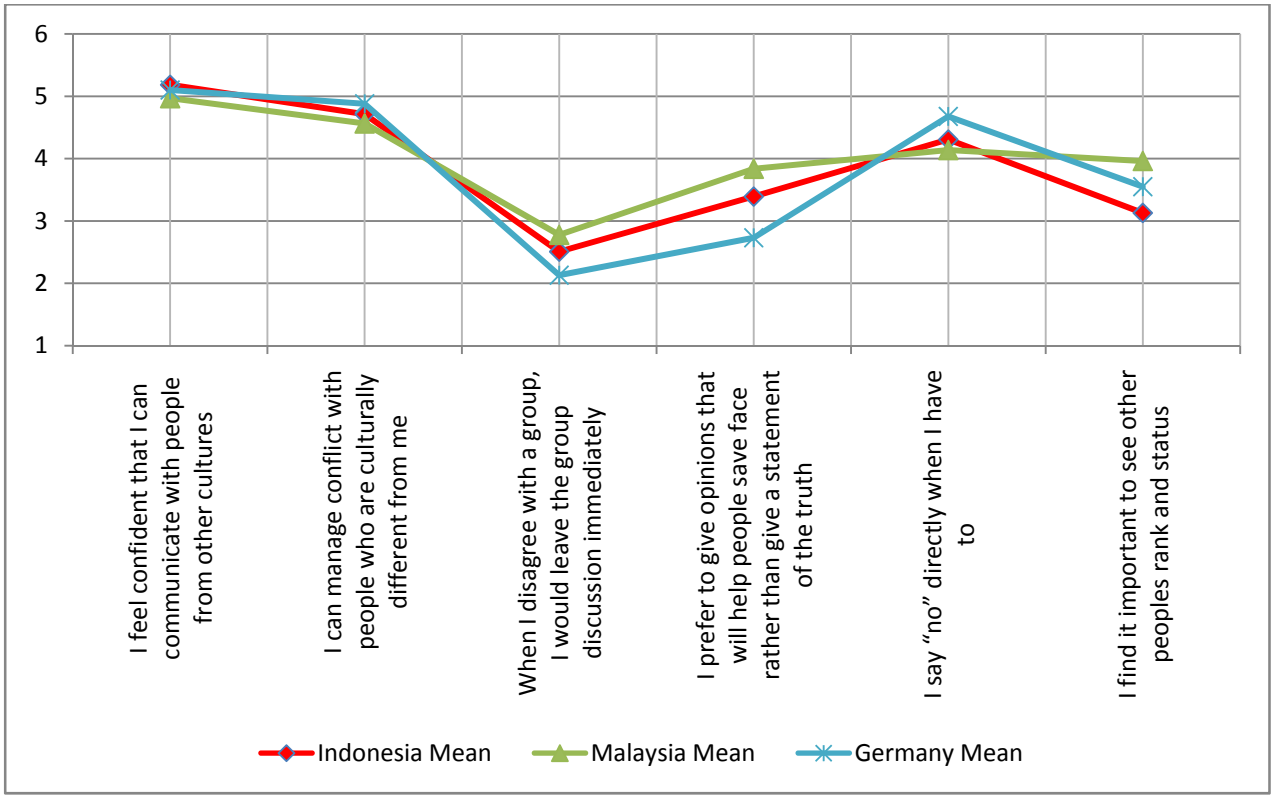


Figure 6.40 Graphic percentages of the intercultural questions

6.9 How cultural factors influence the groupware

The cultural influence in CSCW is multi-faceted; five studies have been conducted to jointly provide a holistic understanding of the cultural influence on users' acceptance and intention of usage for groupware applications. The initial study (CQ) has defined the value differences among countries and relates these characteristic of the countries and will be used as the basis foundation in relation to the cultural factors discussed in this dissertation; the first part (chapter 6.8.2) has examined the acceptance of groupware is influence by user's preference of cultural specific design; the second part (chapter 6.8.3) has investigated the influence of selected cultural dimension toward users intention to use groupware; the third part (chapter 6.8.4) assessed Trompenaar's seven cultural dimension in defining user's expectation of groupware application; the last study (chapter 6.8.5) explored the HCI point of view toward the interface design of groupware. To provide an integral understanding of the cultural influence in groupware acceptance, this subchapter summarizes the interpretation of findings and implications of the four parts of studies.

As the world is becoming a global marketplace, collaboration is critical in today's global industries and market. People work in distributed development teams, in which collaborators may be located, distribute across the country. User are forced to work effectively and efficiently using various interaction tools such as teleconferencing, e-calendar, email, IM, chat, blogs, and wikis to collaborate. Designing for collaboration is a challenge due to the numerous factors of etiquette, trust, and responsibility. It is becoming more common to release a software product in many different languages and the issue of cultural localization is rapidly becoming more important. Designing global products inherently brings the responsibility of respecting other's values and traditions [18] .

In many ways, culture affects our context of use and our perceptions. National culture impacts individuals' cultural values, which in turn influence technology acceptance [214]. Users from different culture have different perception of preference of groupware features that determine the intention to use. The cultural dimension used in the studies examined how the cultural orientation impacts users' perception prior to their actual usage of the groupware application. Differences in culturally background can be observed in the collaborative application even though social presence is limited. The perceived advantages of collaborative technology and attitude toward e-collaboration can vary significantly among individual adopters of different cultural backgrounds [215]. Groupware as a collaborative system is one of the area in which technology and usage are reflected by social influence processes. Research informing the role of social influence processes in technology acceptance and usage behavior is also relevant in certain context of the actual technology utilization by its users. In the adoption of new technology such as groupware, it is needed to study how social influences shape user's attitude. Varying configurations of people, technology, organization, and cultural elements are difficult to combine effectively to produce maximum outcomes in globally distributed collaborations.

People from different cultures are different in how they see the world. People of different cultures use different databases, different operating environment, run different software and process information differently to get to what are often different goals, which makes research in collaborative interfaces can be more complicated than in single-user interfaces, especially when it is designed for multicultural users to use. Studies of anthropology and social science related to culture are needed to understand the reason why user from different culture would react and behave differently toward an interface preferences. The operation of groupware as an intercultural application requires a level of collaboration, coordination and cooperation that cannot ignore the impact cultural diversity plays and the barriers that it may creates. Collaboration takes time, effort, and motivation; groupware developers and designers are challenged to persuade users to participate in the actual use of the system.

This dissertation has compared users from East Asia (Indonesia and Malaysia) and Europe (Germany) to explore the differences in users' perception triggered by selected cultural dimension, in regards to features, tools and interface in groupware environments. According to Richard Nisbett (2003), Western and Eastern (especially East Asia) are different. East Asians and Westerners perceive the world and think about it in very different ways. Westerners are inclined to attend to some focal object, analyzing its attributes and categorizing it in an effort to find out what rules govern its behavior. Rules used include formal logic. Causal attributions tend to focus exclusively on the object and are therefore often mistaken. East Asians are more likely to attend to a broad perceptual and conceptual field, noticing relationships and changes and grouping objects based on family resemblance rather than category membership (Nisbett, 2003).

Cultural differences that exist between different countries may affect multinational organizations' ability to adopt and utilize IT. In the movement toward globalization of markets and corporate multinationalism, cross-cultural research needs to be more increasingly conducted. Davis et al. (1992) underscored that the role of social influences in information technology acceptance and usage represented an important area for better understanding of 'real world' applications of TAM. TAM has been widely applied in technology assessment with reliable result when users have worked with the technology over time. In the first and second study, analyses of studies provide evidence on how culture plays an important role toward the acceptance of groupware. Groupware is a social technology [35], where groupware is specifically designed and developed to support group of users working together in order to achieve common goals. With this in mind, the usage and the acceptance of groupware is not only dependent on what one user thinks and believes, but what other group members think and believe as well. In this research, the intent was to predict user's acceptance of a cultural designed groupware through the lens of the TAM by adding cultural factors that influence specific design preference to the model and explore whether user's are willing to adopt and use groupware application with cultural-influenced interface design. TAM explained how an individual's adoption of information technology is dependent from their perceived ease of use and perceived usefulness of the technology. TAM therefore provides a useful guidelines and reference point to investigate the influencing factors of a groupware adoption/usage.

Culture is a construct that is not directly accessible to observation but inferable from verbal statements and other behaviors, and useful in predicting other observable and measurable verbal and non-verbal behavior [107]. The consideration of culture, as a social influence and how it affect the commitment of user toward the use of groupware system seems important for understanding, explaining, and predicting system usage and acceptance behavior. The findings in Part 1 suggest that cultural influence play an important role in determining the acceptance and usage behavior in adapting new collaboration technologies. User's individual cultural orientation contributes to the way in which users will use and accept groupware. The result of this empirical study validates the proposed research model and hypotheses, and demonstrates that the hypotheses can be supported. Cultural specific design preference influences user's preference of system usefulness and user's perception of system ease of use. When users get greater satisfaction with culturally design interface system (e.g., it is interesting, not too hard, and meets the needs of users at different levels), the stronger their feelings about its usefulness and ease of use. In term of ease of use, it is when the system design is developed in a more culture-friendly form, users will feel more comfortable and find the system familiar and easier to use.

In this study, it shows that TAM provides explanation for groupware adoption and usage in all three countries studied, although with less effect for Germany. Relationships among primary TAM constructs found in this research are largely consistent with those typical in previous TAM research.

The only finding in this research inconsistent with previous TAM research concerns the perceived usefulness and how it affects users' satisfaction in using the application. This is in line with Malhotra & Galleta's (1999) research, whereas when TAM is applied to collaborative system, it is often observed that the belief structures (perceived ease-of-use and perceived usefulness) are not stable [85]. The impact of usefulness in user's attitude of satisfaction on user's anticipated application use behavior is not as strong as that of user's belief on ease of use in user's attitude of satisfaction in using groupware. It shows that user's would be more intended to use a system that is easy to use rather that useful but complicated to use, especially since modern applications are becoming more and more sophisticated. In terms of user-interface design, an application that is comfortable and easy to use user-centered and culturalized interface should be designed.

The findings demonstrate the existence of cultural differences in terms of users' specific interface design preference acceptance. The differences found in each culture can be concluded that culture does play an important role in determining users' preference in working with a groupware application. Not only do users (from all three countries) have different preferences in design features, but there are also differences in the acceptance process, although cultural specific interface design preference is significant only for Indonesia and Malaysia. It is interesting though to see that the acceptance process seems to flow differently from the two Asian groups (Indonesia and Malaysia). It seems that Indonesian users find usefulness a more important variable, while Malaysian users find ease of use as more important. For the Indonesian user, acceptance is routed through cultural specific design preference, usefulness, attitude of satisfaction, and system usage. However, for the Malaysian it seems to move strongly along the ease of use side of the model. The "usefulness" path shows weaker significant relation compare to its "ease of use" path and the anticipated application use behavior did not show any significant relation to the system usage. It seems that the Indonesian user is more satisfied by the usability of the system rather than the easiness of the system, especially since the system use behavior and system usage is also affected by the system usefulness. On the contrary, results suggest that Malaysian attitudes of satisfaction are attributable to user's preference and perception of system ease of use. System use behavior is attributable to attitudes of satisfaction, as expected. This suggests that Indonesian will be willing to try to cope with a useful interface design, even when it rather complicated to use. Malaysian, however, will tend to give up more easily when an interface is hard or complicated to use. Also, Malaysia's perception of ease of use influences anticipated system use behavior. This implies that when users find a groupware system that is easy to use, they will also be satisfied in using the system. In the Indonesian model as elsewhere [216–219], perceived usefulness is the key aspect of adoption in comparison to perceived ease of use. For Indonesian user, preference of system usefulness influence their attitude of satisfaction implies that when preferences for the design features are met, users will be satisfied with the groupware application usage. There seems to be no need to find out whether the system is easy to use. Maybe Indonesian users find that their demands for ease of use are met when the system is designed the way they want it to, in which certain functionality levels must be met.

One interpretation that can be used for this study is that as the groupware system become easier to use and users become more aware in the usage of the technology, the variation perceived ease of use dimension is reduced. The most interesting observation with the German users is that culturally design preference shown no significant relation to user's belief of usefulness and perception about system ease of use. Although result shows usefulness and ease of use seem to drive attitude of satisfaction, the German model indicated a non-significant relationship between cultural preference to both usefulness and perceived ease of use. Also, only satisfaction of usefulness show significant relation towards users anticipated system use behavior. This may suggest that the German user perception of usefulness and

ease of use are not dependent to the design of the system that is made customized for multicultural users. This would suggest that German users put more emphasis on the functionality provided by the systems than on the way the interface system is designed. The findings that different users from different countries form different path through the research model (Table 6.66) supports the assumption that groupware acceptance is indeed influence by culture.

Table 6.66 Culturally based acceptance paths

Indonesia								
Design preference	➔	Usefulness	➔	Satisfaction	➔	Intention to use	➔	Usage
Malaysia								
Design preference	➔	Ease of use	➔	Satisfaction	➔	Intention to use		
Germany								
	➔	Usefulness and Ease of use	➔	Satisfaction	➔	Intention to use		

Intention to use is an outcome variable used to determine whether users are willing to adopt the groupware system. System usage is the actual usage of the system. In other words, the more users feel that a system is useful; the stronger will be the intention to use the groupware application. In terms of the total effect of intention to use a groupware application, perception of system ease of use has the strongest effect then the perceived of system usefulness when examined to the whole sample of countries. This shows that user's from the three countries tested; most users prefer to use an application that is easy to use rather than useful in supporting their daily work activities.

The research model in Study 2 was based on an extension of the technology acceptance model with incorporating constructs of cultural dimensions by Hofstede and Edward T. Hall to capture user's preference of a groupware design. The result of Study 2 suggest that high-low context, collectivism-individualism, uncertainty avoidance and power distance influence user's perceived of usefulness and ease of use. The constructs perceived usefulness and ease of use are determinant of attitudes and intentions to use new groupware technologies. Given that those with cultural factor orientation, user would accept tools that they perceive will help them accomplish their goals. The results demonstrate that user will have a positive attitude towards the use of groupware by designing the applications that are tailored to what the users' want; users will feel more incline to adopt the groupware application. Therefore designers and developers of groupware systems must focus on the targeted user's goal demand and orientation.

Hall's low and high context focuses upon cultural differences in communication process [108]. Context refers to the amount and specificity of information in a given situation. Visual communication on groupware application is expressed through the use of video conference. This analysis is examined how the uses of different communication tools differ between high- and low-context cultures. High-context communication implies that little has to be said or written because most of the information is either in the physical environment or internalized in the person; therefore can be concluded as an indirect and not to the point of communication style. Low-context communication implies that the mass of information is made explicit and needs more additional information described, therefore can be concluded a communication that is direct or to the point. Users belonging in high-context culture will have strong perception of Groupware usefulness than those in low-context culture. Hall's (1976) description of low-and high-context cultures can be argued that there is greater need for coordination of activity in high-context cultures than in low-context cultures; therefore, there should be a

correspondingly greater degree of need for collaboration within group members with the usage of a groupware. Since high-context oriented individuals prefer less coded messages, the electronic communication, implying very explicit context, will not be very useful as a means of communications. It cannot inform the receiver on the context of the message. From the CQ study, result shows that German has the tendency to be included in the low context, while Indonesia and Malaysian in the high context culture. Users that belong to the high context culture will prefer to have flexible and extendable session timing, while user in low context culture will prefer to have fixed session timing in which give a defined timing prior to each start of the session. In regards to this assumption users was asked whether or not they will prefer to have a moderator that control the flow of the meeting. Without having a moderator to control the flow of the session, users will have the flexibility to adjust their session timing. Users that belong to the high-context culture will use emoticons to express feelings and emotions, and use video conferencing tools rather than chatting tools. Users belonging to high-context culture would probably use emoticons more often than people from low-context culture. High context culture would also prefer to use video or audio, while users that belong to the low-context culture will prefer to use the chatting tools, whiteboard, word applications, or audio only for collaborations.

In high individualism cultures, the ties between individuals are loose, people are expected to look after themselves, and the individual's rights are seen very important. In low individualism cultures, or in collectivism cultures, we find people are integrated into large, strong, cohesive groups [70]. In their research, Paul et al. (2005) concluded that a collective orientation is related to enhanced collaboration [220]. In Hofstede's study, Germany scores high on individualism [112]. In high individualism cultures, the focus is on individual performance and responsibility. Germany is categorized as an individualist country, while Indonesia and Malaysia, is categorized belonging in the collectivistic culture [112]. The result of the CQ study also shown that Germany scores higher in Individualist, while Indonesia and Malaysia tend to be a culture with collectivist when it comes to group-oriented, therefore it can be concluded that Germany has the tendency to be included in the individualist culture, while Indonesia and Malaysia have the tendency to be included in the collectivist culture. Organizations are symbolic entities; they function according to implicit models in the minds of their members, and these models are culturally determined [112]. According to Hofstede in his book Culture Consequences, the crucial dimensions are power distance and uncertainty avoidance; power distance is involved in answering the question of who decided what, and uncertainty avoidance is involved in answering the question how one can assure that what should be done will be done [112], power distance with "concentration of authority" (centralization) and uncertainty avoidance with "structuring of activities" (formalization). Any organization in any culture depends on the performance of people. In collectivist (low-IDV) countries, social harmony is an important aspect for organization to function, it is even more crucial than formal performance, therefore users were also asked regarding their opinion to this statement: "I like to see a message pop up, when I did a mistake" and "I like to see a message pop-up when the other users make a mistake".

Bandura (1997) suggested that self-efficacy can be shaped by either direct experience or through observing the experience of other. Therefore in individualistic cultures, computer self-efficacy is more likely to be shaped by user's prior experiences with IT, while in collectivist cultures it is more likely to be shaped by user's observations of and interactions with members of the user's work group. Germany as an individualistic societies, perceptions about the usefulness of IT are likely to be based on beliefs about how the system affects the individual's job performance rather than how it affects the performance of the group. Individualistic societies tend to believe in personal control and individual achievement, therefore users in individualistic culture accept task accomplishment as their personal responsibility. Perceived of usefulness for collectivistic culture are made based on the extent to which

IT technology is seen to enhance the task performance of individuals. On the other hand, in collectivist culture such as Indonesia and Malaysia, the group or work team rather than individuals is seen as responsible for accomplishing tasks. This lead to perceive of usefulness of the use of IT technology, in this case groupware is seen to enhance the task performance of the groups. This is in line to the proposed hypothesis, where Indonesia and Malaysia, as high context culture will have strong perception of Groupware usefulness.

Triandis (1986) argues that collectivistic cultures focus on the in-group and individualistic cultures do not [186]. He contends that the larger the number of in-groups, the narrower the influence and the less depth of influence. In terms of group composition, this will affect the group size that user will allow when a session starts in the groupware. Users that belong to a high rating of individualistic culture, the tendency to limit the group occur, and will not allow a non-invited user to enter and join a session. Invitation to join a session would be made by sending individual invitation. On the other side, users that belong to a high rank of collectivistic would have the tendency to send an invitation to a mailing list (so that everybody in the list are invited) and will not limit the group size. Also users of this type would allow late joiners (late participants that request to join the session even if the session have already been started) and allow early leavers (to leave the session even when the session is not finish).

In collectivistic culture, decision making are usually done collectively using voting or the group's majority voice. This may affect potential groupware users in collectivist cultures will likely to polling or voting tools to form a consensus in obtaining a decision [221]. To avoid conflicts, polling tools will be useful for this type of user to be able to obtain a fair result of discussion whenever ambiguity persist. Users that belong to collectivistic culture will make use of the polling or voting tools as one of the tool for decision making. Shown by the Table 6.67, Indonesia as a collectivist culture proved that survey/polling tool will be most likely to be used as one of the feature in a groupware application. The percentage graph is shown in Figure 6.41.

Table 6.67 Survey/polling tool feature result

Feature	ALL	Indonesia	Malaysia	Germany
Survey/polling tool	24.4%	31.8%	16.7%	27%

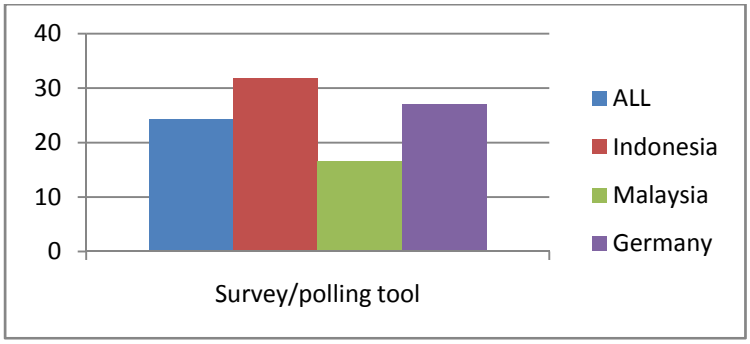


Figure 6.41 Graphic of survey/polling tool feature

Uncertainty avoidance is defined as the degree to which people in certain culture prefer structured over unstructured situations [185]. Uncertainty avoidance is also defined by Hofstede as "the extent to which members of a culture feel threatened by uncertain or unknown situation" [112]. Individuals from countries with stronger uncertainty avoidance indexes are more inclined to avoid risks, enjoy working with tight rules and control systems and resist innovation. Team members are likely to enjoy tasks requiring precision, on time/punctuality, and comfortable with detailed planning. While individuals from countries with weaker uncertainty avoidance enjoy innovation, accept higher risk levels and are comfortable with open-ended learning situations. The team members tend to resist stress better. Having a good mix of people from different countries in the team project allows the companies or organization of a brainstorming exercise. The understanding that team members may have different tolerance levels for ambiguity or uncertainty will assist us in determining the level of details required for the rules of collaboration when working as a global team.

High UA cultures try to minimize uncertainty and are inclined to support rules and regulations, to avoid risks and are intolerant of persons with divergent ideas [222]. This dimension reflects the resistance to change and the attitude to take risks of individual from different countries. Users belonging in Low UA will make use of all the provided tools available in the groupware. Low UA cultures are more the risk takers; it can then be assumed those users are more of the "experiment" type. Individuals in high uncertainty avoidance cultures are uncomfortable with ambiguous and uncertain situations therefore they will be expected to reduce uncertainty. Since groupware doesn't allow the social presence, it could accentuate the feeling of uncertainty. Consequently, users' in high uncertainty avoidance cultures will be less oriented to use IT than individuals in low uncertainty avoidance cultures.

Generally, a high UA indicates the society's low level of tolerance for uncertainty [116]. In a country with low UA characteristic, societies are open toward changes or ready to accept changes. Users belonging to the high UA culture are tend to be more rigid type of person and would have the tendency to work using the default setting. Users are the type that are strictly following the rules, since user belonging to this culture resist change more, therefore would like everything to do in order and using the default setting. On the contrary, users belonging in the low UA are more of the flexible type of individuals and more of a risk taker. User of this type would prefer to be able to configure or set up the configuration manually based on their taste and preference. Users are also the type of individuals that have the tendency to ignore rules therefore all settings of the groupware should be made flexible.

Power distance is the acceptance of inequality between a less powerful and a more powerful individual, where both belong to the same social system [112]. This dimension reflects the extent to which less powerful members of organizations accept an unequal distribution of power. An example of a low PD cultural norm is that all members should have equal rights, and that subordinates and superiors are equal [112]. This dimension reflects how individuals from different cultures handle the fact that people are unequal, and how the team leaders or the project stakeholders are likely to be involved in the decision-making process. According to Hofstede's result, Malaysia has the greatest power distance index. Indonesia is also categorized under high power distance, while Germany is considered to be in the low power distance culture. Surprisingly, the result in the CQ study shows that there might be a shift in culture, survey results shows that most Indonesian and Malaysian respondents agreed that there is no distance or gap between different levels, or in other word different levels are treated to be equal, which show that the PD score for Indonesia and Malaysia should be low. Germany stays consistent with the previous findings by Hoftede (2001), in which has the tendency to be a low PD culture.

In culture with high power distance, the relationship between the boss and the subordinate is strictly ruled and dependent on the decision of the boss. This will affect the usage of the user profile in a groupware application. Since rank and status is important, user would like to have the ability to view other user's profile, whether or not that person may have high influence on decision making during the running session. Power distance dimension was also asked in regards to user's perceived ease of use on the windows screen layout, whether user would like to have a distinction between the boss and the subordinate shown in the application (i.e. the boss/project leader's has a bigger size of windows screen) and users opinion regarding the question "I find it important to see other peoples rank and status".There is also a distant between boss and subordinate in culture with high PD, which usually make higher level of participating users (such as the boss) to have special treatment, such as the size of the video screen on the groupware interface layout would be more acceptable if it can be adju*sted to be larger than the subordinat*e. Features that have significant impact on application awareness such as colour coding, user's profile information, and adjustable video size will be very useful for users that belong to the high PD.

The research was also designed to assess the cultural dimension of user's preference of a groupware design; beside cultural dimension by Hofstede and Hall, selected cultural dimensions from Trompenaars were examined to judge their impact on key constructs in the research model. In regards to Trompenaars' synchronic vs. sequential dimension or how user prefer to perform task, users would be more satisfied if the groupware application is designed in a way that it would be able to run several features. As seen from the result in Chapter 4, synchronic behavior in running several features in one application becomes a common cultural element.

Ascription vs. achievement is Trompenaars dimension that defines the way we seek to have control over our own lives and over our destiny or fate. This relates to determine whether user wants to be in full control to configure and adapt the application or just accept the application as provided by the developer. Respondents from Indonesia and Malaysia find it easier for them to follow a template when using the application rather than exploring on figuring out how to do it by themselves. This is on the contrary with the German respondents, they prefer not to use the template and design it by themselves, which shows that user wants to be in full control to configure and adapt the applications.

Universalism vs. particularism dimension by Trompenaars is used to examine whether user would prefer a universal interface of a particular design. Indonesia and Malaysia respondents find it important to have an interface that is adapted to their culture and prefer to have an interface to be adapted to their culture. This can be predicted, since Indonesia and Malaysia belongs to the particularist culture [119], although they also thinks that culturally adapted software would take more time to learn rather than universal software design for everybody in the world. The result of the German respondents on the contrary, respondents did not agree to have software that has an interface adapted to their culture since it is not an important matter to have such an interface. This is probably since Germany has the tendency to belong to the Universalism culture, that's why the German respondents prefer to have a universal interface rather than an interface designed particularly for them.

Trompenaar's dimension of individualism vs. communitarism is examined, this dimension will relate to the context of awareness. One important concept defined in groupware application, is the concept of awareness. With awareness, user will be able to increase communication opportunities in a distributed workspace. Awareness is defined as an understanding of activities by other users, which also may provides a context for your own activity [33]. This context is used to ensure that each individual contribution of users is relevant to the group activities and to evaluate actions of each individual with

respect to the groups' progress and goal. In term of this awareness concept, users were asked whether it is important to see what the other teammates are working on, respondents from Indonesia and Malaysia agree that it is important, but German respondents slightly disagree. Respondents from Indonesia and Malaysia mostly agreed that they would like to see a message pop-up when they perform a mistake, while German respondents prefer not to be notified when they perform mistakes by a show of a pop-up message. This reaction is also similar to when other user perform a mistake, respondents from Indonesia and Malaysia also mostly prefer to be notified, and the German respondents on the contrary.

In terms of specific vs. diffuse cultures, Trompenaars researched differences in how people engage with colleagues in similar or multiple areas of their lives, classifying the results into two groups: people from more specific-oriented cultures tend to keep private and business agendas separate, having a completely different relation of authority in each social group [119]. Germany is defined by Trompenaars, as a culture that has the tendency to be specific [120]. Most German respondents answered slightly disagree to have a private chat option in order to chat with certain users to during discussion group, perhaps they would most likely differentiate between business and personal matters during working discussion session. But surprisingly, when asked regarding user's opinion on the statement "I would rather to focus on a task than a personal relationship", most German respondents slightly disagree to this statement. Therefore, it can be assumed that they would value personal relationship rather that task. This is also similar to the question asked regarding user's opinion on the statement "I find using a technology for producing work is more important than for establishing relationship", the mean value for German respondents is the lowest among the other countries, which explains that for German respondents establishing relationship is more important than producing work.

Diffuse cultures tend to have a large personal side to people's lives. This is reflected in their business relationships. Diffuse cultures put personal relationship ahead of task or business matters. Indonesia and Malaysia tend to be included in diffuse culture, they would like to have a private chat option (to chat with certain users) during discussion group [1]. Diffuse culture will tend to prioritize personal relationship rather than business. Most Indonesian and Malaysian respondents, in comparison to the German respondents, preferred to use familiar software than to use software that may have many features that they need but too complicated to use.

Affective vs. neutral dimension was examined to understand whether users will have the tendency to display their emotions about usability problems. Trompenaars defined Indonesia has the tendency to be in the neutral culture, while Malaysia to be an affective culture, and Germany is positioned in the middle [120]. In terms of emotions, most Indonesia and Malaysia respondents agreed that they would prefer to give opinions that will help people save face rather than give a statement of the truth. German respondents mostly disagreed and would prefer to give a statement of truth despite of the fact that the statement may offend the other party. Indonesia respondents showed the most in strongly agreeing to use emoticons to express their emotions (e.g. smiley) in comparison to Malaysia and Germany. In an affective culture, it is acceptable for people to show their feelings, while in a neutral culture the expressing of feelings is controlled and individuals are not encouraged to publicly display their emotions. According to Trompenaars [118], people from neutral cultures control their feelings but can suddenly explode during stressful periods. While people from high affective cultures, use all forms of gesturing, smiling and body language to openly voice their feelings. Most respondent answered agree to have an emotional awareness (mood indicator) of the other user's reaction when they are presenting a document or presentation. An example of an emotional awareness is when an indicator is present that shows whether or not the other users understand or doesn't understand to the material being presented. No significant difference was also shown by the respondents in the question asked

regarding the importance of performing well on the application when other people can see then working.

The result shows that most Indonesia and Malaysia users agree, while most German users slightly disagree, to have an interface that is adapted to their culture. This may be related to Trompenaar's dimension of Universalism vs. Particularism, in which Indonesia and Malaysia has the tendency to belong to the Particularism culture that often searches for differences, for unique and exceptional forms of distinction that render phenomena incomparable and or matchless quality. It shows different result of user's expectation since each country also answered differently on how they find it important to have an interface that is adapted to their culture. Indonesia and Malaysia shows almost similar result, in which most respondents agree, on the other hand, German users mostly answered slightly agree. Most Indonesian and Malaysian users agree that they will refuse to use an interface that has materials or features that is not suitable for their culture. German respondents show that they disagree, they will not refuse an application that is not suitable for their culture, and this may be understood well. According to Trompenaars, Germany has the tendency to belong to the Universalism culture.

Culture influences the interface design of a groupware system based on user's preference [19], [180], [181]. In terms of interface design preference, the average Asian's respondent for both Indonesia and Malaysia, prefer to have strong bright colors for the interface design of a groupware application. On the other hand respondents from Germany, prefer not to have strong bright colors. Asian respondents, both Indonesian and Malaysian, like many different colors in comparison to German respondents. All respondents have the same preference for having windows that divide screen into areas and have online help available at all times. Indonesian and Malaysian respondents also agree that they prefer to have pop-up menus that appear when user clicks on a particular area of the screen, whereas German respondents answered to only slightly agree. Most respondents, although with different level of agreement, mostly agree to have pulled down menus that are dragged down from the top of the screen. Indonesia and Malaysia as countries that belongs to the Polychromic culture, which tend to do things more than one simultaneously, agree to prefer to have an application that can show multiple windows. As predicted, Germany as a country that has the tendency to belong to the Monochromic culture, disagree to have multiple windows while working on an application. German users mostly disagree to have multiple windows (one window on top or the other); this is consistent on the German's cultural dimension of monochromic culture.

Underlying cultural assumptions affect the different approach to work collaborately within virtual team work. Different cultures have different approaches in collaboration techniques. Similarly in group interaction situations, for example, user underlying individualistic or collectivistic traits affects their approach to team work; the cultural norm in building relationships and the cultural views of status within society affect the interaction techniques within the level of hierarch in the organization. In regards to the intercultural communication questions, users from Indonesia, Malaysia and Germany have similar answers to the questioned asked regarding their confidence in communicating with other cultures; most respondents agree that they feel confident; therefore working with multicultural team will not become a barrier in term of confidence. Similar response was also attained regarding users' conflict management with people that are culturally different from them. One of the questions asked was "I can manage conflict with people who are culturally different from me". Problems sometimes can occur within people from different cultures, and these problems are difficult to solve because people may not realize how influenced they are by their culture until they meet people from other cultures and conflict occurs [223]. The lack of common native language also may lead to further barriers to communication. It is very important to understand what types of differences you can come across when working with global team. Most respondents from each countries answered agree that

they have not difficulty in managing such conflict. Most users answered disagree that they would immediately leave the group discussion when misunderstanding occurs. Users were asked their opinion in the statement "I prefer to give opinions that will help people save face rather than give a statement of the truth", German respondents disagree with that statement, while Indonesia slightly disagree and Malaysia slightly agree. Indonesia and Malaysian respondents mostly answered slightly agree, while German respondents agree with high mean value, that will directly say "no" when they have to. Malaysian respondents has the highest mean value in agreeing that it is important to see other people's rank or status, Germany with mean value and Indonesia with mean value.

One of the failures of the previous groupware application is that the system was not build or was not well designed for the target users. Previous research stated that most people must adapt to the technology rather than adapting to its needs [18]. Our research shows that user's would actually prefer an application or more specifically a groupware application that has cultural aspects adapted in its design. This research shows that culture did influence user preferences in the interface acceptance of a groupware application.

6.10 Creating a Cultural Synergy Groupware

"Bhineka Tunggal Ika" Unity through Diversity (National Motto of Indonesia)

The problem motivating this dissertation was that the need for supportive and reliable collaborative application is critical. As mentioned in Chapter 1, at the University Duisburg-Essen Germany, a synchronous groupware named PASSENGER has been developed at the Institute of Computer Engineering throughout the last years [8], but the system has not applied any social aspect which allow multicultural user to collaborate conveniently. One important aspect in designing a groupware is how the social process of a group functions and to embed that process into the system. This research suggests solutions on how to support cultural differences in the interface design and tools that support for collaboration among culturally diverse users in order to develop strategies for groupware developers and designers for greater effectiveness in a global setting, an enhanced sensitivity to cultural differences.

Each culture has its own taste and preference. Users from different cultures have different opinion and preference on what a collaboration application should be designed in order to be fully utilized by its users. The coexistence of cultural differences in teams can only be achieved when virtual team members recognize and respect each other's cultural differences [70]. Culture influences interpretation of communication. For example, polite expressions of acknowledgement by Asian engineers could be misinterpreted as agreement or commitment by their European or American colleagues (Herbsleb and Paulish 2005). Culture also affects interpretation of requirements; domain knowledge used to fill in gaps or place requirements in context varies considerably across national culture (Herbsleb and Paulish 2005). Different culture may interpret communication in different ways. Less profiency of language may cause team members to feel inhibited from asking for clarifications due to fear of looking stupid, resulting in incorrect assumptions. Culture also interferes with collaboration when national norms result in conflicting approaches to problem solving. In the study conducted by Herbsleb and Paulish (2005), American and European engineers were observed to have different views on the value of "up front" design, with Europeans tending toward more initial design effort, and Americans preferring to preed quickly to implementation, the difference in approach caused conflict and negative impressions. Cultural differences can occur even when teams share a common language and nationality; differences in "corporate culture" can lead to conflicting

approaches to problem solving and communication, which in turn might be misinterpreted as rudeness and incompetence [224].

A groupware system is visible if the functionality offered by the system and its state of use can be displayed to the users. It should provide adaptive, user-customizable graphical user interfaces and support cooperation among geographically dispersed users [225]. Face-to-face meetings, discussion boards, team working on a project development should all be able to run in a collaboration application. Collaboration tool should also facilitate awareness of partner's gaze and body language and enhances trust-building eye contact trough web camera [43]. It should be able to replace "real world" activities into virtual activities. Several studies note that language skills, culture, and personality affect individual preferences for communication technology [226]. Rich synchronous communication technology such as video conferencing is appropriate for highly interactive discussions where body language and intonation can convey the degree of understanding among participants [227], it is also seen as the best solution for meetings in which reaching agreement is the objective [228] (Bhat, Mayank, and Murthy 2006). Language skills can also influence media choice. Users with weaker English will prefer asynchronous forms of communication (such as email or instant messaging) over telephone or video conferencing; because they provide more time to compose a response.

Cultural values and norms differ from one culture to another [229]. The findings in this research suggest that cultures differ with respect to their preference, behavior, and how users participate in social media activities. Groupware system interface therefore should be designed user-oriented, which include social and cultural factors as the determinants of success, especially when an application is design for multicultural user. User preference when working with a groupware can affect the performance of their work and the system usability. When users work with their preference setting, it will make them feel comfortable in the virtual environment. Hofstede [112], Hall [108], and Trompenaar's [230] research on cultural dimensions provides a theoretical foundation for exploring the impact of cultural differences on the adoption of IT-based innovations such as groupware application. The dimension collectivism – individualism relates to whether user prefers to work and decide in groups versus alone; people from some culture prefer to make decision individually, which people from other culture prefer to make decision by consulting with a group or forming consensus. Uncertainty avoidance could affect technology acceptance by influencing choices of computer-based media versus traditional media and cultural differences in uncertainty avoidance, specifically, could affect the way in which individuals choose media for their communication tasks [3]. For high UA culture, anxiety is released more through the showing of emotions. In the contrary to the low UA culture, anxiety is released more through passive relation, and emotions are supposed to be controlled. Users belonging in the low UA culture are more of the loosely type of people and more a risk taker. User of this type would prefer to be able to configure or set up the configuration manually based on their task and preference. Low UA users are more tolerant or different opinion and have fewer rules. In high UA cultures, communications needs to be clear, explicit, and based on facts. Work in low UA countries is oriented toward relationships, whereas work in high UA countries is oriented toward the task [112], and therefore the degree of UA in a culture may be related to what interaction behaviors are seen as important. User from a low context country should have a greater need for explicit information in the form of text; on the contrary, user belonging in a high context would prefer pictographic or symbolic representation. Polychromic or parallel oriented users would prefer to work multitasking. Monochromic or sequential users prefer to perform one action at a time in sequence. Affective vs. neutral dimension shows how important it is for user to perform well in front of the others. Some cultures should feel more comfortable with a privatized interface that will not show clearly to others that users are making mistakes (via beeps and display items). Diffuse vs. specific

dimension described that people from diffuse cultures prefer that business relationships also be of a personal nature, while specific oriented people want to keep personal and business relations strictly separate. Decision in particularistic culture are based on personal trust, while in universalistic culture on written contracts and strict enforcement of rules are preferred regardless of relationships. Therefore features and functionalities in a groupware design such as standard communication protocols might need to be more or less dependent on formal constraints, depending on which type of culture the interface is designed for. Most people must adapt to the technology rather than adapting to their needs [231]. Since there is not enough effort to adapt software culturally, people from other cultures tend to adapt to the technology [197]. Therefore, groupware application should be adjusted for these factors.

Table 6.68 summarizes how cultural factors should be taken under consideration in the context of groupware acceptance. It is important to know what a person needs and wants in order to support their daily work activities, because on this basis she/he will decides to adopt or not [180]. System designers and developers therefore should be aware of these differences in order to have their system to be useful.

Table 6.68 Cultural factors in consideration in the context of groupware

Cultural Factor		**Implication to groupware design**
High Context vs. Low Context	High Context	- Strong perception of groupware usefulness - Prefer to have flexible and extendible session timing - Prefer not to have moderator to control the flow of the session - Use emoticons to express feelings and emotions - Use video or audio conferencing tools - Prefer pictographic or symbolic representation
	Low Context	- Less perception of groupware usefulness - Prefer to have fixed session timing in which given a defined timing prior to each start of the session - Prefer to have a moderator that control the flow of the meeting - Less usage of use emoticons to express feelings and emotions - Prefer to use the chatting tools, whiteboard, word applications, or audio only for collaborations - greater need for explicit information in the form of text
Collectivism (Communitarism) vs. Individualism	Collectivist (Communitarism)	- Usefulness of IT are likely to be based on beliefs about how the system affects the job performance of the group in enhancing the task performance - The whole team is responsible for accomplishing tasks - To work and decide in groups (consulting with a group or forming consensus) - *In terms of group composition*[225] - The tendency not to limit group size (open group size) - *In terms of participation* [225] - Will allow a non-invited user to enter and join a session (dynamic) - Make use of the polling or voting tools as one of the tool for decision making - *In terms of awareness* - it is important to see what the other teammates are working and prefer to see a message pop-up when they perform a mistake
	Individualist	- Usefulness of IT are likely to be based on beliefs about how the system affects the individual's job performance rather

		than how it affects the performance of the group (in enhancing the task performance of individuals) - Accept task accomplishment as an individual personal responsibility - Prefer to work and decide alone/ individually - *In terms of group composition* [225] - The tendency to limit group size (closed group size - joining need confirmation) - *In terms of participation* [225] - Will not allow a non-invited user to enter and join a session (static) - Not relying on polling or voting tools for decision making - *In terms of awareness* – it is not important to see what the other teammates are working and would not prefer to be notified when other user perform a mistake
Low Uncertainty Avoidance (UA) vs. High Uncertainty Avoidance (UA)	Low UA	- Have the tendency to make use of all the provided tools available in the groupware - Have the tendency to ignore rules therefore all settings of the groupware should be made flexible - Prefer to be able to configure or set up the configuration manually based on their taste and preference
	High UA	- Have the tendency to use less of the provided tools available in the groupware - Minimize uncertainty and have the tendency to strictly follow the rules - Resist change more, therefore would like everything to do in order and using the default setting
High Power Distance (PD) vs. Low Power Distance (PD)	High PD	- *In terms of "User Info" feature* - Have the ability to view other user's profile - *In terms of Window size* - size of the video screen on the groupware interface layout would be more acceptable if it can be adjus*ted to be larger than the subordinat*e
	Low PD	- *In terms of "User Info" feature* - User profile is not necessary - *In terms of Window size* - size of the video screen on the groupware interface does not take any account on user's preference
Synchronic vs. polychromic	Synchronic	- Application is not required to be designed in a way that it would be able to run several features
	Polychromic	- Application should be designed in a way that it would be able to run several features
Ascription vs. Achievement	Ascription	- Accept the application as provided by the developer
	Achievement	- Full control to configure and adapt the application
Universalism vs. Particularist	Universalism	- *In terms of interface design preference* – prefer to have a universal interface that is designed for everybody in the world to use - Will not refuse to use an interface that may be perceived as unsuitable to use - Strict enforcement of rules are preferred regardless of relationships
	Particularism	- *In terms of interface design preference* – prefer to have an interface that is adapted to their culture - Refuse to use an interface that has materials or features that is not suitable for their culture - Decision in particularistic culture are based on personal trust
Diffuse vs. specific	Diffuse	- Prefer to have a private chat option (to chat with certain users) during discussion group - Prioritize personal relationship rather than business - Prefer to use familiar software than to use software that may have many features that they need but too complicated to use
	Specific	- Prioritize task rather than personal relationship (keep personal and business relations strictly separate)

		- Will struggle in using complicated software when it offers many useful feature and functionalities to complete their task
Affective vs. Neutral	Affective	- all forms of gesturing, smiling and body language to openly voice their feelings - A privatized interface that will not show clearly to others that users are making mistakes (via beeps and display items). - Emotional awareness (mood indicator) of the other user's reaction when they are presenting a document or presentation
	Neutral	- Prefer to use emoticons to express their emotions

Individuals' needs and characteristic initially shape the design of system interface and features, increasingly social requirements determine the nature of the technology-mediated collaboration [214], [232]. Overall, the findings of the four studies have provided an integral understanding of the cultural influences in CSCW, more specifically for new innovative groupware adoption and acceptance.

6.11 Creating a cultural fit interface

Usability testing is an absolutely necessary part of the user interface process. In order for a software or system to be usable, the surface representation must correspond to something that is interpretable by the user. In human computer interaction, the interface is there to transform the properties of the computer's representational system to those that match the concepts of the user. To the user, the interface, is the surface of the artifact, it shows the functionality accessible by the user [43].

User-interface design is influenced by cultural differences. Different cultures in the world have its own pattern of social interaction and behavior [221]. Due to a trend towards standardization, companies aimed to develop one version of the software to be used in all countries for all cultures. Standardization without paying special attention to the specific target cultural preferences might lead to a user feeling forced to use the system. Culture is something in which people take pride and give us all the sense in dignity; it must be respected in the user interface [64]. In order to provide interfaces that are properly localized for target users, we need to learn about the target users and able to identify culturally specific features of software and of cultural biases in the target culture. One of the goals of a user interface designer is to create an interface that is easy to understand for the users and users accept the way the software looks on screen, therefore a great attention should be given for the cultural element in creating products and interfaces that are culture "fit" to its users [221].

A user interface should always look familiar and friendly to its users. Good interface is when it provides an easy access to the features and functionalities, good page layout and user satisfaction. The interface should be usable by the users; it should also provide information needed for the users. Color is an important part of human-computer interaction. It is a powerful part of human perception. Colors can also connate functions in certain countries. In some cultures, yellow may be a sign of mourning, red is a sign of communism, and white is used a sign of death. The average Asian's respondent for both Indonesia and Malaysia, prefer to have strong bright colors for the interface design of a groupware application, while German users prefer not to have strong bright colors. German users responded very low on the selection of many different colors.

Many user interfaces are not user friendly and are difficult to learn, confusing, hard to use and leads to frustration. Graphical user interfaces such as windows and icons are some of the interface problems that differentiate user from different culture's preferences. Icons are used to communicate ideas. Icons

that represent everyday objects or functions in one country may present a user in another country with obstacles because the objects may not exist in every part of the world. Asian users, both Indonesia and Malaysia, seem to prefer to have icons, buttons, and images on the interface design. The interface should provide a "help" box containing all the necessary information on how to use the groupware. Indonesian and Malaysia users prefer to have the user manual or documentation to be available. Information retrieval should also be available. All users have the same preference for having windows that divide screen into areas and have online help available at all times. Indonesian and Malaysian, in comparison to the German users, prefer more to have pop-up menus that appear when user clicks on a particular area of the screen. All users would also prefer to have pulled down menus that are dragged down from the top of the screen. The more empowered the user is with his or her mouse; the easier the interface will be for users. Table 6.69 shows the summary of user's interface design preference for each country.

Table 6.69 Interface design preference in accordance to each country's preference

Interface design	**Country**		
	Indonesia	**Malaysia**	**Germany**
Strong bright colors	Yes	Yes	Yes
Many different color	Yes	Yes	No
windows that divide screen into areas	Yes	Yes	Yes
Online help	Yes	Yes	yes
Pop-up menus that appear when user clicks on a particular area of the screen	Yes	Yes	No
Pulled down menus that are dragged down from the top of the screen	Yes	Yes	Yes
Have multiple windows (one window on top or the other)	Yes	Yes	No

Beside the interface design factor mentioned in Table 5.4 above, cross cultural considerations should also be adjusted in designing an interface, which includes the following: language, technical infrastructure, learning styles, reasoning patterns, high/low context communication, and social context. When being introduced to a piece of software the user will go through a learning curve. If the interface is similar to interfaces the user is already familiar with, the user will have a notion of what to do. According to Tony Fernandes, in his book "Global Interface Design" [64], a good user interface should be designed as: (a) communicate in the country's native language, (b) support the natural writing symbols, (c) support native date, currency, numbers, and addresses, and (d) communicate in an inoffensive manner. Using the correct written language is a powerful tool in maintaining the usability of a product. Providing multiple languages of the correct written language for a target country may mean providing support for several languages, for example, the languages used in Belgium are French and Dutch. The Swiss use German, French, Italian, and others. For the new groupware system, it should provide user the ability to change languages by simply selecting one from a popup. Where the fonts can also be automatically adjusted and so is the dictionary. In addition, the user may select what language they would like the user interface to be presented in. The interface should also include translation tools to help users get from one language to another as well as spell checking for various languages. Or if the interface does not facilitate other different language then it should at least facilitate the typing of foreign characters.

System design for multicultural user should use appropriate and familiar objects, as well as understand the cultural blind spot. Designer should be aware of the importance to understand that people have varying sets of values, without such knowledge, designs will be produced that will be offensive to people. Symbols can express an idea with a simple word or image, but symbols should also be carefully used, since the interpretation of a symbol can vary greatly. Sometime, symbols can communicate unintended negative messages and misunderstanding may occur. The same symbol can mean differently in different culture. Everyday objects that work internationally as well as international symbols should be used. If the interface is similar to interfaces the user is already familiar with, the user will have a notion of what to do. System developers therefore should be aware of these situational factors in order to have their system to be useful. It is also encourage for system developers to design an interface that is easy to understand as well as easy to use for its system users

6.12 Creating a cultural fit team composition

"We cannot enter into alliances until we are acquainted with the designs of our neighbors" Sun Tzu the Art of War.

The need for effective collaboration within the team member is essential in a groupware application. These factors are impacted by language, culture and process and have a direct influence on the level of cooperation that can be achieved.

By the beginning of the twenty-first century, global business had brought contact with foreign cultures home to almost every business [167]. Cross cultural dialogue has become the foundation on which global business succeeds or fails. Cultural differences influence the way people interact in virtual teams and often people are not aware of this. Dekker et al. (2008) shows that "people from different cultures have different opinions on what behaviors are critical for effective team functioning". Global virtual team members consisting of people from different cultures may see constraints and opportunities from various angles before finding together a strategy that takes into account the different standpoints. Team creativity in global virtual teams is influenced by the creativity of the individuals comprising the team and the composition of the team. Cultural differences leads to technical misunderstandings of goals, tasks, requirements, etc., and inhibit the formation of trust due to the lack of shared understanding among teams [226].

Virtual team members need to be comfortable working independently, but also need to have a strong teamwork ethic. Virtual teams in cross-cultural settings require international competencies. According to Hardin et al. (2007), it is reasonable to believe that cultural differences at a national level influence the way people interact in virtual teams and may influence team outcomes [68]. Diversity in terms of areas of specialization and work responsibilities are especially relevant to enhanced team creativity [67].

Multicultural teams can potentially become the most effective and productive team in an organizations [167]. In multicultural team, members represent three of more ethnic backgrounds. Multicultural teams thus have the potential to achieve higher productivity than homogeneous teams, but they also risks experiencing greater losses due to faulty process [167]. To perform most effectively, multicultural teams need to recognize and integrate all represent cultures. Cultural diversity can have positive and negative impacts on a team's productivity [233]. Research conclusively demonstrated that the behavior of people in work teams varies across culture. Among other differences, researchers have found that team members from more collectivist cultures – such as those in Indonesia and Malaysia –

frequently work more cooperatively with each other, enjoy working together more, than their counterparts in more individualistic cultures, such as those in Germany. The productivity of a team does not depend how well the diversity is managed. When well managed, diversity becomes an asset and a productive resource for the team [234]. When ignored, diversity causes process problem's that diminish the team's productivity. Five of the most typical challenges of multicultural team are (Marquath and Horvath, 2001): managing cultural diversity, differences, and conflicts; handling geographic distances, dispersion, and despair; dealing with coordination and control issues; maintaining communication richness; developing and maintaining team. When team members are able to accept the integration of the difference they have, they will get the benefit from the advantages of the qualities that participants from different cultures could bring to the project.

The essential ingredient for a successful cultural mix is skill in putting into operation the knowledge you acquire about another culture. Teams should not ignore or minimize cultural differences: "Many barriers to intercultural communication are due to ignorance of cultural differences rather than a rejection of those differences" [167]. Teams, therefore, cannot begin to enhance communication without first recognizing and then understanding and respecting cross-cultural differences. Teams generally produce more and better ideas if all members participate. In low PD culture, the opinion of all team members is important because status differences are minimized and individuals are viewed as being equal. In high PD culture, on the contrary, people that are higher in status are viewed as superior. Therefore, including all team members might not always be seen as something that is necessary. Team leaders should be able to manage the distribution of power according to each member's ability to contribute to the task, and not according to some gradient of relative cultural superiority.

If multicultural teams fail to balance creativity, they become awkwardly inefficient structures adding little value to the organizations [167]. Hofstede points out that culture influences factors that motivate and demotivate behavior (Hofstede 1980). According to his dimension, it is not surprising that the highly individualistic, task-oriented German culture will focus on job enrichment, whereas the more collectivistic and relationship oriented cultures such as Indonesia and Malaysia will tend to develop new approaches to the quality of working life. To function effectively, multicultural teams must therefore use their diversity to generate multiple perspective, problem definition, ideas, action alternatives, and solutions.

CHAPTER 7

GROUPWARE REQUIREMENTS FOR MULTICULTURAL USERS

7.1 Introduction

This chapter will discuss the requirement analysis in the cultural engineering phase for Passenger 2 to define the groupware requirements for multicultural users as shown in Figure 7.1. The requirement specification in which will lists all functions and features that the proposed groupware system must satisfy will be defined in this chapter.

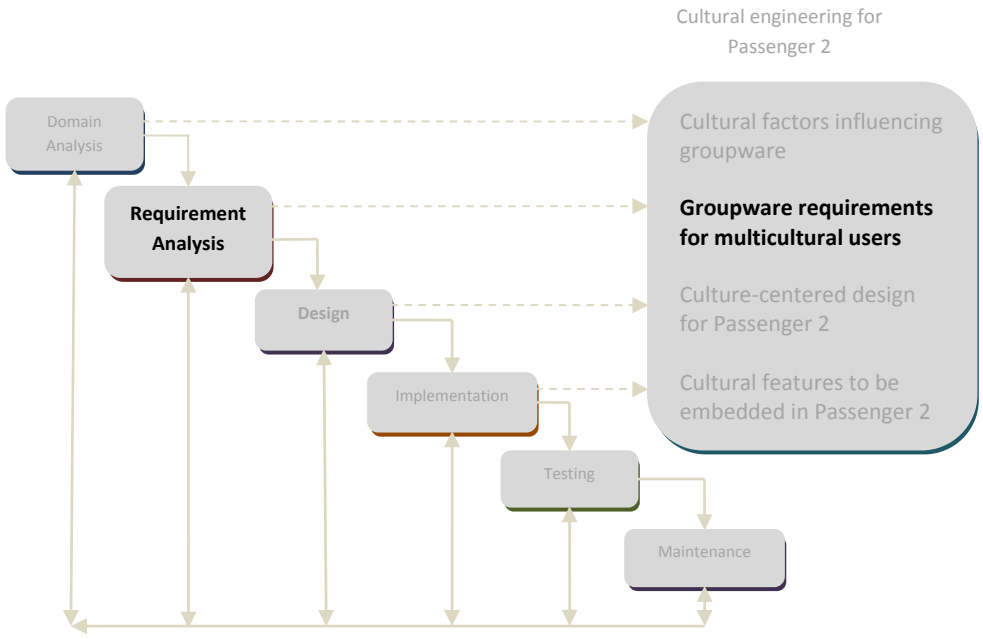


Figure 7.1 Requirement Analysis

Requirement analysis is the phase of software development in which the needs of users (clients) with respect to a proposed project or technology are analyzed [235], in this case for the new groupware system. Requirement analysis usually start with an orienting goal, the goal of this research is to create a groupware system for multicultural users. Although it is impossible to specify all requirements in advance, users cannot appreciate their real needs until they see what kinds of options are available [235]. This requirement analysis will later provide crucial input to the design of the new groupware.

7.2 Groupware requirements for multicultural users

Groupware design aims to improve the organizational effectiveness in cooperative work; however unintended consequences may persist and lead to the failure in the implementation. Such consequences may due to the differences expectations of the users. Groupware, as CSCW software, to succeed needs to respond to users' needs.

Introducing new application to a new culture can bring many unpredictable factors, such as the functionality of the system may be affected by the underlying traditions of the culture where the system is designed. Most of computer supported collaborative work (CSCW) research assumes that stakeholders belong to the same culture [236]. To develop such shared understanding and context among collaborators from different culture is a unique challenge, since the users fundamentally see the world in a different way.

Below is the propose groupware requirement design in a multicultural context (Figure 7.2):

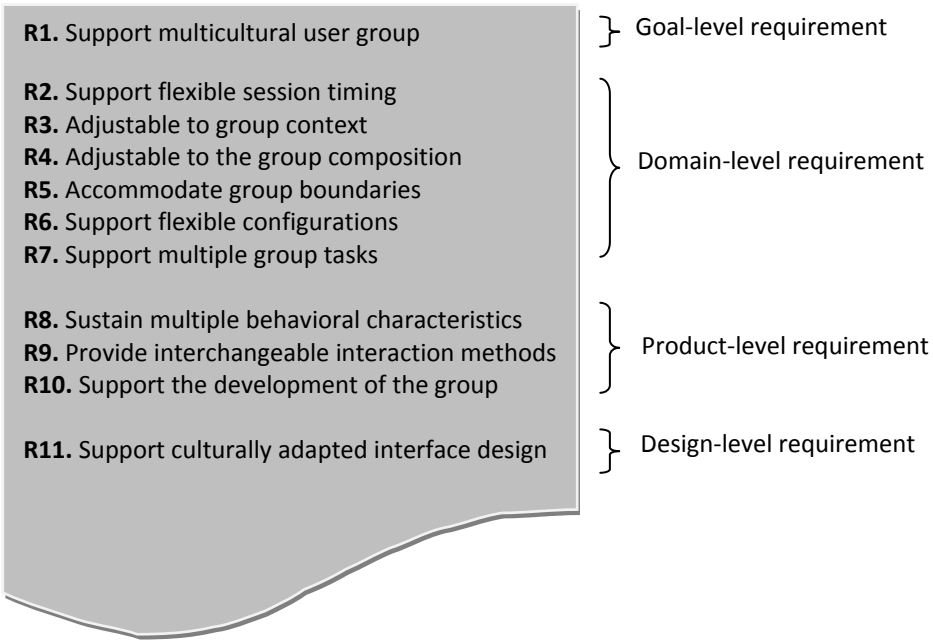


Figure 7.2 Groupware design requirement in a multicultural context

Goal-level requirement – The requirement states the groupware goal. It is called goal-level requirement because it is the goal of the groupware to be.

R1: Support multicultural user groups

Domain-level requirement –The requirement outline the tasks involved and require support for these tasks. The analysis result of cultural factors in consideration in the context of groupware identified the tasks that users will perform.

R2: Support flexible session timing

Groupware systems should support flexible session timing. Members of low context, individualistic cultures tend to communicate in a direct fashion, while members of high-context, collectivistic culture tend to communicate in an indirect fashion [107]. Users belonging in the high-context culture are often indirect when stating a purpose. This will affect the timing of the session in a groupware. The session should not be given a strict ending time and flexible. Users belonging in the low-context culture are

the “straight to the point” type of user. Time is used as effective and efficiently as it should be. Therefore each session should be given a limitation of time.

R3: Adjustable to group communication context

Groupware should be “personalize-able” to individual and overall group needs [237]. A high-context communication or message is one in which “most of the information is either in the physical context or internalized in the person, while very little is in the coded, explicit, transmitted part of the massage.” A low-context communication or message is one in which “the mass of information is vested in the explicit code” [207]. In low-context cultures, open confrontation of ideas and direct, issue-oriented discussion are valued modes of human expressiveness. This relates to the usage of tools in groupware, whereas in low context culture, user would prefer to be able to use external tools to express their creative ideas while working. Users belonging to high-context culture would probably use emoticons more often than people from low-context culture.

R4: Adjustable to the group composition

In terms of group composition, this will affect the group size that user will allow when a session starts in the groupware. Group composition also changes as members leave and enter the session. Users that belong to a high rating of individualistic culture, the tendency to limit the group occur, and will not allow a non-invited user to enter and join a session. Invitation to join a session would be made by sending individual invitation. On the other side, users that belong to a high rank of collectivistic would have the tendency to send an invitation to a mailing list (so that everybody in the list are invited) and will not limit the group size. Also users of this type would allow late joiners (late participants that request to join the session even if the session have already been started) and allow early leavers (to leave the session even when the session is not finish).

The previous groupware developed at our Institute, Passenger 1, limit its group size to maximum four users. Passenger 2, as the new groupware being develop, should be open to more users included in the group, but there should still be a limitation of users in the group. An increased group size results in process loss due to motivation and coordination decrements [238].

R5: Accommodate group boundaries

Groupware systems should also accommodate group boundaries [11]. In accommodating the group boundaries, the concept of awareness is used. With awareness, user will be able to increase communication opportunities in a distributed workspace. Awareness is defined as an understanding of activities by other users, which also may provides a context for your own activity [119]. This context is used to ensure that each individual contribution of users is relevant to the group activities and to evaluate actions of each individual with respect to the groups’ progress and goal. Group members can have the possibility to see what the other teammates are working on, or the ability to see a message pop-up when they perform a mistake by a show of a pop-up message. One way to support successful collaboration is to share information about users’ work activities because individuals can more efficiently coordinate their work if they know about one another activities [239].

Another feature in accommodating the group boundaries is having an emotional awareness (mood indicator feature). This feature has the possibility to show the other group member reaction during work presentation to show whether or not the other members understand the material being presented. Collaboration tool should also facilitate awareness of partner’s gaze and body language and enhances

trust-building eye contact trough web camera [43]. It should be able to replace "real world" activities into virtual activities. Several studies note that language skills, culture, and personality affect individual preferences for communication technology [226]. Rich synchronous communication technology such as video conferencing is appropriate for highly interactive discussions where body language and intonation can convey the degree of understanding among participants [227], it is also seen as the best solution for meetings in which reaching agreement is the objective [228] (Bhat, Mayank, and Murthy 2006).

User-profile. In culture with high power distance, the relationship between the boss and the subordinate is strictly ruled and dependent on the decision of the boss. This will affect the usage of the user profile in a groupware application. Since rank and status is important, user would like to have the ability to view other user's profile, whether or not that person may have high influence on decision making during the running session. Another feature that group should accommodate is the option for users to group potential information recipients together into roles (i.e., if user wish to hide their personal information to colleagues outside than his/her organization).

User documentation. The new groupware system should accommodate user documentation which store information about how to use the system. Documentation should include online help utilities, intelligent tutoring systems and user forums. User forums can include Frequently Asked Questions (FAQ) forum that is tightly integrated to the system functionality. The advantage of user documentation is to support new users to get started and familiar with the system as well as experience users to recover from errors. Documentation can also be in form of demonstration or interactive tutorial. Demonstrations are very good at expressing simple and dynamic information [240]. Demonstrations motivate people to use software, while removing the possibility of error [235], [241], [242]. Interactive tutorial is similar to online manual; it can illustrate typical user-system interactions [235].

Icon tooltips. An icon tooltips is a pervasive technique for embedding documentation in the interface [235]. This type of tool is very useful for user; it gives a brief description that appears in a pop-up label box when the users scroll the mouse pointer over the icon. Another option of an icon tooltips is with a balloon help. A balloon help is turned on and off explicitly through a menu choice.

R6: Support flexible configurations (User control)

User holds the control in selecting which type of configuration systems according to their needs and preference. Groupware should provide users with highly flexible systems so that they can modify the software to their behavioral needs [11], [243], [244].
In a country with low uncertainty characteristic, societies are open toward changes or ready to accept changes. Individuals in high uncertainty avoidance cultures are more likely to consider computer-based media less useful and harder to use than those in low uncertainty avoidance cultures [107]. Users belonging to the high UA culture are tend to be more rigid type of people and would have the tendency to work using the default setting. Users belong to this type of culture resist change more, therefore would like everything to do in order and using the default settings, and also insist to have clear instructions. Therefore manuals or guidelines should really be available for users to refer to. On the other hand, users belonging in the low UAI culture are more of the loosely type of people and more a risk taker. User of this type would prefer to be able to configure or set up the configuration manually based on their taste and preference. This type of users will have the tendency to ignore rules; therefore all settings should be made as flexible as it can be. User having their own behavioral

characteristic holds the control to adjust the setting of the system in accordance to their preference and needs.

R7: Support multiple group tasks

Collaborating with the support of a system requires special aspect of functionality. It should facilitate the integration of actions originating from different users on shared objects and environments, facilities to manage and coordinate the collaboration, and communication functionality [245].

A powerful technique for helping people translate their task goals into system goals is direct manipulation [246]. A direct manipulation user interface is built from objects and actions that are direct analogies of objects and actions in the real world, such as user interface controls look like buttons that can be pressed or data containers look like folders that are grabbed, dragged or stacked [235].

Groupware should be designed to run multiple overlapping windows to increase the flexibility and control of user interaction. The variant of the multiple windows can be either overlapping or tiled display. One of the benefits for tiled display is when a task involves multiple related goals; it can encourage dynamic construction and switching among plans [235]. User interaction modes work against flexible tasks-switching and activity management.

Accommodate several features to run simultaneously. In supporting the development of the group, the system should also accommodate several features to run simultaneously. Groupware should accommodate several features to run simultaneously without having to switch between different applications. For instance PASSENGER supports collaboration in distributed software design, whereas Microsoft LiveMeeting™ facilitates Office collaboration [225], this means users will need to install and run both systems in parallel. Groupware therefore should support the potential tasks that a group needs to perform the task. Groupware should also act as a tool to create and share information within the group members.

Product-level requirement-specifies what functions and features that the groupware should have.

R8: Support multiple behavioral characteristics

Groups exhibit a variety of behavioral characteristics while completing their task during their development and as part of interaction [11], in which these behavioral characteristics will lead to how the group will use the groupware. Groupware should be design to accommodate use's multiple behavioral characteristics. Below are the possible approaches in supporting the multiple behavior characteristics of multicultural users.

R8.1 Provide moderator to control the interaction (as an option)

Users that belong to the high context culture will prefer to have flexible and extendable session timing, while user in low context culture will prefer to have fixed session timing in which given a defined timing prior to each start of the session (R2). Without having a moderator to control the flow of the session, users will have the flexibility to adjust their session timing.

R8.2 Provide interchangeable video window size

Power distance is a potent factor in technology acceptance because the greater the level of power distance in a society the greater the influence of the social elite, such as senior managers, on attitudes toward change [211]. In low power distance cultures, it may be important for users to participate actively in the system design and implementation process, thereby empowering them to decide on system features and functionality [116]. This also affects the communication style in a groupware, as the boss, usually would want to have more special treatment. This will affect the video screen window on the groupware interface layout. The boss' screen should be different from its subordinates, for instance the size of the window would only be accepted if it is made larger.

R8.3 Electronic brainstorming tool

It has been frequently found that status differences among group members may undermine the discussion or implementation of a useful idea if its originator or supporter is of low status of the group [175]. An electronic brainstorming tool that shows the anonymity of the initiator can be a solution in considering a variety of the viewpoints.

R9: Provide interchangeable interaction methods (i.e. video/audio/chat)

Groupware should have the ability to interchange the interaction methods. The goal of interaction design is to specify the mechanisms for accessing and manipulating task information [235]. High context culture would also prefer to use video conference to coordinate within a group and the tendency to make use of PowerPoint during discussion to highlight pointers rather than a long documentation reports. Low-context cultures have the tendency to use notepad, and word applications for collaboration. Language skills can also influence media choice. Users with weaker English will prefer asynchronous forms of communication (such as email or instant messaging) over telephone or video conferencing; because they provide more time to compose a response.

In face-to-face interaction, users relay on a variety of nonverbal communication cues such as body gestures, eye gaze, facial expression, etc, to maintain awareness of what the other group members are doing and to know whether they understand what has been said or done. This type of information is often absent when working in remote collaboration. The groupware should include all possible aspects of communication between users as far as this communication is routed through the system.

Work in low UA countries is oriented toward relationships, whereas work in high UA countries is oriented toward the task [112], and therefore the degree of UA in a culture may be related to what interaction behaviors are seen as important. User from a low context country would have a greater need for explicit information in the form of text; on the contrary, user belonging in a high context would prefer pictographic or symbolic representation.

R10: Support the development of the group

Mandviwalla and Olfman (1994) defined two concrete areas where groupware can support group development: (1) influencing the behavioral processes that govern group development; and (2) managing the mechanical aspects of the development process. Influencing behavioral processes implies the use of techniques to increase consensus and increase interaction [11]. For example, in collectivistic culture, decision making are usually done collectively using voting or the group's majority voice. This may affect potential groupware users in collectivist cultures will likely to polling

or voting tools to form a consensus in obtaining a decision [221]. To avoid conflicts, polling tools will be useful for this type of user to be able to obtain a fair result of discussion whenever ambiguity persist. Users that belong to collectivistic culture will make use of the polling or voting tools as one of the tool for decision making. Shared whiteboard system would also be useful for brainstorming, where user can write on the board with different colored pointers and markers; it can also be use for users to place documents and images that can be transmitted to the entire group members. The notes on the whiteboard may be stored and also printed for later reference.

The group will also need a record of past activities for future planning and growth [247] in managing the mechanical aspects of the development process. It is necessary for a groupware to support its users in keeping all of the history of all the previous work and keep track of all the changes done in their work. The group also needs support for administration function, such as information of the other members (user info), the ability to see the list of all group members, to schedule group meetings, adding/deleting group member, and starting a new group.

Since low UAI culture are risk takers, then user are more of the "experiment" type. Users of this type will have the tendency to use the most of the provided tools available in the groupware. Users of this type also have the tendency to negotiate; therefore groupware may be useful for as a negotiating tool.

Lessons learned from Passenger 1, the users don't have the ability to customize the system. Based on this experience, the new Passenger 2 groupware should have the option to supports both individual-level or group-level customization. For group-level customization, accessible is only given to the owner or creator of the group. Although flexible customization is important, but there are also disadvantages that may occur. The disadvantage of highly customizable systems is that the group members may not know what they want, and thus pick too many features just to be on the safe side [11]. Group-level customization also may lead to group conflict if members of the groups interpret their requirements differently. From the socio-technical perspective this "conflict" may be viewed as the process of jointly optimizing the technology and social goals of the group [11].

Design-level requirement- this requirement specify the product interface should look like.

R11: Support culturally adapted interface design

Cultural specific design preference influences belief on usefulness and ease of use which lead to user's satisfaction in using the application influences user behavior on the groupware acceptance [180]. Cultural specific design preference represents what users want the system to look like and what functionality should be included. Cultural specific design preference influences user's preference of system usefulness and user's perception of system ease of use. When users get greater satisfaction with culturally design interface system (e.g., it is interesting, not too hard, and meets the needs of users at different levels), the stronger their feelings about its usefulness and ease of use. In term of ease of use, it is when the system design is developed in a more culture-friendly form, users will feel more comfortable and find the system familiar and easier to use. This section will be discussed more thoroughly in the next chapter.

7.3 Summary

The effective adoption of groupware requires a fit between the features of the technology and the cultural aspects. Groupware should support collaborative work. Collaborative work is people and technology, within a specified work context, interactively connected for the pursuance of individual or common purpose [175]. The social group process is one of the key concepts in collaborative working. It is the group's ability to arrive at a shared understanding [175].

Software is developed to be used by people within a specific cultural context [248]. Thus, cultural influence should be one of the main factors to be considered in design global software for multicultural users. A simple cultural difference may become a barrier of an effective teamwork. The cultural requirement set was designed for software engineers to cultural differences.

CHAPTER 8

CULTURE-CENTERED DESIGN FOR PASSENGER 2

8.1 Introduction

This chapter will discuss the design in the cultural engineering phase for Passenger 2 to define culture-centered design (CCD) for Passenger 2 as shown in Figure 8.1 below:

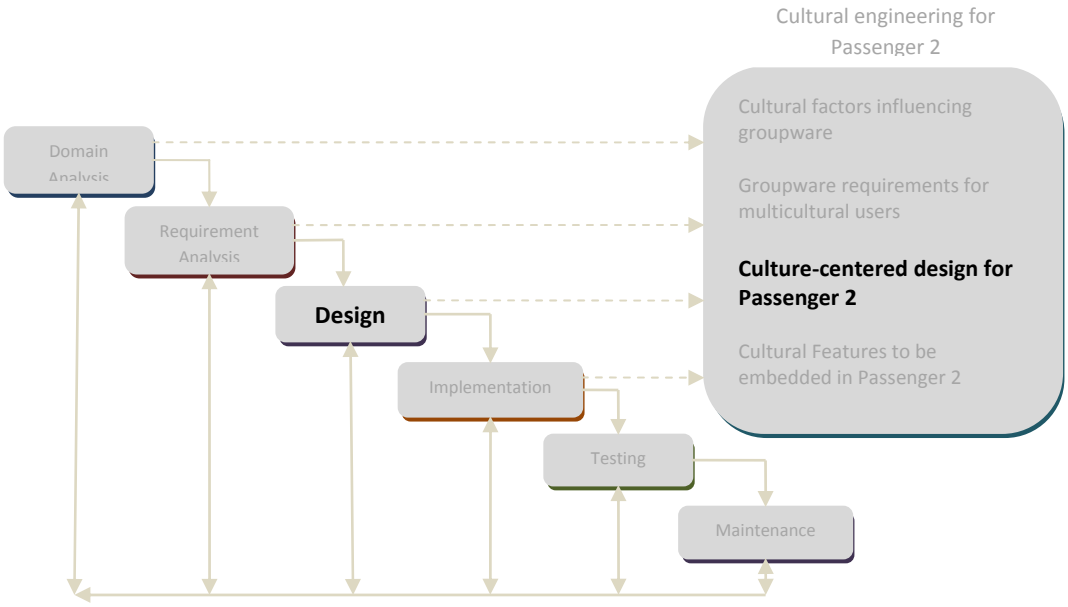


Figure 8.1 Design Phase

Passenger 1 is a special groupware that is strictly limited for educational purpose in the field of software engineering. Passenger 2 is expected to be the ideal collaboration solution for multicultural users. As a new innovative groupware application in enhancing the previous groupware (Passenger 1), Passenger 2 should be the solution that fosters new levels of communication, creativity, and efficiency that provides features and technology to overcome cultural obstacles to collaboration and to improve the performance of a group. The effect on cultural on the acceptance of groupware has been discussed in Chapter 6 in order to understand the important characteristics of cultural aspects for user interface design. Culture affects how people value and prioritize human relationship and technologies. This chapter proposes groupware design features to improve the technical flexibility of Passenger 2. The aim is to design cross-cultural user interface design to support cross-cultural collaboration to better facilitate the users in the target culture. Technology design differs in different culture especially if the technologies involve cognitive tools and a number of people.

Collaboration by using groupware does not necessarily take place between people with the same level with equal rights. Multicultural groups should be well supported since evidence has shown that multicultural groups achieve a significantly higher number of ideas in comparison with homogeneous groups [249]. The design requirement of groupware will mostly also be influenced by the

organizational culture and the organizational hierarchical structure. Therefore, this chapter tries to propose a cultural-centered design for groupware as an intercultural collaboration tool.

8.2 Features and functions for Passenger 2

When team members are dispersed geographically, it forces the members to work remotely. Passenger 2 should be aimed to provide its user an online work space with all the tools, data and interactivity that group members need to explore ideas, resolve issues, and at the end to become more productive, where each group member can define how they want to keep informed of the group activity.

Groupware common features include chat, shared whiteboard, application sharing, shared file system, calendar, and awareness notification therefore Passenger 2 should include these. What makes Passenger 2 different from the other common groupware would be to include features and functionalities proposed below:

8.2.1 Features

Features proposed in the new Passenger 2 which enhanced the features not accommodated in Passenger 1:

a. Shared Whiteboard - The whiteboard is a shared drawing tool. With the whiteboard tool, it may be used for collaborative brainstorming and to highlight or illustrate ideas. This tool is ideal for drawing other user attention to certain areas on the presenter screen. The whiteboard should be able to allow multiple users to draw different types of shapes, add text or color to those shapes, and allow different members of the group to access the shapes at the same time.

Figure 8.2 Sample of drawing toolbar for the whiteboard

Whiteboard in Passenger 2 should have the several tabs for new whiteboard, so that each time another user would like to propose a new idea, the current whiteboard that the group members are working on do not necessary to be closed.

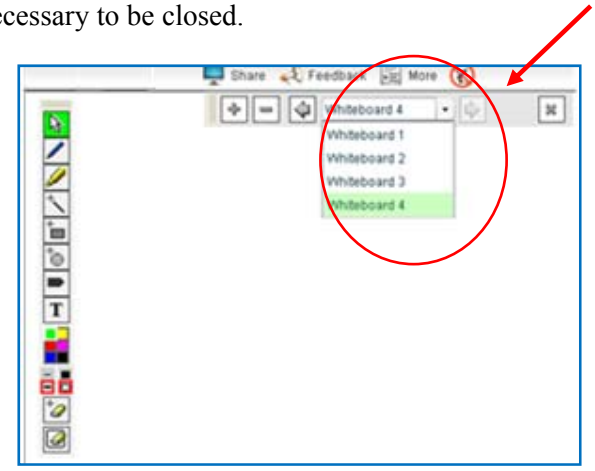


Figure 8.3 Sample of the several tabs for new whiteboard

b. Video and audio conferencing - Video and audio conferencing to allow two-way or multi-way calling with live visual component (video). The difference with the previous Passenger groupware, the video and audio conferencing should have the possibility to be recorded. When this option is given then developers should also consider the significant storage space and transfer speed.

c. Online conferences - With the online conferences it can enhance the traditional face-to-face conference. Passenger 2 should be design to deliver a collaborative environment that provides organizations with a powerful facility for user to effectively work together on project online. Such facility include documents, schedules, graphics and information that can be maintained within discussion areas that enables the team members to easily share and collaborate on a specific project.

d. Text chat (group chat with moderated, scheduled, private and public formats) – to allow users to write messages in real-time, either in public space or private space. Chat system has its own advantage such as for backward reference during conversation that enables user to refer back on the previous conversation and can directly pick up on the ongoing discussion. Private chat for informal communication is important for developing task-related and social processes in a group.

e. Shared editor - Groupware system should have a shared editor or a simple text editor that allows the member of the groups to type, save or edit text files. Passenger 1 was designed specifically for software engineering scenario, which did not provide such facility, therefore shared editor should be considered in Passenger 2.

f. Information sharing support - Groupware supports cooperation by enabling interaction through a shared document or collection of documents [41]. Meeting support products enables participants to collaborate in the production of a shared document. Information sharing support in groupware enables interaction through a shared document or collection of documents. For example, document management systems help teams collaborate by providing access and version control, document search, and status tracking [250]. Information sharing support or meeting support products enable its users to collaborate in the production of a shared document.

g. Language translators - The issues of language barriers always appear when it comes to cross-cultural settings. While English is usually the dominant language use for majority of the available groupware, there must be recognition that different cultures operate in different languages as well. One solution would be the incorporation of language translators by the groupware designers. Suitable language translation features, should be adequately considered and made available in the new groupware.

h. Project management tools for project management - Since cross-cultural users may view time differently. Eastern culture has the tendency to see time as polychromic, where several things are being done at the same time. Appointment is treated more flexible, where schedules can be change frequently or set aside. While Monochromic time dominates most business in Western cultures, such as Germany. Monochromic time is perceived as being almost tangible: people talk about is as though it were money, as something that can “spent”, “saved”, “wasted”, and “lost”. Time is viewed as a commodity; it is scheduled, managed, and arranged. Disadvantages, such as business lost, can occur in international business caused by monochromic and polychromic people do not understand each other or even realized that two such different times exist. Therefore provisions of

tools for project management should provide an up-to-date accurate scheduling and timing information for the whole project.

8.2.2 Functions

System functionality can be seen as the "back end " of an application: what information it holds or accesses, the kinds of operations that are permitted based on this information, and the results that are returned by these operations [235].

a. Remote keyboard or mouse control and Screen sharing

Passenger 2 as a collaborative system should allow a remote support solution, in which one user may help their colleagues in solving the problems in their screen. An example of a scenario, user A may be reluctant to use the system to work together when problem often occur with that system, but on the other hand, the other party (User B, the other member of the team that are located somewhere else in the world) may think that their colleague (User A) do not want to work together with them. Therefore using remote support solution may prevent such misunderstanding. By the use of real time screen sharing and remote keyboard and mouse control, user B can effectively assist their colleagues (User A) system problems. This can be achieved via screen sharing that allows one user to view the other users screen and to control their mouse or keyboard live using the service provided by Passenger 2 or over the Web.

This remote support solution is one of the "ease of use" that can prevent user to leave the application when they experience trouble. Screen sharing tool also give the possibility for a member of the group to share different applications with other members of their group. When one user shares the view of their screen to the other group member, they can also assign "Remote Control" to the other user to grant control over their mouse and keyboard. One user is able to request remote control from the other user that is currently presenting their screen. Before receiving the remote control of the other user, firstly this user must accept the request. Samples of the remote control options are shown in Figure 8.4 below:

Figure 8.4 Accepting or rejecting the remote control request (modified from [251])

However, during screen sharing, user should also have the option to select which applications that they want to share with the other group members and which application that they would rather keep hidden. This option is to assure that only the desire applications that are relevant for the session purposes are the one can the other group members can access. Or another option would be by providing users the possibility to suspend transmission during the running session in order to browse through their personal confidential files or application. And once finish, they can continue transmission.

Figure 8.5 Sample of GUI to suspend transmission (source: [251])

i. File transfer with drag and drop content

The file transfer features give the possibility for the user to transfer files easily. The concept of negotiability is implemented here (this will be described later in this section). The recipient of the file that is being transferred will have the option to either accept or decline to receive the file. With the drag and drop content, it gives the flexibility for user to share documents, images, or other types of file just by dragging from the local folders and dropping into Passenger 2.

j. Recording and playback

A session in groupware is defined by Olson et al. as a period of time when two or more members of a group are working together synchronously [37]. The meeting sessions should be able to be recorded for documentation purposes.

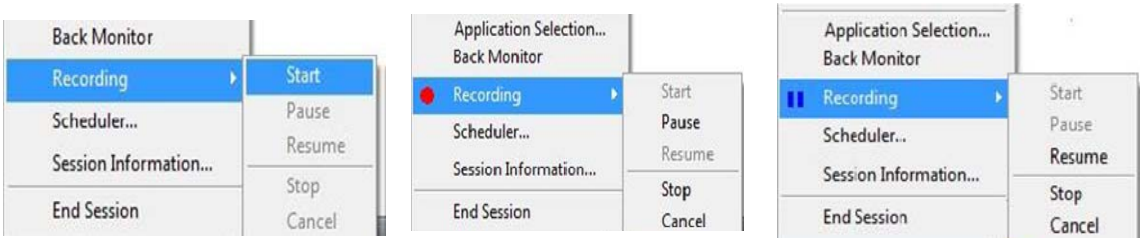


Figure 8.6 Sample of the recording feature (option to start, pause and resume record) (source: [251])

Figure 8.7 To playback the session player

The playback session player gives the possibility for user to playback the session. This gives benefit for users that cannot attend the session.

k. Lock session

This lock session is useful when use within users coming from individualist countries that may prefer not to have other users outside their group members to join a session. Once the session has been started and all the invited participants have joined, the initiator or the organizer of the meeting is able to lock the session room in order to prevent unauthorized people from joining. Even though, this person may have the current session ID or password, but once the session is locked, then they will be denied access and a small notification window will appear to inform them. If during the meeting, the group member decides to add another user, then session can also be unlocked to allow the new user to join the current running session.

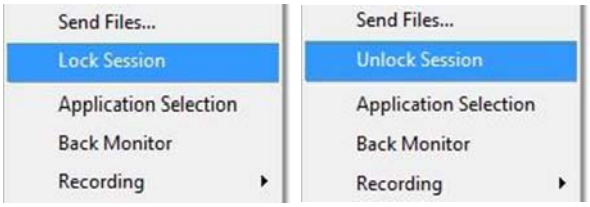


Figure 8.8 Sample of GUI to lock and unlock the session (source: [251])

Users coming from the Individualist culture will have the tendency to limit the group size and will not allow a non-invited user to enter and join a session. Therefore the selection to lock the session is necessary. When user decides to lock a session, this type of message should appear in the system:

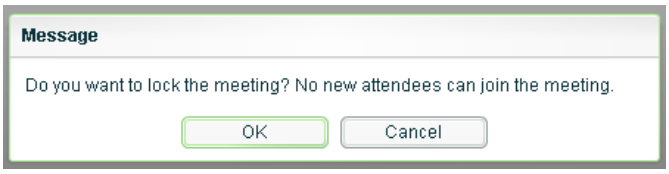


Figure 8.9 Sample of message to lock the meeting

l. Scheduler

As discussed in Chapter 6, different cultures view time differently, and these different time visions can affect the way members handle project deadlines and schedule. When working across global boundaries, communication and time zone difficulties often occur. As time may have different interpretation by different cultures, a scheduler for the session is necessary to avoid misunderstanding and to stay in track on the session agenda.

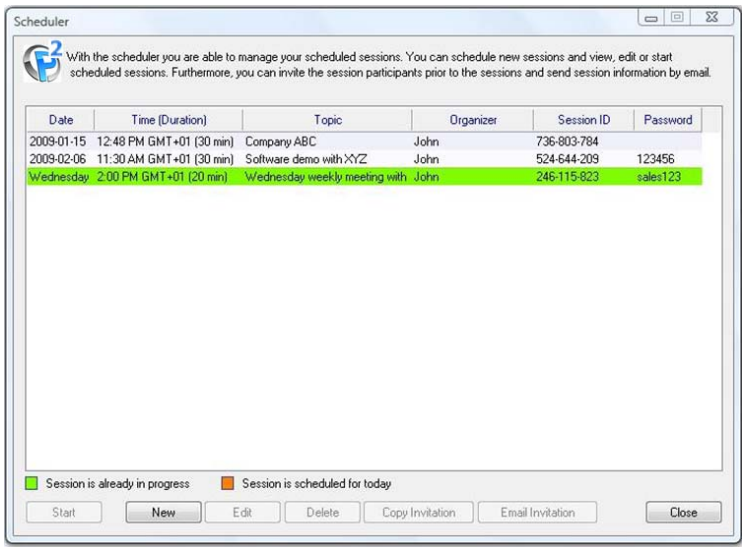


Figure 8.10 Sample of Scheduler to schedule a meeting session

m. Feedback indicator

Communication in global team can be very challenging, where language differences can lead to misunderstanding and the differences of the communication styles [252], [253]. Members communicating not using their mother tongue may have difficulties in communicating and will tend to speak slower. This may be wrongly attributed to lack of attention, enthusiasm and confidence. Feedback indicator is necessary to show the other user's reaction when one user is pressing a document or presentation. Below is the example on how the feedback functions can be used in Passenger 2.

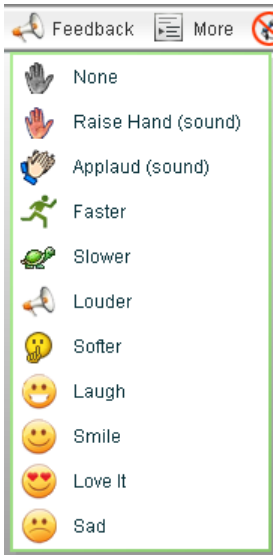


Figure 8.11 Feedback features (source: [254])

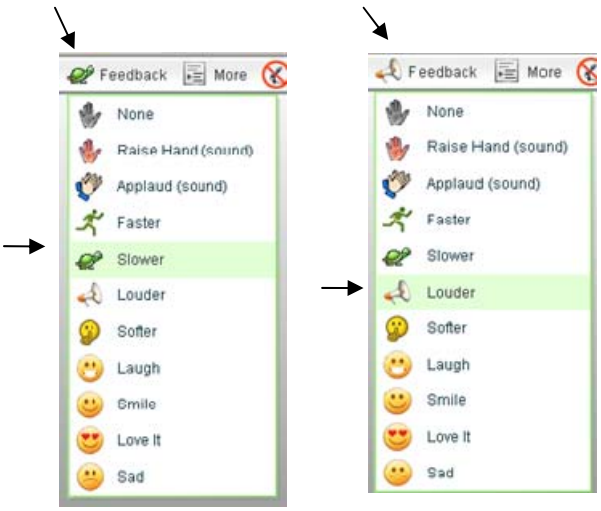


Figure 8.12 Sample of feedback feature for presenter to speak slower or louder (source: source: [254])

n. Multiple telepointers and multiple displays

Awareness is an understanding of the activities of others, which provides a context for your own activity [255]. Telepointer is a kind of action awareness and use to control who is speaking or which content that is being edited or use to indicate where each user is drawing or pointing by showing pointers. Telepointer provide embodiment, awareness and gestural communication and are one of the most useful elements of real-time groupware. Telepointer are replicated cursors that track the location and interactive movement of each person's mouse pointer in a groupware application [256]. The richness of the multiple telepointers are to enhanced awareness, but developers should also be aware that although telepointer can convey a great deal of information, the problems that often occur is that information is sensitive to lag and issues of pacing and synchronization [256].

Multiple displays allow more information to be displayed and viewed at one. Previous findings by Wang and Blevis (2004) reported that users working in companies as designers tend to use large amounts of visual data and they need large workspaces to present information in the way that does not clutter the workspace, but is still easy to view and manipulate all at once [257].

o. Floor control

To support interactive and collaborative work in Passenger 2 and to keep the changes and actions coherent, some kind of floor control mechanism would be needed. Although free access would seem to be better, cross cultural collaboration are very fragile of miscommunication. Turn-taking as the social protocol would be proposed to be the best simple solution for floor control mechanism. Social protocols are the accepted rules and policies that control the interaction. Social protocols are a critical element of the group context. When and how technological mechanisms are implemented to support particular social protocols of interaction is a key issue in a groupware system [258]. Turn-taking is supported as the ordinary social communication mechanism. For example, if a user wants to a turn in the working space, then he/she can simply say so, just take over by issuing the command to take the floor. All the other participants will see the change of control. Other type of social protocols may also

involve support for a specific type of culture such as democratic or consensus based, or support that can be specifically tailored for multiple cultures.

8.3 Culture-centered groupware design approach

Different cultures have different needs; an evolving approach should be taken in groupware development. Rather than developing different versions of groupware specific to different culture, an expert system that helps in defining which features or functionalities of groupware that would be best suited for its users would be more effective. With the use of an expert system, the functionalities of groupware will slightly matched to the behavior of a group from a specific culture. To even more facilitate its user, the expert system will display only the suitable tools on the screen to support the different needs of different cultures. Developers who understand the work environment well enough to design successfully will be in a good position to help design strategies for supporting adoption as well [131].

Passenger 2, an innovative synchronous groupware application that is currently developed in the Institute of Computer Engineering, UDE would need to incorporate the following facilities which use is introduce as a culture-centered design approach in order to provide a real 'added-value' from both the social and engineering viewpoint, as shown in Figure 8.13:

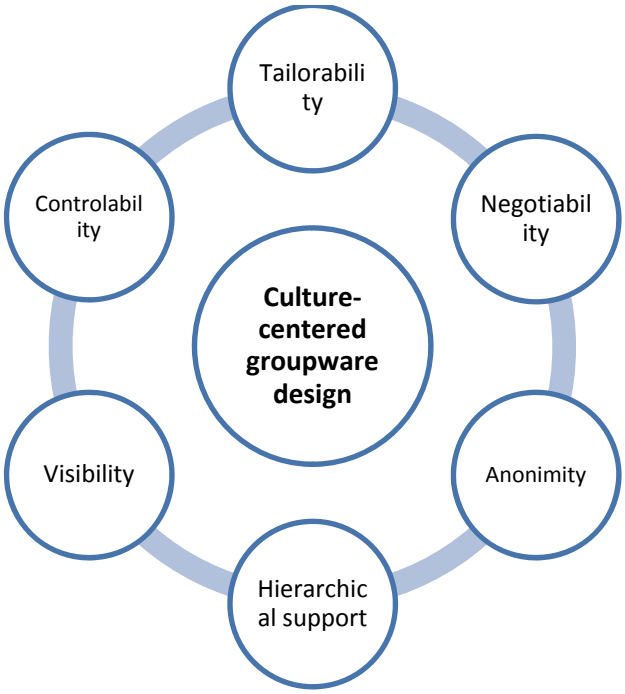


Figure 8.13 Culture-centered design approach for groupware

a. Tailorability

Groupware should be flexible in a way that it can be setup to display information for users of that system. The most promising groupware development methodology is participative design [13], [259]. The technological features of groupware systems should not be designed static, it need to be tailored according to the different preference of users. Groupware should be designed flexible according to the

users need. Using tailorable system is a good step to provide flexibility, but in order to do so, to tailor effectively would be a great challenge since people are not conscious of detailed functioning of the system and how the changes will affect the other users.

b. Controlability

User should be able to control the features provided in the groupware. The user's control-ability implies that user has the choice of different options. Control-ability, in this case should focused which require specific reactions by other users who do not choose between different options but are affected by the choice of an active user. User, therefore, should be able to choose between various media and should be able to make a choice of various functions within one type of this media. For example, if one user decided to activate the usage of the telephone, other users that may not wish to have this media to be activated, should be given the option to select the functions that is included in that media, such as call waiting, automatic callback, etc. The interest of one user (user A) finding access to another one (user B) may be in conflict with the interest of User B that might prefer to be undisturbed. Therefore such functions that provide the possibility for making access more flexible are worthy.

Another example, if user A wants to have unlimited access to user B's file, and if user B only permits this for a limited period of time, there should be the possibility for user B to do so by entering directly into the list of parameters of the command or the menu field used to specify this certain access. Control-ability is referred to the ability of groupware systems that enable each user to specifically select the appropriate number of functions during the configuration process.

Groupware should enable the group of users to specifically select the appropriate number of functions and their functional alternatives during a process of participative configuration [155]. A configuration of groupware should also consider that an activation of a function affects users in different roles. The effect of the design requirements will also be influenced by the organization that will use the groupware itself, and by its hierarchical structure. One technical solution is to allow users to group the potential information together into roles. For examples, if user wishes to hide their information details from the other users, then they can categories the users that may view his information into a special group.

User has the control to select only features or icons to be put to the screen depending on the interest of the users. Another feature in control-ability is the capability that would allow user to block incoming messages (in private chat) when they wanted to concentrate on the tasks.

c. Negotiability

The mechanism of negotiability should also be applied in the design requirement. As groupware has more than one user, the multitude of individuals implies the existence of diverging and even conflicting interest [155], [260], [261]. Potential conflict may arise; this should be anticipated on the level of design requirement. Negotiations among users should be possible and facilitated. Therefore to allow this facilitation, the system has to offer options to its function, in which user may choose. Negotiability would ask in the system as asking for a mechanism to support these processes at the moments a function's activation.

Members of organizations sometime have different/multiple goals and conflict may be as important as cooperation in obtaining issue resolutions (Kling 1991). Groups and organizations may not have shared goals, knowledge, meaning, and histories (Heath & Luff 1996; Ackerman 2000). Without

shared meanings or histories, meanings will have to be negotiated (Boland et al. 1994). The norms for using groupware system are often actively negotiated among users. Therefore groupware should have some kind of mechanism that would allow users to negotiate its use in order to make the system more flexible.

Audio conferencing give benefit for users that cannot type fluently, but it can also be a disadvantage for multicultural users. User who are not fluent in communicating with certain language (such English) will then feel burden and not confident with his/her fluency in communicating and will prefer to use text medium (such as chat).

Negotiability in the technical area itself are insufficient in conflict solving, conflicts of interest between different users should be discussed in group meetings and solved by less structured communication among users. Therefore, functions that provide such support should be taken care. If functions are activated, their complexity and effort of use should be in a reasonable relationship. The relationship between effort involved in use and the effect caused by use is strongly influenced by the qualification levels of the users [155].

The negotiability tools should be able to be adapted to the necessities of certain workgroups. The possibility to include or exclude this functions that are not considered to be suitable for a special groups of users should also be provided.

d. Anonymity

Group process refers to the way the group works. Examples of measures of group process include time to reach a decision, efficiency of communication and equality of participation [262]. When the group perform brainstorming tasks, equal participation of the group members is important. But this can also become a cultural barrier, anonymity should be considered for this case.

Anonymity is where users' contribution can be anonymous. Anonymity can be provided as an option in the groupware user's profile setting, since it may be effective in reducing the power distance during the meeting (Chung & Adams 1997; Robichaux & Cooper 1998). With user's status as anonymous, the issue with who has the power to decide can be reduced and will no longer be relevant since the group ideas are anonymous, which may encourage more equal participation from all participants. This can help the users concentrate on what is being put forward rather than who said it.

In a brainstorming session, user has the ability to enter as many ideas as they want anonymously. For example, high power distance members may be reluctant to speak up during discussions, especially when the identity of the other speakers is not known [263]. For a groupware to be effective, it is important for each group member to have equal opportunity, regardless of status differentials, to express an opinion in a group decision.

e. Visibility

Communication and cooperation between users can be supported by the visibility of user in the groupware. A groupware system is visible if the functionality offered by the system and its state of use can be displayed to the users [155]. Visibility means that there should be an option provided in the groupware of generating the data records that can be displayed.

As visibility makes users aware of certain aspects of a system it is conflicting to the requirement for transparency as it is understood in the distributed systems community, which demands for a masking

out of certain aspects from the users [264]. Visibility of user can either be restricted to functions active at the same time.

Another form of visibility is providing user the possibility to have different user interface layout, whereas user have different preference in working. As Western has the tendency to be low context and Asian to be high-context. Groupware therefore, should have the possibility to offer different working styles and different user interface layout. Although awareness to common objects can be shared via a common view of the work, or also known as WYSIWIS (What You See Is What I See). Strict WYSIWIS was found to be limiting and relaxed versions were proposed to accommodate personalized screen layouts [265]. One example of different version of the same workstation is shown in Figure 8.14, where two collaborative users share the same mission-planning workspace but with different version of the area map application. The left user uses two-dimensional and right users uses three-dimensional rendering of the mission-planning document, but they both use the same chat JavaBean [266].

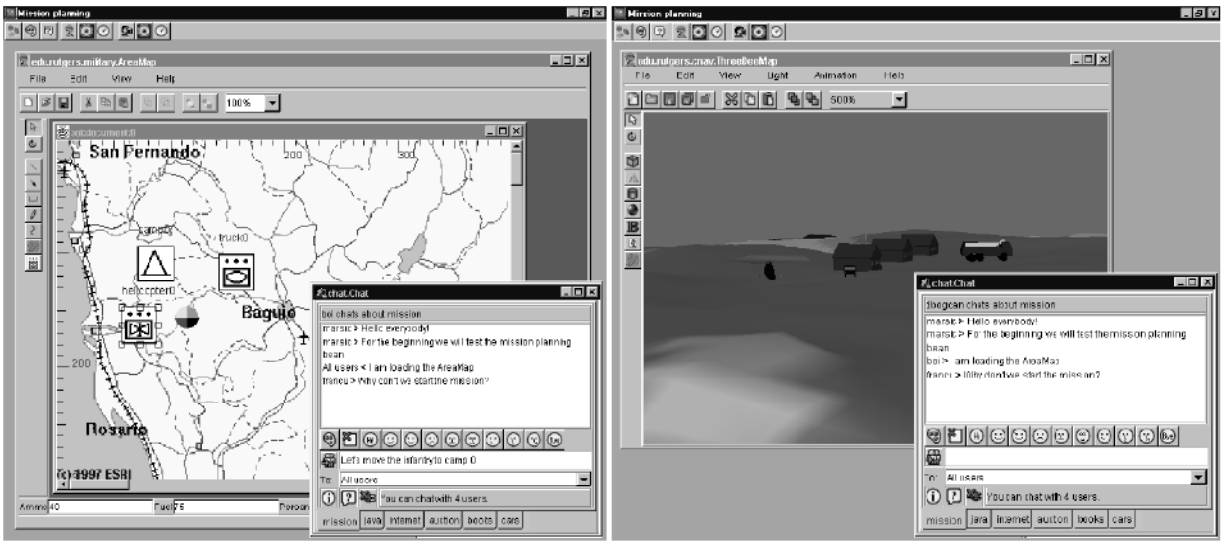


Figure 8.14 Two collaborative users sharing the same workspace but with different version of application view (source: [266])

Infrequently used groupware features should also have the possibility to be "invisible" from the user's screen, yet when needed it is accessible to the users.

f. Other supports - Hierarchical support

Asensio et al (1998) performed research on how to support hierarchical relationships and competitive/cooperative interactions in CSCW applications by grouping of individuals from different hierarchical levels in different subgroups enables hierarchical relationships and restriction of information dissemination among different subgroups, gives support to different levels of competitive/cooperative interactions [150]. Hierarchy in implementation of CSCW application had already been researched in other works [267].

CHAPTER 9

ICEES AS A CULTURAL FEATURE FOR GROUPWARE

9.1 Introduction

This chapter will discuss the implementation in the cultural engineering phase for Passenger 2 as shown in Figure 9.1 below. The implementation phase in this case will be developing an expert system as a cultural feature to be later on embedded in Passenger 2.

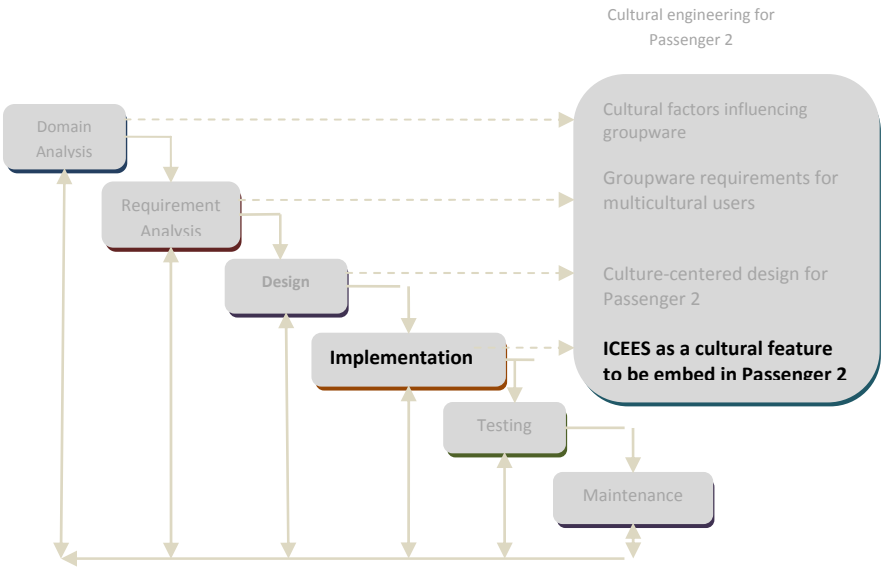


Figure 9.1 Implementation phase

Groupware is one of the communication solution tools for people who are working collaboratively at different geographic sites. Considering that communication involves human aspect that are influence by their cultural styles, an expert system focusing on cultural dimension that are used to select which groupware tools are best recommended for the group to use based on user preference that are influenced by their culture is created. This expert system, which is named the Intercultural Collaboration Expert System (ICEES), focuses on the techniques from the field of social studies (cultural influence) to define a new approach to groupware tools selection to be later on embedded to a groupware application.

This expert system guides the group members' choices between which communication and working tools to use. The tendency to focus on the cultural background is considered appropriate for communication technologies than can best support the collaboration of the group. It provides direct benefits for all group members. Groupware will be more "group-friendly" with the adoption of this expert system. This system is designed to facilitate and improve the performance of the group. The users will need to mutually adjust their behaviors and communication style to support the necessary information exchange. To support cross-cultural collaboration during usage requires a system designer

to embed mechanisms to construct shared understanding between the users and the system a priori [268].

9.2 Intercultural Collaboration Environment Expert System (ICEES)

The Intercultural Collaboration Environment Expert Systems (ICEES) provide advice to the group in selecting the most suitable tools for enhancing the group discussion. It is a knowledge-based expert system that will assist user in PASSENGER 2 on which tools and features that would be mostly recommended for the user and for the group to use based on the users' preferences. The system analyze user's preference according to their cultural characteristics, in order to discover behavior patterns that will help the collaborating team to define the best communication tools and features that is the best choice for them to use.

The methodology used in developing ICEES is divided into three stages, as shown in Figure 9.2. Stage 1 comprises a set of activities to collect the data regarding users' preferences of groupware tools usage analyzed by the used of the technology acceptance model. The data has been obtained through field research studies (see Chapter 6). The results analyzed from the survey are then converted into initial rules that produce the input and output system's behavior. The results are then applied to obtain the preference rules, which are designed in Stage 2. The preference rules are then used to analyze the selection of the groupware tools that is best recommended for the group to use.

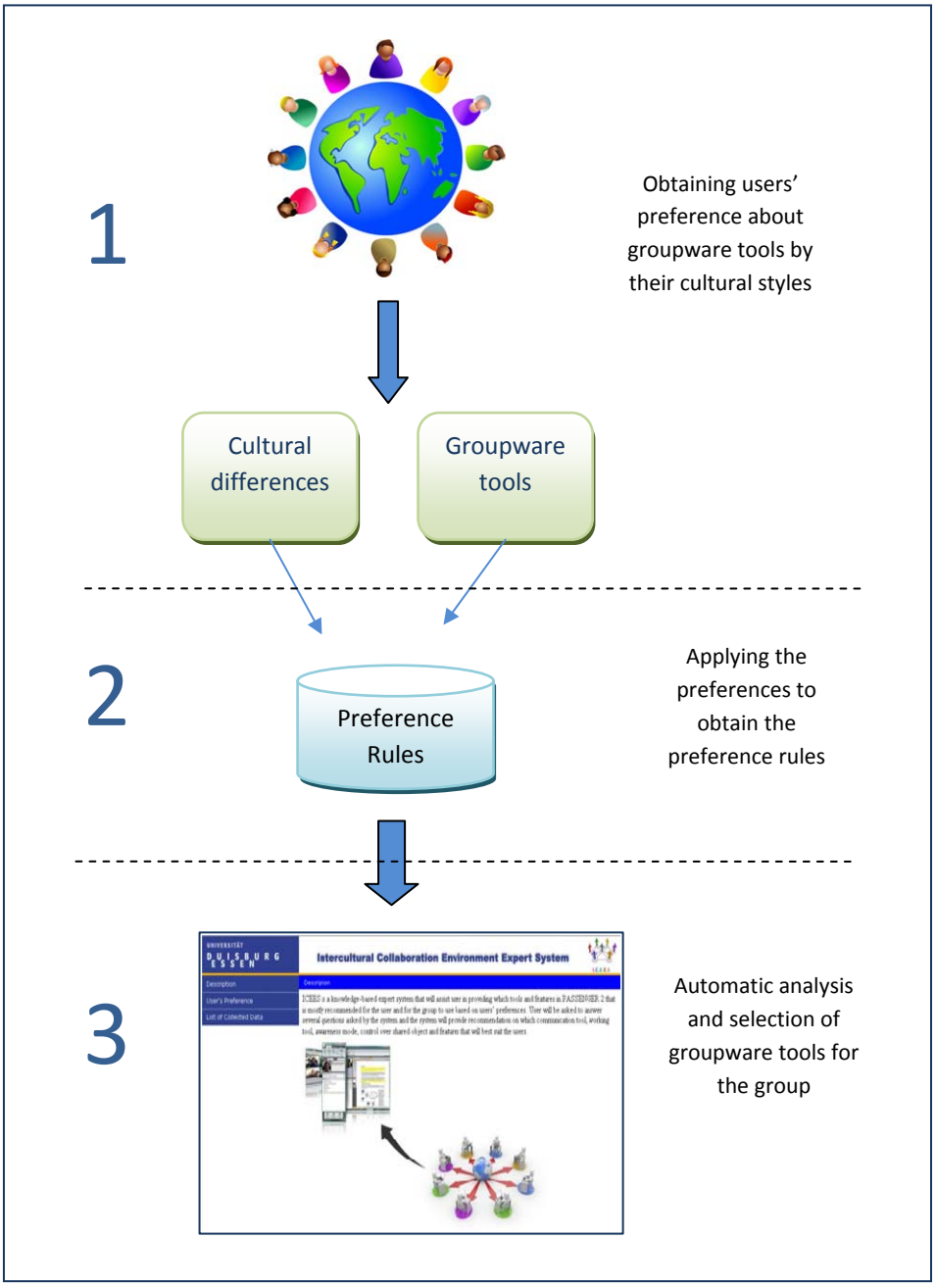


Figure 9.2 A methodology to obtain recommended tools for group to use base on the group members' preferences

The ICEES provides recommendation tools for its user and can be used at any place that has an Internet connection. The system was made web based to follow the principal feature of the World Wide Web (WWW), which allow people from different location and time zones to communicate. ICEES can be accessed through the web and use Apache for its web server and the data collected is store using MySQL as its database server. As depicted in Figure 9.3, the process of obtaining each team members personal preferences who will work within the virtual group will be stored in a database and then the selection process is carried out through the automatic tool that chooses and gives recommendation of the most appropriate communication tools and features for the group to use.

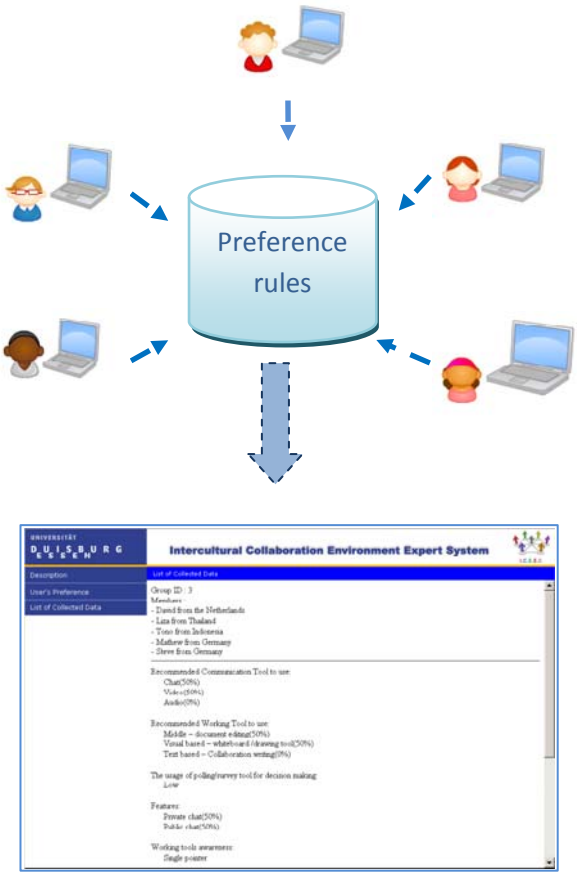


Figure 9.3 ICEES select the most recommended tools for group to use base on individual group members preferences

ICEES is user friendly and does not require programming knowledge for a query session. This system provides support through the use of semi-structure questions that user must select or fill in. User will be asked to answer several questions asked by the system and the system will provide recommendation on which communication tool, working tool, awareness mode, control over shared object and features that will best suit the users. As depicted in Figure 9.4, user will interact with the expert system through the user interface. The inference engine provides the reasoning and interprets the knowledge based.

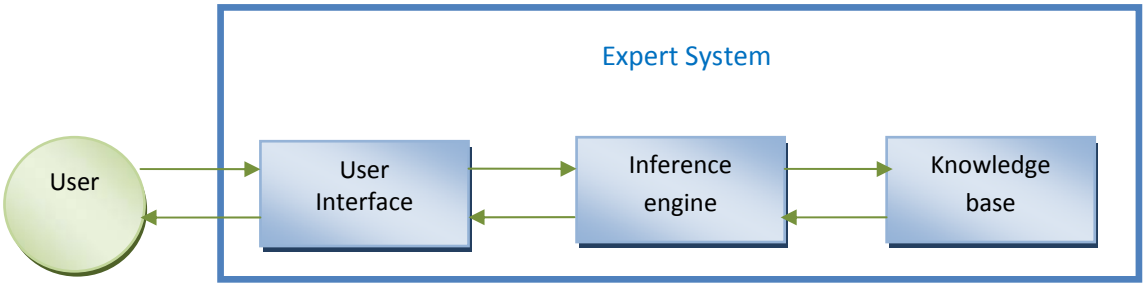


Figure 9.4 Expert system diagram block

9.3 The development of ICEES

The most significant characteristic of ICEES is that it is web-based, which runs over the Internet. Rapid advances of Internet technologies have opened new opportunities for enhancing traditional

decision support systems and expert systems [269]. With a web-based expert system, the knowledge and expertise of the domain expert can be easily adopted and utilized by many users at many different locations without having the presence of the expert. ICEES was developed using a mixture of Internet techniques and programming languages. PHP, HTML, CSS and Java Script were used in the programming. Server side database plays an important role in the development of ICEES. It is used for storing all the information needed for the recommendation tools and features for the users. The data collected is stored in the database and easily analyzed by the systems built in database analyzer. The database is designed using MySQL. The database includes the communication tool, working tool awareness mode, features and cultural dimensions. PHP, as an embedded scripting language, was chosen due to its ability to easily build dynamic web pages. It provides an easier way to accomplish web related programming tasks. PHP is suited to the web along with the HTML tags and content. Using PHP provides the ability to deploy the web based expert system.

ICEES user interface and inference engine corresponds to the difference between a traditional knowledge based system's visible user interface and invisible internal model base and reasoning engine. The user interface of ICESS comprises of HTML/JavaScript pages. The GUI interacts with the user through a standard internet browser such as Internet Explorer or Mozilla Firefox. The recommended Operating System to use is Windows XP. ICEES can be easily accessed globally, where user location is irrelevant and no installation is needed at the user's location. ICEES employ a backward chaining inference engine. The system is given a specific goal or conclusion to determine based on the order of the rules in the knowledge based and then proceeds to search the knowledge based for the rules that have that goal as its conclusion. The main techniques for knowledge acquisition were text analysis and survey results. Knowledge was represented in simple production rules constructed in JavaScript and used Apache for its web server.

The tasks involved in developing ICEES include knowledge acquisition (KA) and knowledge representation. Knowledge acquisition is used to obtain the facts and rules from the expert in order for the system to draw expert level conclusions. The process of the KA for ICEES was obtained through literature research, field work surveys, and taking results from case studies. The knowledge is assembled into an organized rule base for the inference engine to interpret and use. The result of the knowledge acquisition was then formulated into the rules for the inference engine to process, using the "If-Then" rules. The process involves coding facts, rules, and relationships in the programming language for the system. The If-Then rules can later be extended when new rules need to be added to the system.

9.4 ICEES preference rules

In order to obtain the knowledge base for the preference rules, users' preference on using groupware tools and features firstly need to be defined. This was done prior to the making of ICEES. Field research was conducted and the results are used for the knowledge base for this expert system. The survey on how culture influence groupware discussed in Chapter 6 is analyzed to obtain the IF-Then rules to achieve the set of the preference rules. An inference engine was then created as the tools in the selection process to choose and suggest the most recommended tools and feature for the group to use.

The obtained set of rules firstly represents preferences according to the user that input the system. A database has also been created to temporarily store this information and later on use to discover the most suitable tools that will be recommended for the group to use. The system will also provide the

percentage of degree on the recommended tools to use, so that when the group decided not uses the given recommendation, the group can select the lower degree that is recommended by the system.

The set of the preference rules for the most recommended groupware tools to use represent the preferences according to the cultural style of the people; however the rules can also be used to know the suggested groupware for the group. Each person in the group will select which tools that they prefer the most to use, and the system will then combine their preferences, and decide for the group which tools that are recommended for the group to use. These is achieved by selecting the groupware tools that appear the most preferred, or the majority voice of the groupware tool selection will be recommended by the system. The rules are made with a ranking system, where each selection of the input are given a value, which then these values are added once the entire of the group members have enter in their input. The application of this preference rules includes:

- Obtain each group members' personal preferences
- Obtain the most recommended groupware tools for the group to use that combine the result of the individual group members' personal preferences

ICEES is designed to facilitate multicultural collaboration in considering which tools and features to use. To assess the recommendation tools and features, users answer a number of questions about their preferences. The query session consist of semi-structure questions that user must select or fill in. The questions corresponds to the cultural dimensions proposed by Hofstede, Edward T. Hall and Trompenaars, which includes high-low context, individualism vs. collectivism, specific vs. diffuse, polychromic vs. monochromic, and power distance. The output variables represent the users' choice, for example, the recommended communication tools, working tools, and awareness mode to use.

The system is designed for group of maximal seven users to work, each time additional users has input their preference, and the system will calculate and give recommendation of which tools that will be best suited for the group to use.

9.4.1 Knowledge base and rules

The ICEES knowledge base includes the cultural dimension reviewed in this dissertation, consisting of High-Low Context, Individualism-Collectivism, Specific vs. Diffuse, Monochromic vs. Polychromic, and Power Distance. The knowledge base contains all the recommended tools and features.

Every user has their own preference using the tools in the groupware based on their comfort or familiarity of usage. Some users tend to prefer working with tools based on graphics since due to their cultural background coming from high-context culture, while other prefer to work with tools that are more text-based with background culture of the low-context culture. The preference of the usage of the communication tools in groupware may also be due to the degree of language fluency. Users working not with their mother tongue language often prefer to use tools that do not force them to talk too much, or chat is more prefer. The results that are given the previous chapters shows that users coming from low-context culture will prefer to use the text based communication and users coming from high-context culture will prefer to use the visual based communication.

Table 9.1 An example of the ICEES knowledge base

Cultural Code	If	Then
HLC1	User prefer to have an information displayed is LOW CONTEXT	The recommended Communication Tool is CHAT
	User prefer to have an information displayed is MIDDLE CONTEXT	The recommended Communication Tool is AUDIO
	User prefer to have an information displayed is HIGH CONTEXT	The recommended Communication Tool is VIDEO
HLC2	User prefer the working tools to be TEXT BASED	The recommended Working Tool is COLLABORATION WRITING
	User prefer the working tools to be in the MIDDLE between Text based and Visual Based	The recommended Working Tool is DOCUMENT SHARING
	User prefer the working tools to be VISUAL BASED	The recommended Working Tool is WHITEBOARD
Ind	User STRONGLY DISAGREE that individuals job performance is more important than the performance of the group	The use of Polling Tool is HIGH
	User STRONGLY AGREE that individuals job performance is more important than the performance of the group	The use of Polling Tool is LOW
Spe	User STRONGLY DISAGREE to keep private and business agenda separate	The recommended features to be available is PRIVATE CHAT to specific users
	User STRONGLY AGREE to keep private and business agenda separate	The recommended features to be available is PUBLIC CHAT to all users
Pol1	User STRONGLY DISAGREE to do several things at the same time rather than one thing after another	The recommended Working Tool Awareness is SINGLE POINTER
	User STRONGLY AGREE to do several things at the same time rather than one thing after another	The recommended Working Tool Awareness is MULTIPLE POINTER
Pol2	User STRONGLY DISAGREE to be fully alert to all the changes that the other users have done	The recommended Message Awareness is SHORT MESSAGE ALERT
	User STRONGLY AGREE to be fully alert to all the changes that the other users have done	The recommended Message Awareness is MESSAGE POP UP
Pol1+Pol 2	User prefer to do one thing after another and needs to be fully alert to all the changes that the other users have done	The recommended Awareness Mode is TIGHT (WYSIWIS)
	User prefer to do several things at the same time and do not need to be alert of all the changes that the other users have done	The recommended Awareness Mode is LOOSE (WYSINWIS)
PDI1	User STRONGLY DISAGREE that all users should have equal involvement (not based on hierarchical position)	The recommended Control over Shared Object is FREE ACCESS
	User STRONGLY AGREE that all users should have equal involvement (not based on hierarchical position)	The recommended Control over Shared Object is CENTRAL MODERATOR
HLC + PDI1	User prefer to have an information displayed is LOW CONTEXT and User STRONGLY DISAGREE that all users should have equal involvement (not based on hierarchical position)	The recommended Attention Attractor is BEEPING SOUND
	User prefer to have an information displayed is HIGH CONTEXT and User STRONGLY DISAGREE that all users should have equal involvement (not based on hierarchical position)	The recommended Attention Attractor is BEEPING SOUND and WINDOWS BLINKING
	User prefer to have an information displayed is LOW CONTEXT and User STRONGLY AGREE that all users should have equal involvement (not based on hierarchical	The recommended Attention Attractor is BEEPING SOUND and WINDOWS BLINKING

	position)	
	User prefer to have an information displayed is HIGH CONTEXT and User STRONGLY AGREE that all users should have equal involvement (not based on hierarchical position)	The recommended Attention Attractor is WINDOWS BLINKING WITH VIDEO SCREEN ENLARGEMENT

Each rule has two sections – in the form of 'IF-Then'. ICEES users can query the system using an inference process that automatically determines which rules are applicable. The following are examples of the rule (in an English format for easy reading) maintained by the system:

IF
User prefer to have an information displayed is LOW CONTEXT
THEN
The recommended Communication Tool is CHAT

IF
User prefer to have an information displayed is HIGH CONTEXT
AND
User STRONGLY DISAGREE that all users should have equal involvement (not based on hierarchical
position)
THEN
The recommended Attention Attractor is BEEPING SOUND and WINDOWS BLINKING

After the facts are collected from users, the system will produce conclusions of the recommended tools and features for the group. The following are examples of rules taken directly from the ICEES knowledge base for recommended communication tool, recommended working tool, and:

```
echo "Recommended Communication Tool to use:<br>";
$HLC1[0]=$rec[2];
$HLC1[1]=$rec[3];
$HLC1[2]=$rec[4];
$indexvalueHLC1[0]=0;
$indexvalueHLC1[1]=1;
$indexvalueHLC1[2]=2;
array_multisort($HLC1,SORT_DESC,$indexvalueHLC1);
for($i=0;$i<=2;$i++)
{
    if($indexvalueHLC1[$i]==0)
            {
                echo "      Chat";
            }
    else
            {
            if($indexvalueHLC1[$i]==1)
            {
                echo "      Audio";
            }
            else
            {
                echo "      Video";
            }
            }
    echo "(".$HLC1[$i]."%)<br>";
}
```

```
echo "<br>Recommended Working Tool to use:<br>";
$HLC2[0]=$rec[5];
$HLC2[1]=$rec[6];
$HLC2[2]=$rec[7];
$indexvalueHLC2[0]=0;
$indexvalueHLC2[1]=1;
$indexvalueHLC2[2]=2;
array_multisort($HLC2,SORT_DESC,$indexvalueHLC2);
for($i=0;$i<=2;$i++)
{
  if($indexvalueHLC2[$i]==0)
            {
               echo "      Text based –  Collaboration writing";
            }
  else
            {
            if($indexvalueHLC2[$i]==1)
            {
               echo "      Middle – document editing";
            }
            else
            {
               echo "      Visual based – whiteboard /drawing tool";
            }
            }
            echo "(".$HLC2[$i]."%)<br>";
}


echo "<br>The usage of polling/survey tool for decision making:<br>";
$Ind[0]=$rec[8];
$Ind[1]=$rec[9];
$indexvalueInd[0]=0;
$indexvalueInd[1]=1;
array_multisort($Ind,SORT_DESC,$indexvalueInd);
for($i=0;$i<=0;$i++)
{
    if($indexvalueInd[$i]==0)
            {
               echo "      High";
            }
    else
            {
               echo "      Low";
            }
            //echo "(".$Ind[$i]."%)<br>";
            echo "<br>";
}
```

9.4.2 How ICEES work

As a web-based application, the ICEES user interface was originally design using the hypertext markup language (HTML) and cascading style sheets (CSS) to display the HTML elements to allow user to access the system with a web browser such as Microsoft Internet Explorer or Mozilla Firefox. The interface contains three main parts: system description, user's preference and list of collected data.

The “Description” parts explain what the system is about as shown in Figure 9.5. The “User’s Preference” part is the generic form that allows information to be obtained from the user, a mechanism that allows interaction with the inference engine in order to perform various computations on that information, and the “List of Collected Data” is a generic form that allows results to be presented on the user’s screen.
The Description includes this text below:

> “ICEES is a knowledge-based expert system that will assist user in providing which tools and features in PASSENGER 2 that is mostly recommended for the user and for the group to use based on users’ preferences. User will be asked to answer several questions asked by the system and the system will provide recommendation on which communication tools, working tools, awareness mode, control over shared object and features that will best suit the users”.

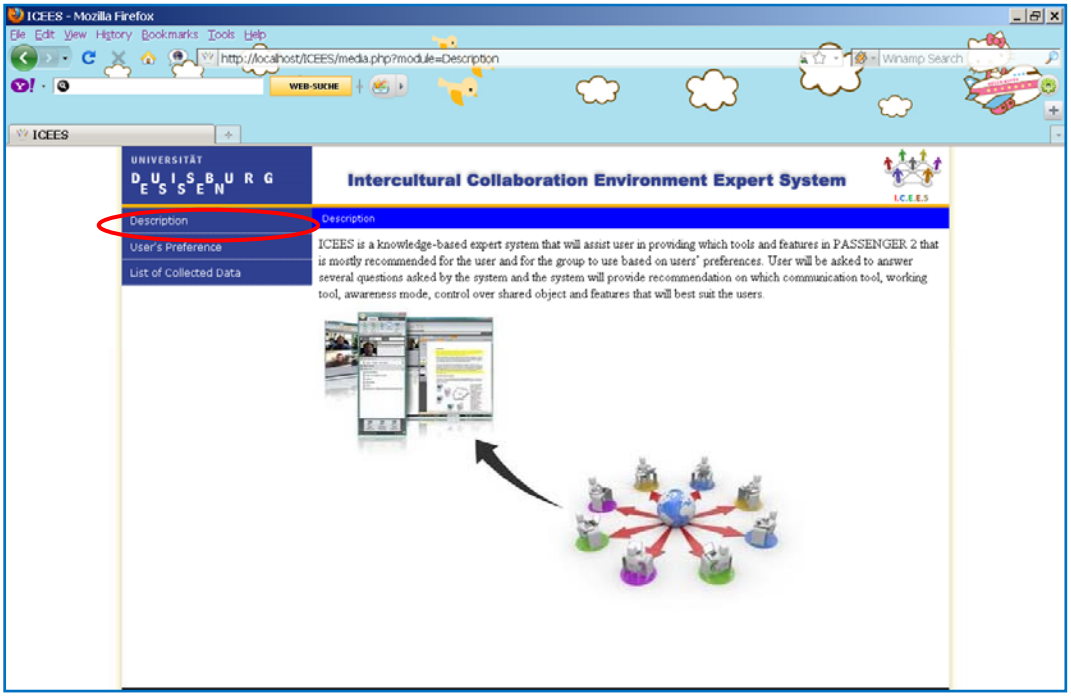


Figure 9.5 Screenshot of the ICEES description page

The questions are designed in related to evoke the cultural dimension that user will have the tendency to belong. The user of the system is prompted to fill in the Group ID, name, country, and to answer a number of questions related to their preference of working and communication styles (as shown in Figure 9.6). Then the system process the users’ responses and what is the most recommended tools and features for the group to use based on these preferences.

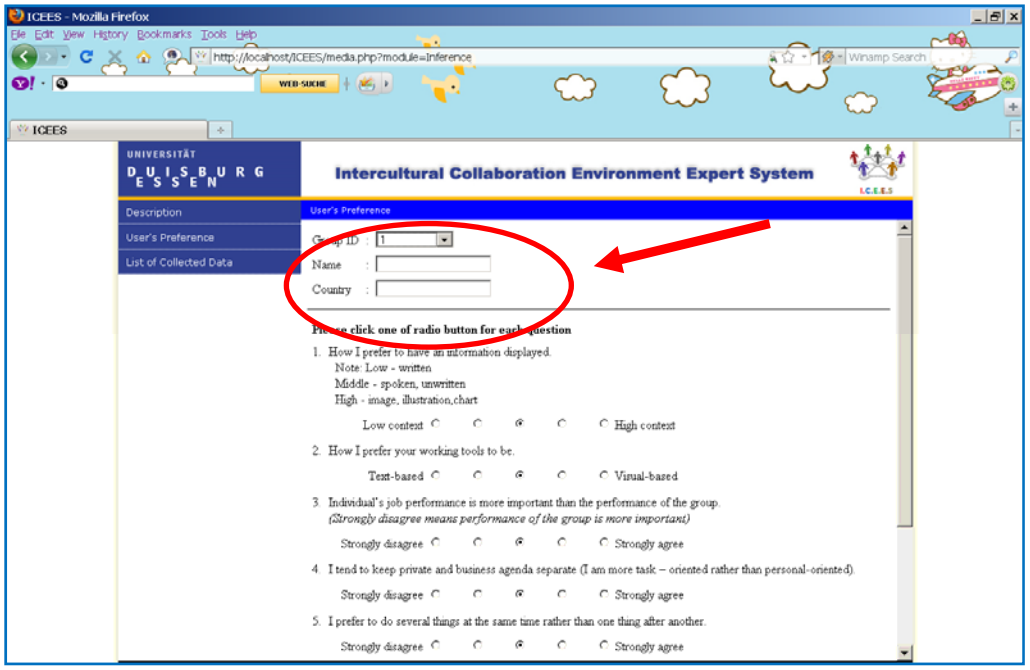


Figure 9.6 User is prompted to fill in the Group ID, Name and Country information

User must enter their group ID or may also create a new group ID, as shown in Figure 9.7:

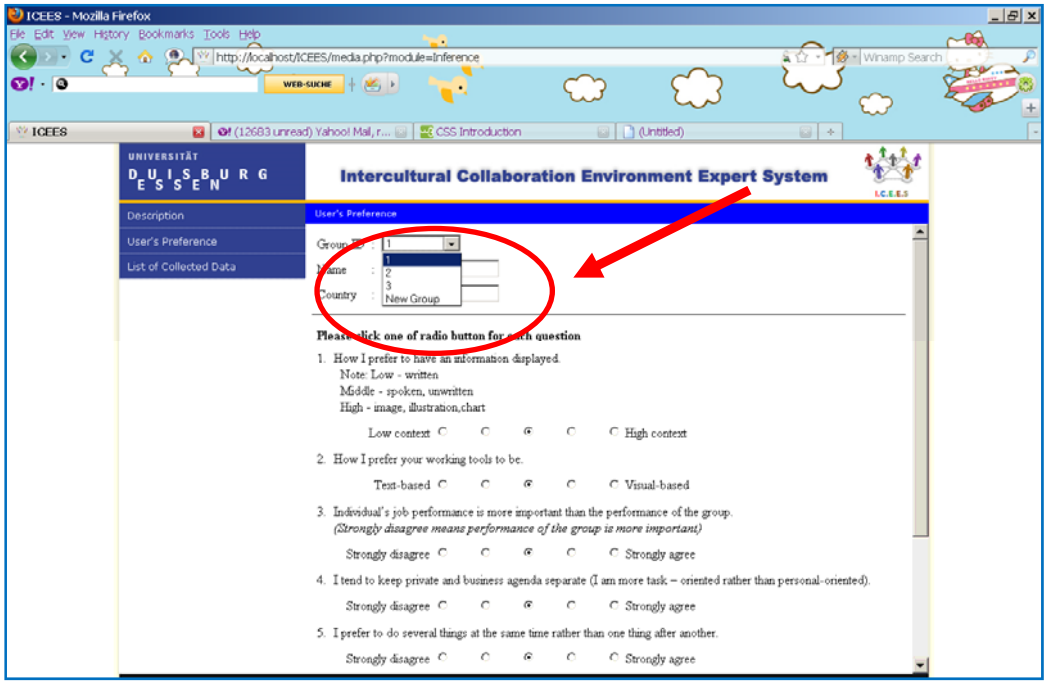


Figure 9.7 User must enter the group ID or create new group

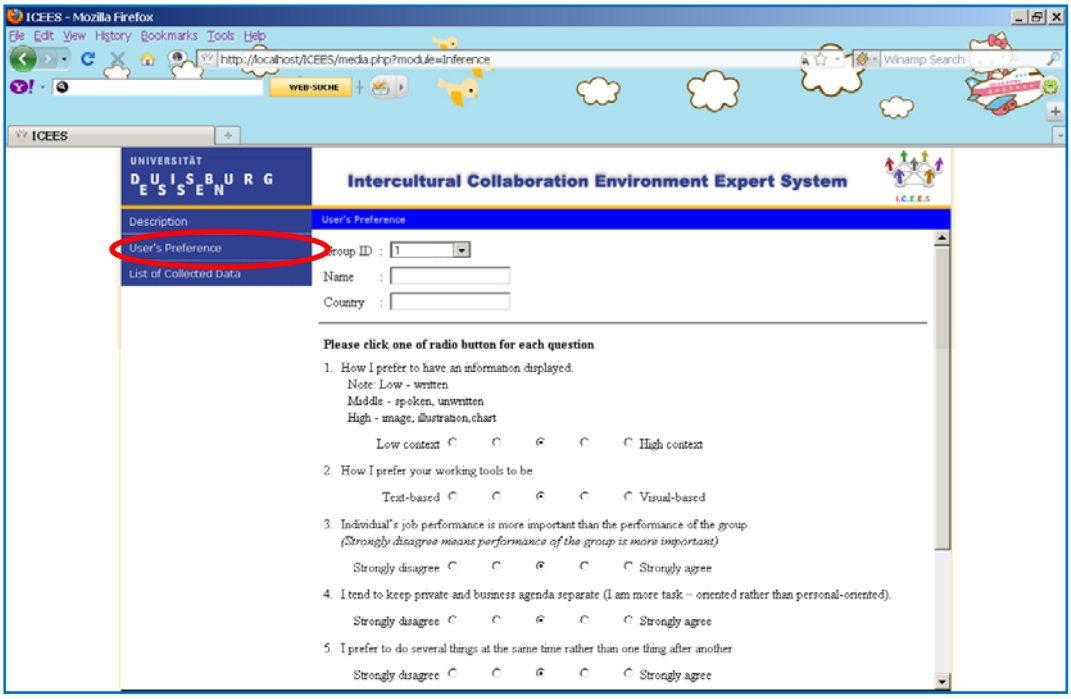


Figure 9.8 Screen layout for the User's Preference page

The screen layout for the User's Preference page as shown in Figure 9.8 shows the questions being asked by the system. This window contains a list of possible answers with input box and radio buttons for the user's response.

The user then can move the cursor to the best suited answer and click the "Submit" button located on the lower part of the input box as shown in Figure 9.9 below, or when the user decided to change the answers, user can select the "Reset" button to erase all the answers and user can start to answer the questions again from the beginning:

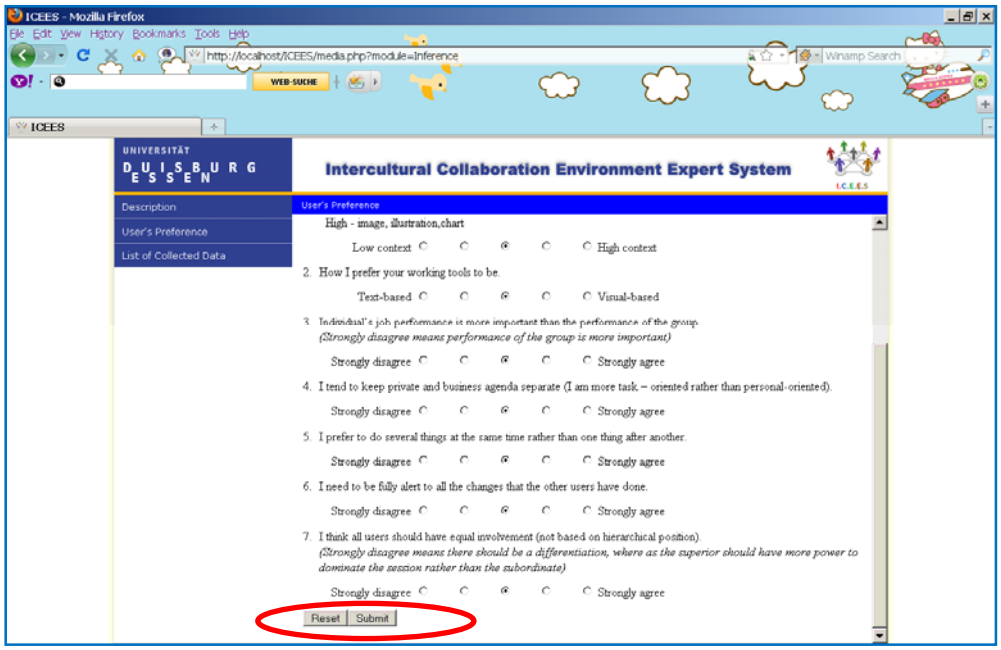


Figure 9.9 Screenshot of the User's Preference page with the Reset and Submit button

After the user selects of types in the answers and click on the "Submit" button, the system stores the information on the database created for the system as shown in Figure 9.10.

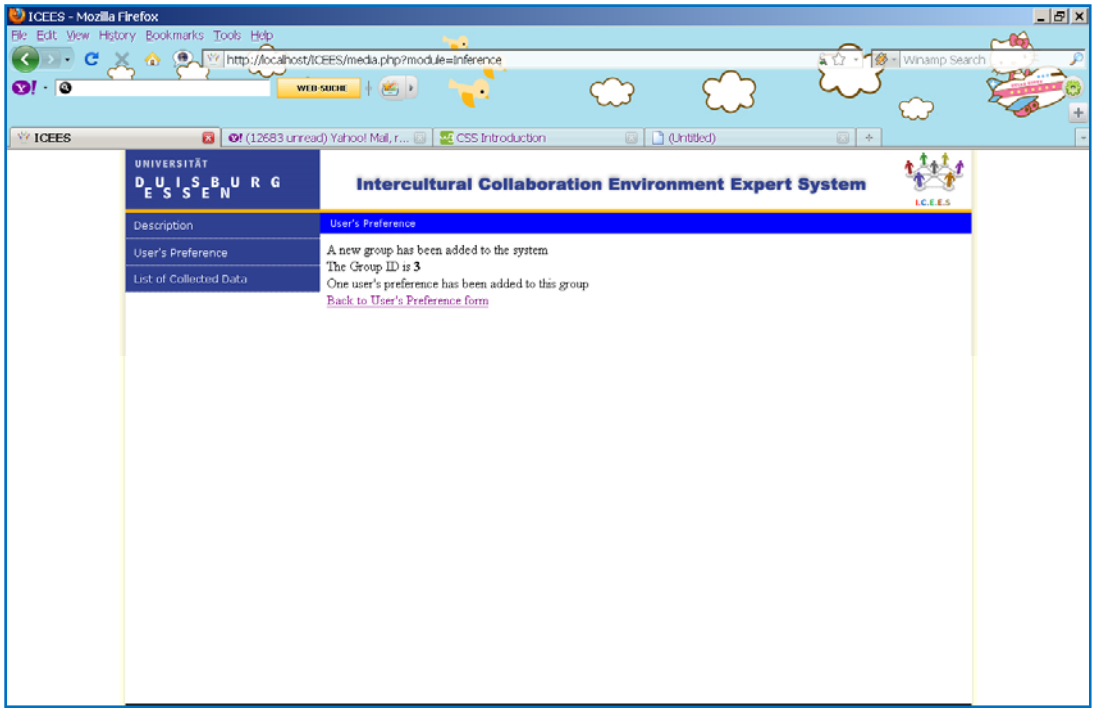


Figure 9.10 Data input by user is stored in database

The list of recommended tools and features for the group will be presented when the user click on the "List of Collected Data" menu (Figure 9.11), the system will calculate all the group members' answers to reach an assessment conclusion.

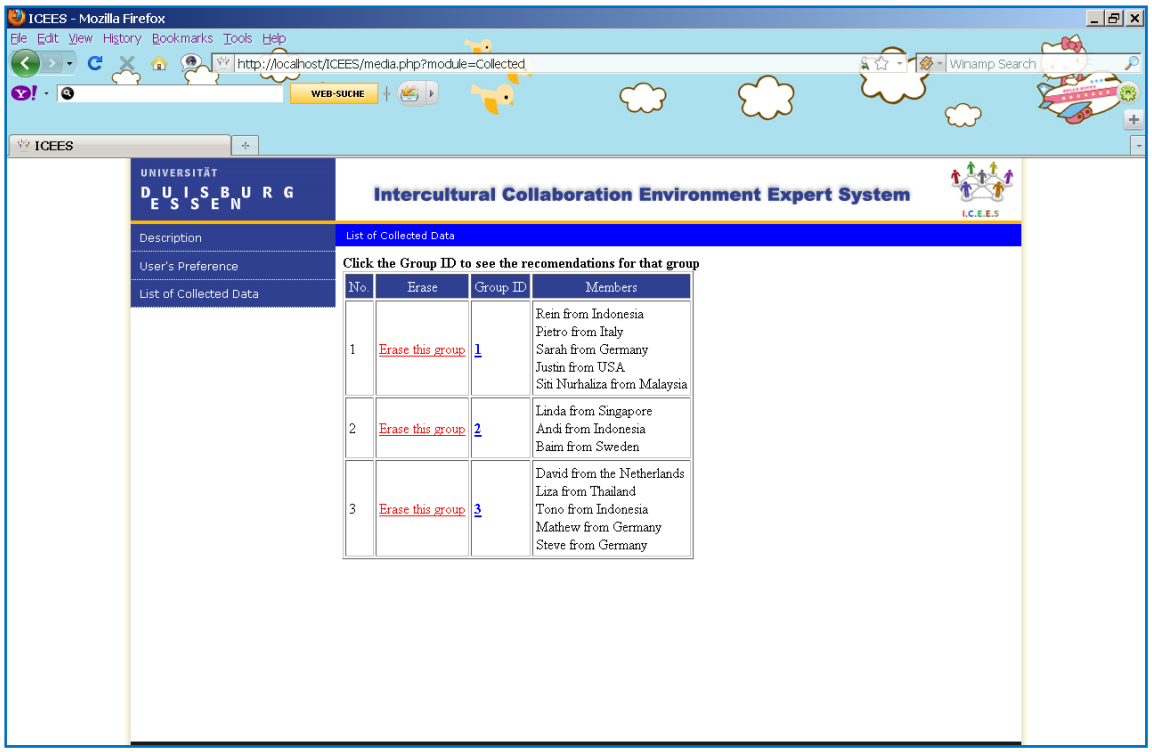


Figure 9.11 Screenshot of the List of Collected Data

Based on the answers, the system is able to provide the most recommended tools and features to use for the group. The sample of the assessment result is shown in Figure 9.12 and Figure 9.13.

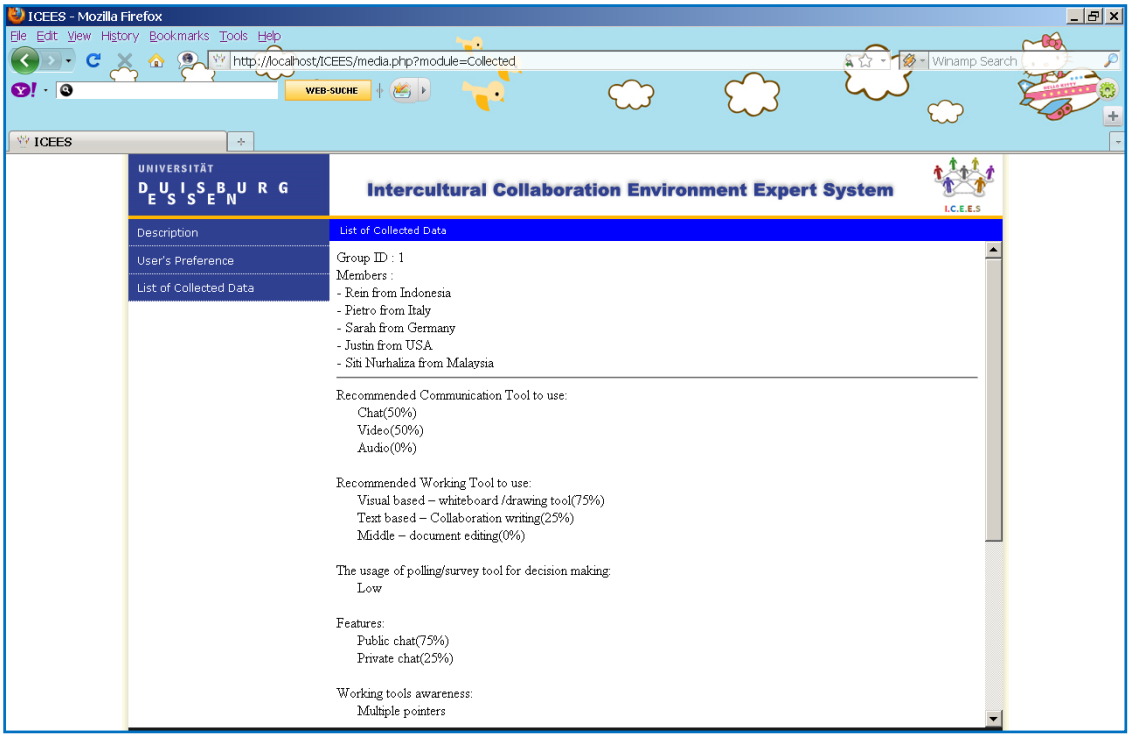


Figure 9.12 Screenshots of the ICEES recommendation result with five group members

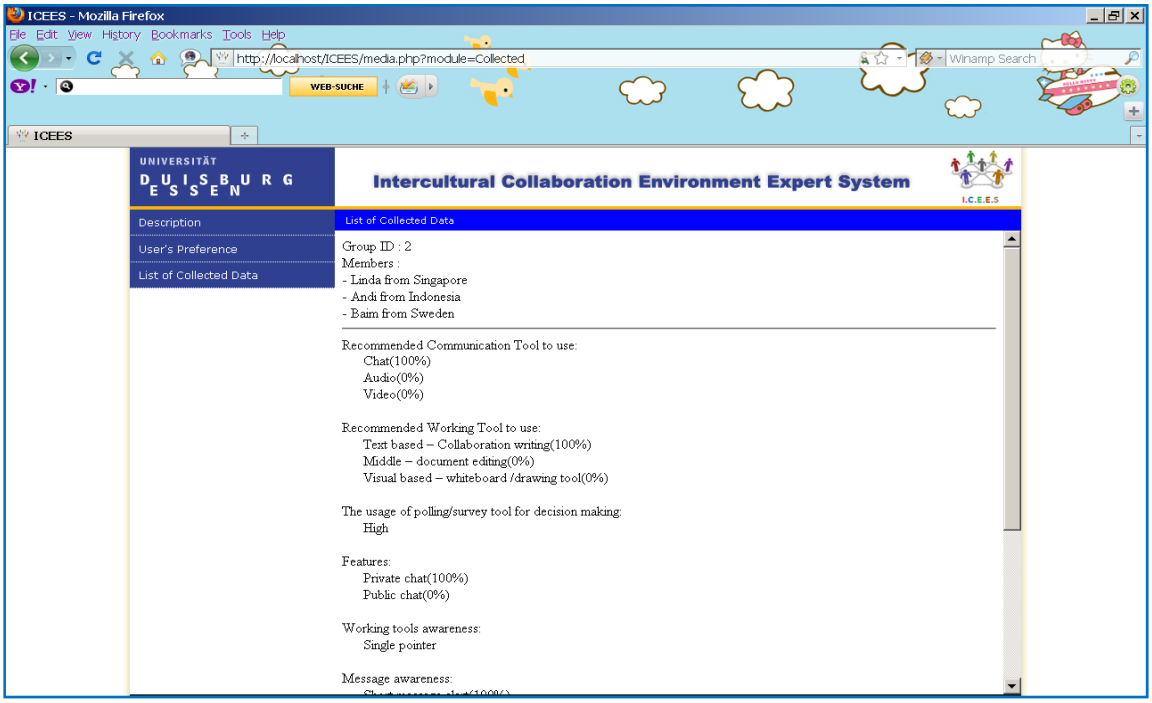


Figure 9.13 Screenshots of the ICEES recommendation result with three group members

9.5 Conclusion

Having a culture consultants/experts are rather expensive, this type of expert system benefits cross-cultural user in collaborating together. The use of ICEES can assist users by providing a culture expert available. The essence of an expert system is to mimic an expertise and distribute expert knowledge into non-experts' hands [270]. ICEES is designed to mimic a cultural expert in a selection of a groupware environment.

Expert systems may be one of the most utility when used as a powerful aid to decision-making. Choosing the most suitable communication and working tools is important for team that is located distributed to work optimally. Therefore an expert system was developed to support group in choosing which tools to use based on their group members selection influenced by cultural factors. The strategy combine the group members' preferences by searching the most recommended tools and features for the group to use in order to support optimal communication.

This system is made a part of how culture affect the usage of groupware as a social applications and how culture is proposed to be the 9^{th} layer and groupware as the social layer representing as the 8^{th} in the extension of the seven layers of the ISO OSI reference model. This system is proposed as an embedded system in the groupware as a strategy to minimize cultural misunderstanding and problems that commonly arise during intercultural collaboration within teams distributed geographically apart. One of the most common problems in communication are the way people have different interpretation on the same issues, this research centered and analyze groupware suitability based on cultural influence.

CHAPTER 10

CONCLUSION AND FUTURE WORKS

10.1 Conclusion

Given the ongoing trends toward end-user computing, the theory of culture influence as a social influence offer a rich understanding of user behavior in the implementation of new communication, coordination and collaboration technologies. Cultural awareness of differences is very important. People from different culture have different preferences and different expectations [19]. This dissertation seeks to contribute to the understanding of cultural influence in global virtual team working with collaborative application namely groupware. Groupware application should include functions that facilitate social support to increase users' intention to use of the system. Designers and developers of global intercultural collaboration application need to be aware of the views of user's preference in order for the system to be useful. Prospective users will tend to accept the system better if it is design based on their needs and preference of usage with its relevant tools and features.

The findings of the studies have revealed the importance of designing culturally sensitive design system to facilitate groupware application. Results shown in this dissertation proves that user preference and behavior within global virtual teams differ across cultures. This research also contributes to the understanding in developing global virtual teams supported by groupware as a collaborative technology. Especially since virtual teams are becoming more and more common, this research is expected to be a step in the right direction towards enhancing satisfaction and productivity in collaboration working within members from different culture. This research have provided a cross disciplinary perspective on groupware development with the socio-technical issues, where a set of design requirements has been defined.

Most software engineers when designing new technologies or new applications focused only on the technical issues and fail to include the social factors that are very important in developing technologies that serves as social applications. Therefore in this dissertation, two extension layers are proposed and introduced the functionality of the new 8^{th} and 9^{th} layers that extends the well know 7-layer OSI model. These two extension layers mainly focus on the end-user of the applications consisting of social layer as the 8^{th} layer and cultural layer as the 9^{th} layer, which are used to link applications to human needs. These extension layers help software engineers to develop applications within a socio-cultural deployment context. It helps software engineers to understand the need of their end-users benefiting from the products that they are developing the products for.

By establishing the appropriateness of theoretical research and introducing a new approach, called culture-centered design and the cultural engineering as the anchor for groupware development in multicultural context, requirements, features and functions that should be included in groupware as an intercultural collaboration tools was defined in this dissertation. This study suggest a rich series to follow up issues that would improve designers and developers of users demand for the future groupware applications provide good implication to enhance the usability and acceptability of a culturally sensitive system for CSCW activities. An expert system to be embedded in groupware, called ICEES, was also developed in the context of a cross-cultural collaboration and is expected to support PASSENGER.

Furthermore, this dissertation can serve as a benchmark for future research on groupware design for multicultural users across different countries. It can also be use as a requirement set for next generation groupware (Passenger 2) to be developed at the Institute of Computer Engineering, University Duisburg-Essen. By implementing the cultural engineering and culture-centered design approach, it will make this new groupware as an intercultural collaboration supporting tool.

10.2 Contribution of the research

This research is an initial step for encouraging future research to develop new innovative groupware technology suitable for multicultural users. Contribution of this research is that the groupware requirements described within this dissertation can be understood easily by software engineers, so that they can aid communication and therefore can develop groupware that facilitate intercultural collaboration.

This research is expected to bridge the socio-technical gaps that are missing the previous CSCW researches. Software engineers can use the result of this research to produce collaborative technologies that bridge the social aspect to the technical side, especially since most technologies are better equipped to deal with technical issues than social ones, and therefore many technological solutions end up in the field without being used due to social rather than technical reasons [271]. This dissertation is expected to solve some of the gaps between the technical capabilities and the social needs to support collaborative activities.

This dissertation investigates evidence of cultural differences and its effect on groupware. It proposes requirements and user interface design for groupware and provide a knowledge-based expert system to be embedded in groupware applications.

The principles presented in this dissertation provide groupware designers with a guideline to the development of the successful intercultural collaboration tools. It alerts groupware designer to the cultural problem that may encounter miscommunication in collaboration support. Furthermore, this research contributes knowledge on how to identify user's need to support collaborative activities among culturally and geographically dispersed group members. This research contributes knowledge in using inductive and deductive, qualitative, and comparative analytic approaches for the identification and design of a groupware application for multicultural users to support cross-cultural collaboration.

10.3 Future Works

This research opens several interesting aspects for future research, partially resulting from its limitations. The research concentrated on a particular domain (the acceptance of groupware by multicultural users) and particular task (designing groupware for multicultural users). One of the limitation of this study is its limited sample size, which only provide three countries samples. The narrow demographic sample may generate results not applicable to users in other cultural groups. Additional investigation other different cultures is essential to understand whether cultural factors critical to the success of a groupware initiative design for multicultural users. Future research may address different user groups, user tasks and different types of interface design for groupware to evaluate whether findings are generalisable. Future research should consider samples from a wider

range of groupware technologies. A longitudinal study in examining the actual usage of groupware would be a valuable research for the future in enhancing new innovative groupware technologies.

One of the issues for future research is to expand the ICEES knowledge-base and the inclusion of an explanation facility. When a user need additional information about the other group members' culture, it would be beneficial for the users to have the ability to ask the system. Programming expertise as well as cultural knowledge needs to be available to support the updating of the information in the expert system. The future goal for ICEES is as a module that can be incorporated within the Passenger 2 Groupware.

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2. **R. Suadamara**, S. Werner, and A. Hunger, "Cultural Influence on User's Preference on Groupware Application for Intercultural Collaboration," *Proceedings of the 3rd ACM International Conference on Intercultural Collaboration in Copenhagen, Denmark*, pp. 215-218, Aug. 2010.

3. **R. Suadamara**, S. Werner, and A. Hunger, "ACM Conference on Cross-cultural Design of a Groupware Application for Global Virtual Team," *for publication of The HCI International 2011 Conference Proceedings and published by Springer the Lecture Notes in Computer Science* (LNCS)*, Lecture Notes in Artificial Intelligence (LNAI) series and the Communications in Computer and Information Science (CCIS) series. Available on–line through the SpringerLink Digital Library, Florida, USA*, Jul. 2011.

4. **R. Suadamara**, S. Werner, and A. Hunger, "Culture Requirements for Multicultural Users," ACM Conference on *Designing for Global Markets 9. Proceedings of the 9th Annual International Workshop on Internationalization of Products and Systems (IWIPS 2010), in London, UK*, pp. 51 - 61, Jul. 2010.

5. **R. Suadamara**, S. Werner, and A. Hunger, "Culture Influence on Human Computer Interaction: Cultural factors toward user's preference on groupware application design," *Proceedings of the ACM Conference of the 12th International Conference on Enterprise Information Systems in Funchal, Madeira*, pp. 186-191, Jun. 2010.

6. A. Hirlehei, **R.Suadamara**, A. Hunger, S.Werner, A. Ekadiyanto, H.Mahmoody, Y.Luo, "Towards Tailor-able Groupware: A Systematic Approach to User's Requirement Assessment in Supporting a User Defined Environment of Synchronous Groupware," *IEEE Conference Proceedings of the IEEE Professional Communication Society (PCS), pp. 50 - 57*, Jul. 2010.

7. **R. Suadamara**, S. Werner, and A. Hunger, "Cultural Influence on Groupware Application Design: Analysis on user's preference of a groupware design based on cultural factors," *Proceedings of the First Annual Indonesian Scholars Conference in Taiwan*, pp. 57 - 64, Mar. 2010.

APPENDIX A

RESEARCH QUESTIONNAIRE

Dear Sir/Madam,

The Institute of Computer Engineering at University of Duisburg-Essen, Germany, is doing research in the field of systems to support cooperative work for distributed teams (groupware). My name is Rein Suadamara and I'm one of the researchers in team that currently develops a new system to support cooperative work in the strategic management of business enterprises. Within my PhD project I'm focusing on the aspects of team compositions with members from different cultures. Problems in that field might arise from different preferences towards the usage of groupware. The goal of my PhD project is to contribute to the groupware design, especially the interface design, in a way so that differences in the usage of such systems and differences in communication behavior that arise from different cultural backgrounds of the users are minimized by a better support of the system for such team compositions. I'm requesting your participation in my PhD project by filling in this questionnaire. The result of this survey will be used purely for research purposes. This questionnaire may take 20 minutes to complete. We only want to know your opinion. There is no right or wrong answer. Your answers will be valuable for this research. Thank you for your valuable time to participate in this survey! ☺

Best Regards,
Rein Suadamara – Institute of Computer Engineering, University Duisburg-Essen, Germany
Contact information: rsuadamara@googlemail.com

Definition - The following terms are used throughout the questionnaire:

- Groupware : Computer used as a communication system that supports a group of people working together. Groupware support collaboration between users by allowing computers to mediate the interactions.
- Synchronous : synchronous collaboration means the simultaneous presence of the partners (when users are working at the same time/real-time)
- Session : A session is a period of time when two or more members of a group are working together synchronously. Interaction that occurs in the groupware usually takes place in a session.
- Interface : The part of the system that interacts with the user
- GUI : Graphical user interface (GUI) is an interface that does not only display text but also graphics mostly as a set of metaphors for interaction with the computer (icon, pull-down menus, windows)

General Information

1. Name : _____
2. Name of Company/Institution : _____
3. Company's field/area : _____
4. Job position : _____
5. Nationality : _____
6. Age : a. Under 25 b. Between 25-45 c. above 45
7. Gender : a. Female b. Male
8. Experience working in team : a. Yes b. No
9. Have you use any groupware application to support your group work? : a. Yes, please specify:_____ b. No
10. Email address : _____

Part One - Please select the most suited answer.

6 – Strongly Agree
5 – Agree
4 – Slightly Agree
3 – Slightly Disagree
2 – Disagree
1 – Strongly Disagree

		6	5	4	3	2	1
1.	I feel confident that I can communicate with people from other cultures	○	○	○	○	○	○
2.	I can manage conflict with people who are culturally different from me	○	○	○	○	○	○
3.	When I disagree with a group, I would leave the group discussion immediately	○	○	○	○	○	○
4.	I prefer to give opinions that will help people save face rather than give a statement of the truth	○	○	○	○	○	○
5.	I say "no" directly when I have to	○	○	○	○	○	○
6.	I find it important to see other peoples rank and status	○	○	○	○	○	○

Part Two

A. I would most likely use a groupware application for the following purpose (Please put checkmark on the selected answers, more than one answer is possible):

- ☐ Producing reports
- ☐ Weekly meetings
- ☐ Team/Group discussion
- ☐ Negotiating tool
- ☐ Non-business purpose

B. I would mostly/frequently use the following features below (Please put checkmark on the selected answers, more than one answer is possible):

- ☐ Videoconference
- ☐ Calendar
- ☐ Power point
- ☐ Translation Tool
- ☐ Grammar / Spelling Checking
- ☐ Survey tool (questionnaire, polling, voting)
- ☐ Possibility of using external software application (i.e CAD drawings, Adobe Photoshop, Visio, etc,)
- ☐ Audioconference
- ☐ Bookmark
- ☐ Shared Whiteboard
- ☐ Wikipedia / Encyclopedia
- ☐ My info (user profile)
- ☐ Document management (i.e having a shared document option)
- ☐ Share application option (sharing a software application with the other users)
- ☐ Chat or Instant Messaging
- ☐ Plain text email
- ☐ Webinars (Web Seminars)
- ☐ Dictionary / Thesaurus
- ☐ To do list
- ☐ Project management (i.e group timetable, deadline date, etc)

C. If I am working using a groupware application, I would most likely perform the following actions below:

6 – Strongly Agree
5 – Agree
4 – Slightly Agree
3 – Slightly Disagree
2 – Disagree
1 – Strongly Disagree

		6	5	4	3	2	1
1.	Before the session begin, I would like to be able to adjust the number of users participating in the video conference	○	○	○	○	○	○
2.	I will not allow a non-invited user to enter and join a session (I prefer to limit the user joining the session)	○	○	○	○	○	○

3.	I will not allow late joiners (joining the discussion when the session has already started) or early leavers (leaving the discussion even when it is not finish) when I have a discussion	○	○	○	○	○	○
4.	During a meeting discussion, I prefer to have a moderator that control the flow of the meeting	○	○	○	○	○	○
5.	I wait until someone (other user) finishes talking, even when I have something to say	○	○	○	○	○	○
6.	When the session ends, I would stop even though the task has not be completed	○	○	○	○	○	○
7.	I like to use the shared whiteboard (virtual whiteboard available in the application) to share my ideas	○	○	○	○	○	○
8.	I prefer to use notepad or word applications for collaboration rather using the whiteboard facilities	○	○	○	○	○	○
9.	I prefer to use Powerpoint presentation during discussion to highlight pointers rather than a long documentation reports	○	○	○	○	○	○
10.	I like to have a private chat option (to chat with certain users) during discussion group	○	○	○	○	○	○
11.	I find it important to see what my other teammates are working on	○	○	○	○	○	○
12.	I find it important to keep all of the history of all the previous work and keep track of all the changes done	○	○	○	○	○	○
13.	I would rather focus on a task than a personal relationship	○	○	○	○	○	○

D. Please select the most suited answer

6 – Strongly Agree
5 – Agree
4 – Slightly Agree
3 – Slightly Disagree
2 – Disagree
1 – Strongly Disagree

		6	**5**	**4**	**3**	**2**	**1**
1.	I like to use emoticons to express my emotion (e.g. smileys)	○	○	○	○	○	○
2.	I like empty spaces on the screen (i.e when I move my mouse to the sides, the toolbars will appear)	○	○	○	○	○	○
3.	I would like to be notified when a new email / new files / chat messages comes	○	○	○	○	○	○
4.	I like to have an emotional awareness (mood indicator) of the other users reaction when I'm presenting a document / presentation (i.e. understand or not understand)	○	○	○	○	○	○
5.	I like to see a message pop up, when I did a mistake	○	○	○	○	○	○
6.	I like to see a message pop up, when the other users make a mistake	○	○	○	○	○	○

7.	I like to see users login and logout	○	○	○	○	○	○
8.	I prefer the bandwidth of the video conference can be adjusted (high/medium/low bandwidth)	○	○	○	○	○	○
9.	I would like to hide some user's video even if they are online (audio only)	○	○	○	○	○	○

Part Three

A. Imagine that you are given the facilities to use a groupware application to support your daily work with your colleagues in your company or institution that you are working at. Please select the most suited answer.

6 – Strongly Agree
5 – Agree
4 – Slightly Agree
3 – Slightly Disagree
2 – Disagree
1 – Strongly Disagree

		6	**5**	**4**	**3**	**2**	**1**
1.	It is easier for me to follow a template or assistance on how to use the application instead of trying to figure out by my own	○	○	○	○	○	○
2.	I prefer to use familiar software, than to use software that may have many features that I need but too complicated to use	○	○	○	○	○	○
3.	I want to have the settings adjustable and flexible to my preference	○	○	○	○	○	○
4.	It is easier for me to use audio only (without video)	○	○	○	○	○	○
5.	It is easier for me to use video only (with chat)	○	○	○	○	○	○
6.	I prefer to use both audio and video	○	○	○	○	○	○
7.	It is easier for me use the chat message than video/ audio	○	○	○	○	○	○
8.	I always read the user's manual	○	○	○	○	○	○
9.	I like to have the freedom to chose the layout / colors / size of my screen	○	○	○	○	○	○
10.	I prefer to have a basic layout of an interface and don't want to trouble myself in changing the way it look	○	○	○	○	○	○

B. **I like the interface design of a system with:**

6 – Strongly Agree
5 – Agree
4 – Slightly Agree
3 – Slightly Disagree
2 – Disagree
1 – Strongly Disagree

		6	5	4	3	2	1
1.	Strong bright colors	○	○	○	○	○	○
2.	Soft colors like pastel	○	○	○	○	○	○
3.	Many different colors	○	○	○	○	○	○
4.	Black and white only	○	○	○	○	○	○
5.	Text or command based	○	○	○	○	○	○
6.	Icons, buttons, images	○	○	○	○	○	○
7.	Windows that divide screen into areas	○	○	○	○	○	○
8.	Pop-up menus that appear when user clicks on a particular area of the screen	○	○	○	○	○	○
9.	Pull down menus that are dragged down from the top of the screen	○	○	○	○	○	○
10.	Fixed menus that remain in place until the option is chosen	○	○	○	○	○	○
11.	Multiple windows (one window on top of the other)	○	○	○	○	○	○
12.	Online help	○	○	○	○	○	○
13.	User Manual/Documentation	○	○	○	○	○	○

Part Four - Please select the most suited answer

6 – Strongly Agree
5 – Agree
4 – Slightly Agree
3 – Slightly Disagree
2 – Disagree
1 – Strongly Disagree

		6	5	4	3	2	1
1.	I refuse to use an application that has materials or features not suitable for my culture	○	○	○	○	○	○
2.	I am more satisfied is I can run several features using only one application	○	○	○	○	○	○
3.	I am more satisfied if I can draw on a document like using a pen	○	○	○	○	○	○
4.	I am more satisfied if the system to be able to find it just by entering short key word when I lose a file and cannot find it	○	○	○	○	○	○
5.	I am more satisfied if I can use a software that can display my native language	○	○	○	○	○	○
6.	I am more satisfied if I can record all my audio conversation / video conversation / chat conversation	○	○	○	○	○	○
7.	I am more satisfied if I can keep track on all the changes that has been done on the shared file	○	○	○	○	○	○
8.	I do one thing at a time rather than many things at once	○	○	○	○	○	○
9	I would like to have a distinction between the boss and the subordinate shown in the application (i.e the boss/project leader's has a bigger size of windows screen)	○	○	○	○	○	○
10.	If I found some problem when working with the application, I react to it seriously (contact administrator)	○	○	○	○	○	○

<u>Part Five</u> - Please select the most suited answer.

6 – Strongly Agree
5 – Agree
4 – Slightly Agree
3 – Slightly Disagree
2 – Disagree
1 – Strongly Disagree

		6	5	4	3	2	1
1.	I prefer computer software that has an interface adapted to my culture	○	○	○	○	○	○
2.	I find it important to have an interface that is adapted to my culture	○	○	○	○	○	○
3.	I think it is harder to use culturally adapted software compared to the same design for everybody in the world	○	○	○	○	○	○
4.	I find using a technology for producing work is more important than for establishing relationship	○	○	○	○	○	○
5.	I find it important that I perform well on the application when other people can see me working	○	○	○	○	○	○
6.	I get very upset when the application does something strange and I am uncertain of what to do next	○	○	○	○	○	○

APPENDIX B

RESEARCH QUESTIONNAIRE

(GERMAN VERSION)

Sehr geehrte Damen und Herren,

eine Arbeitsgruppe des Fachgebiets Technische Informatik an der Universität Duisburg-Essen befasst sich mit der Erforschung und Entwicklung von Systemen zur Unterstützung der kooperativen Arbeit für dezentralisierte Gruppen (cooperative work for distributed teams - groupware). Mein Name ist Rein Suadamara und ich bin Wissenschaftlerin eines Forschungsteams, welches zur Zeit ein System zur Unterstützung von kooperativer Arbeit im strategischen Management von Unternehmen entwickelt. Im Rahmen meiner Promotion konzentriere ich mich im Speziellen auf die Aspekte der Gruppenzusammensetzung (Team composition) insbesondere mit Mitgliedern aus unterschiedlichen Kulturkreisen. Probleme, die auf diesen Aspekt innerhalb der Nutzung von Groupware zurückgehen, können ganze Projekte gefährden. Das Ziel meiner Forschungsarbeit ist es, diese Aspekte schon beim Design der Groupware, speziell beim Interface Design, zu berücksichtigen und so dazu beizutragen, dass Unterschiede bei der Nutzung solcher Systeme und Unterschiede im Kommunikationsverhalten durch eine verbesserte systemische Unterstützung für solche Gruppenzusammensetzungen minimiert werden können. Ich möchte Sie zur Teilnahme an meinem Projekt einladen, indem sie den unten stehenden Fragebogen ausfüllen. Für das Ausfüllen des kompletten Fragebogens sollten Sie weniger als 20 Minuten benötigen. Ihre Antworten werden ausschließlich zu Forschungszwecken genutzt. Es gibt keine „richtig/falsch" - Antwort. Ihre Meinung zählt und ist für unsere Forschungsarbeit wichtig. Ich bedanke mich für Ihre Unterstützung und aktive Beteiligung! □

Mit freundlichen Grüßen,

Rein Suadamara – Lehrstuhl Technische Informatik, Universität Duisburg-Essen, Deutschland
Kontaktinformation: rsuadamara@googlemail.com

Glossar - folgende Fachwörter werden innerhlab des Fragebogens oft verwendet

- Groupware:	- Ein als Kommunikationssystem verwendetes Computersystem, welches eine Gruppe von zusammenarbeitenden Personen unterstützt. - Groupware unterstützt die Zusammenarbeit von Benutzern durch Computer, die es erlauben zwischen den Interaktionen zu vermitteln.
- Synchron	- Synchrone Zusammenarbeit ist die zeitgleiche Anwesenheit von Partnern (Wenn Benutzer zur selben Zeit / in Echtzeit zusammenarbeiten)
- Session (deutsch: Sitzung):	- Eine "Session" ist eine bestimmte Zeitspanne in der zwei oder mehr Mitglieder einer Gruppe synchron zusammenarbeiten. - Interaktion, die innerhalb einer Groupware auftritt, findet üblicherweiser während einer "Session" statt.
- Interface (deutsch:Schnittstelle):	- Das „Interface" ist der Teil des Systems, der mit dem Benutzer interagiert (Bildschirminhalt)
- GUI:	- Die Grafische Benutzer Schnittstelle (Graphical User Interface □ GUI) ist ein Interface, welches nicht nur Text, sondern auch Grafik darstellen kann. - Meistens wird ein GUI als eine Zusammenstellung von bildlichen Metaphern zur Interaktion mit dem Computer betrachtet (z.B. Icons, ausklappbare Menüs, Fenster)

Persönliche Angaben:

1. Name, Vorname : _____
2. Unternehmen/Institut : _____
3. Branche : _____
4. Position/Funktion : _____
5. Staatsangehörigkeit : _____

6. Alter : a. unter 25 b. zwischen 25-45 c. über 45
7. Geschlecht : a. weiblich b. männlich
8. Erfahrung in der Teamarbeit : a. ja b. nein
9. Haben Sie bereits eine Groupware-Applikation zur Unterstützung Ihrer Teamarbeit verwendet? : a. ja, bitte nennen Sie ein Beispiel:_____ b. nein

10. Emailadresse : _____

Teil 1 – Bitte kreuzen Sie bei jeder Frage an, was Ihnen am ehesten zusagt.

6 – Stimme voll und ganz zu
5 – Stimme zu
4 – Stimme eher zu
3 – Stimme eher nicht zu
2 – Stimme nicht zu
1 – Stimme absolut nicht zu

		6	5	4	3	2	1
1.	Ich bin davon überzeugt, dass ich mit Leuten aus unterschiedlichen Kulturkreisen gut umgehen kann.	□	□	□	□	□	□
2.	Ich kann Konflikte mit Leuten austragen, deren kultureller Hintergrund anders ist als meiner.	□	□	□	□	□	□
3.	Wenn ich mit einer Gruppe nicht übereinstimme, würde ich die Diskussionsrunde sofort verlassen.	□	□	□	□	□	□
4.	Um jemanden nicht in Verlegenheit zu bringen, würde ich eher die Unwahrheit sagen, wenn ich meine Meinung äußere.	□	□	□	□	□	□
5.	Wenn ich es muss, sage ich geradeheraus „Nein“.	□	□	□	□	□	□
6.	Ich finde es wichtig, sozialen Status und Rang meiner Gesprächspartner zu erkennen.	□	□	□	□	□	□

Teil 2

A. Eine Groupware benutze ich/würde ich am ehesten benutzen um:… (Bitte kreuzen Sie die am ehesten passenden Antworten an, eine oder mehrere Antworten möglich):

□ Berichte zu erstellen
□ an wöchentlichen Besprechungen teilzunehmen
□ an einer Gruppendiskussion teilzunehmen
□ (mit anderen) zu verhandeln
□ einen nicht-geschäftlichen Zweck zu erfüllen

B. Folgende Groupware Funktionen benutze ich am häufigsten/würde ich am häufigsten benutzen: (Bitte kreuzen Sie die am ehesten passenden Antworten an, eine oder mehrere Antworten möglich):

□ Videokonferenz
□ Audiokonferenz
□ Chatting oder Instant Messaging
□ Gruppenkalender
□ Lesezeichen
□ Email
□ Präsentationen (z.B. Power Point)
□ Shared Whiteboard (Gruppeneditor)
□ Web-Seminar
□ Übersetzungshilfe
□ Wikipedia / Encyclopedia
□ Wörterbuch / Lexikon
□ Grammatik / Rechtschreibung
□ Meine Info (z.B. Benutzerprofil) (Soziale Netzwerke)
□ To-do-Liste
□ Befragungsmittel (Fragebogen, Umfrage, Wahl)
□ Dokumentmanagement (z.B. mehrfache Benutzung von Dokumenten durch andere Benutzer)
□ Projektmanagement (z.B. Gruppenkalender, Fristtermine, usw.)
□ Die Möglichkeit, eine externe Software zu nutzen. (z.B. CAD Zeichnungen, Adobe Photoshop, MS Visio, usw.)
□ Die Möglichkeit, eine Software mit anderen Benutzern zu verwenden.

C. Wenn ich bei der Arbeit eine Groupware verwende, würde ich mich höchstwahrscheinlich wie folgt verhalten (Bitte kreuzen Sie bei jeder Frage an, was Ihnen am ehesten zusagt):

6 – Stimme voll und ganz zu
5 – Stimme zu
4 – Stimme eher zu
3 – Stimme eher nicht zu

2 – Stimme nicht zu

1 – Stimme absolut nicht zu

		6	5	4	3	2	1
1.	Ich würde die Anzahl der Teilnehmer abstimmen, bevor eine Videokonferenz stattfindet.	□	□	□	□	□	□
2.	Ich würde einen nicht-eingeladenen Benutzer zur Teilnahme der Videokonferenz nicht erlauben. (Ich bevorzuge eine Eingrenzung der Teilnehmerzahl.)	□	□	□	□	□	□
3.	Ich würde „Zuspätkommenden" (Teilnehmer, die zu spät kommen, wenn die Session bereits gestartet wurde) oder „Zufrühgehenden" (Teilnehmer, die gehen, obwohl die Session noch nicht beendet wurde) nicht erlauben beizutreten wenn ich eine Gruppendiskussion habe.	□	□	□	□	□	□
4.	Während einer Konferenzdiskussion bevorzuge ich einen Moderator, der die Konferenz leitet.	□	□	□	□	□	□
5.	Ich warte lieber bis andere zu Ende gesprochen haben, auch wenn ich selbst etwas zu sagen habe.	□	□	□	□	□	□
6.	Wenn die Sitzung zu Ende ist, würde ich sofort aufhören, selbst wenn die Aufgabe noch nicht erledigt wurde.	□	□	□	□	□	□
7.	Ich bevorzuge ein „***shared whiteboard"*** *(gemeinsamer Gruppeneditor in einer Anwendung)*, um meine Ideen dort zu teilen.	□	□	□	□	□	□
8.	Ich verwende lieber „Notepad"- oder „Word"-Anwendungen zur Zusammenarbeit als eine Whiteboard Möglichkeit.	□	□	□	□	□	□
9.	Um während einer Diskussionsrunde wichtige Punkte herauszustellen, verwende ich lieber Powerpoint-Presentationen als einen langatmigen Dokumentationsbericht	□	□	□	□	□	□
10.	Während einer Gruppendiskussion hätte ich gerne die Möglichkeit für ein privates Chatting (mit einem bestimmten Teilnehmer oder mehreren)	□	□	□	□	□	□
11.	Ich finde es wichtig, sehen zu können woran meine Teamkollegen gerade arbeiten.	□	□	□	□	□	□
12.	Ich finde es wichtig, eine Chronik der vorangegangen Arbeitsschritte zu besitzen und alle Änderungen protokolliert zu wissen.	□	□	□	□	□	□
13.	Ich konzentriere mich eher auf die Aufgabe als auf die Beziehung mit meinem Gegenüber.	□	□	□	□	□	□

D. Bitte kreuzen Sie bei jeder Frage an, was Ihnen am ehesten zusagt

6 – Stimme voll und ganz zu

5 – Stimme zu

4 – Stimme eher zu

3 – Stimme eher nicht zu

2 – Stimme nicht zu

1 – Stimme absolut nicht zu

		6	5	4	3	2	1
1.	Ich benutze gerne Emoticons (z.B. Smileys), um meine Gefühle zu äußern.	□	□	□	□	□	□

2.	Ich habe gerne eine freie Benutzeroberfläche auf dem Bildschirm (z.B. wenn ich die Mouse zur Seite lege, tauchen erst dann die Toolbars auf)	□	□	□	□	□	□
3.	Ich habe es gerne, dass ich benachrichtigt werde wenn eine neue Email / Datei / Nachricht kommt.	□	□	□	□	□	□
4.	Ich habe es gerne, die Reaktionen anderer Teilnehmer zu sehen (Stimmungsanzeige), wenn ich ein Dokument oder eine Präsentation zeige. (z.B. verstanden oder nicht verstanden)	□	□	□	□	□	□
5.	Ich habe es gerne, dass sich ein Dialogfenster öffnet, wenn ich einen Fehler beginge.	□	□	□	□	□	□
6.	Ich habe es gerne, dass sich ein Dialogfenster öffnet, wenn andere Teilnehmer Fehler begingen.	□	□	□	□	□	□
7.	Ich möchte es gerne sehen, wenn sich andere Benutzer einloggen und ausloggen.	□	□	□	□	□	□
8.	Ich würde es bevorzugen, wenn die Bandbreite einer Videokonferenz eingestellt werden könnte (hohe/mittlere/niedrige Bandbreite)	□	□	□	□	□	□
9.	Ich würde das Videobild einiger Benutzer ausschalten wollen, auch wenn sie online sind. (nur Audio)	□	□	□	□	□	□

Teil 3

A. Stellen Sie sich vor, dass Ihnen die Möglichkeit gegeben wird eine Groupware Applikation zu nutzen, um Ihre tägliche Arbeit mit Ihren Kollegen in Ihrer Firma oder Institution zu unterstützen. Bitte kreuzen Sie bei jeder Frage an, was Ihnen am ehesten zusagt

6 – Stimme voll und ganz zu
5 – Stimme zu
4 – Stimme eher zu
3 – Stimme eher nicht zu
2 – Stimme nicht zu
1 – Stimme absolut nicht zu

		6	**5**	**4**	**3**	**2**	**1**
1.	Mir fällt es leichter einer Vorlage oder einem Assistenten als Einführung zur Benutzung einer Anwendung zu folgen als es selbst herauszufinden.	□	□	□	□	□	□
2.	Ich bevorzuge eher bekannte Software zu benutzen, als Software mit vielen Features, die ich zwar benötige aber zu kompliziert sind um sie zu benutzen	□	□	□	□	□	□
3.	Ich möchte die Einstellungen innerhalb einer Applikation flexibel einstellen können, damit ich sie nach meinen Bedürfnissen einrichten kann	□	□	□	□	□	□
4.	Mir fällt es leichter nur Audioverbindungen zu benutzen. (Ohne Video)	□	□	□	□	□	□
5.	Mir fällt es leichter, nur Videoverbindungen zu benutzen. (mit Chat)	□	□	□	□	□	□
6.	Ich bevorzuge es, Audio und Video während einer Verbindung zu benutzen.	□	□	□	□	□	□

7.	Mir fällt es leichter, einen Chat zu benutzen als Video/Audio.	□	□	□	□	□	□
8.	Ich lese immer das Benutzerhandbuch.	□	□	□	□	□	□
9.	Ich habe es gerne, wenn das Layout / die Farbe / die Größe meines Bildschirms frei einstellbar sind.	□	□	□	□	□	□
10.	Ich bevorzuge ein Basislayout und möchte mich selbst nicht damit rumärgern das Standard Interface zu verändern.	□	□	□	□	□	□

B. Ich möchte das Design des Interfaces mit

6 – Stimme voll und ganz zu
5 – Stimme zu
4 – Stimme eher zu
3 – Stimme eher nicht zu
2 – Stimme nicht zu
1 – Stimme absolut nicht zu

		6	**5**	**4**	**3**	**2**	**1**
1.	starken hellen Farben	□	□	□	□	□	□
2.	sanften Farben wie pastell	□	□	□	□	□	□
3.	vielen unterschiedlichen Farben	□	□	□	□	□	□
4.	nur Schwarz/weiß Farben	□	□	□	□	□	□
5.	Text oder Anweisungs-basiert	□	□	□	□	□	□
6.	Icons, Buttons, Abbildungen	□	□	□	□	□	□
7.	Fenstern mit aufgeteilten Bereichen	□	□	□	□	□	□
8.	Aufklappmenüs, welche beim Klicken des Benutzers in einem bestimmten Bereich des Bildschirms auftauchen.	□	□	□	□	□	□
9.	Pull-down Menüs, welche von oben des Bildschirms nach unten herunterzogen werden können.	□	□	□	□	□	□
10.	fixierten Menüs, welche erhalten bleiben bis die Option ausgewählt wurde.	□	□	□	□	□	□
11.	mehreren Fenstern (ein Fester auf dem anderen)	□	□	□	□	□	□
12.	Online Hilfe	□	□	□	□	□	□
13.	Benuzterhandbüchern	□	□	□	□	□	□

Teil 4 – Bitte kreuzen Sie bei jeder Frage an, was Ihnen am ehesten zusagt:

6 – Stimme voll und ganz zu
5 – Stimme zu
4 – Stimme eher zu
3 – Stimme eher nicht zu
2 – Stimme nicht zu

		6	**5**	**4**	**3**	**2**	**1**
1.	Ich weigere mich eine Anwendung zu nutzen, in der das Material oder die Features nicht meiner Kultur entsprechen.	□	□	□	□	□	□
2.	Es stellt mich eher zufrieden, wenn man mit nur einer Anwendung mehrere Features benutzen kann.	□	□	□	□	□	□
3.	Es stellt mich eher zufrieden, wenn ich auf einem Dokument malen kann wie mit einem Stift.	□	□	□	□	□	□

4.	Es stellt mich eher zufrieden, wenn es dem System möglich ist, durch Eingabe von kurzen Schlüsselwörtern Dateien wieder zu finden, die ich nicht mehr finden kann.	□	□	□	□	□	□
5.	Es stellt mich eher zufrieden, wenn ich eine Software benutzen kann in der meine Muttersprache zur Verfügung steht.	□	□	□	□	□	□
6.	Es stellt mich eher zufrieden, wenn alle meine Audio-/ Video-/Chatkonversationen aufgezeichnet werden können.	□	□	□	□	□	□
7.	Es finde es gut, wenn alle Änderungen, die innerhalb gemeinsam genutzter Dateien gemacht wurden, nachgeprüft bzw. nachvollzogen werden können (Chronik).	□	□	□	□	□	□
8.	Ich mache lieber eins nach dem anderen, als mehrere Dinge auf einmal.	□	□	□	□	□	□
9	Ich möchte einen Unterschied zwischen den hierarchisch Übergeordneten und den Mitarbeitern auf gleicher Hierarchieebene innerhalb einer Anwendung sehen, z.B. die Fenstergröße des Chefs ist größer als die von Mitarbeitern.	□	□	□	□	□	□
10.	Wenn ich Probleme bei der Nutzung der Anwendung habe, nehme ich es ernst. (z.B. kontaktiere ich den Administrator)	□	□	□	□	□	□

Teil 5 - Bitte kreuzen Sie bei jeder Frage an, was Ihnen am ehesten zusagt:

6 – Stimme voll und ganz zu
5 – Stimme zu
4 – Stimme eher zu
3 – Stimme eher nicht zu
2 – Stimme nicht zu
1 – Stimme absolut nicht zu

		6	**5**	**4**	**3**	**2**	**1**
1.	Ich bevorzuge eine Software, in der das Interface an meine Kultur angepasst ist.	□	□	□	□	□	□
2.	Ich finde es wichtig, dass ein Interface an meine Kultur angepasst ist.	□	□	□	□	□	□
3.	Ich glaube, dass es schwieriger ist, eine an die Kultur angepasste Software zu benutzen, als eine mit einem einheitlichen Design für die ganze Welt.	□	□	□	□	□	□
4.	Ich finde es wichtiger, eine Technologie für die Erzeugung von Arbeit zu nutzen, als für den Aufbau von menschlichen Beziehungen.	□	□	□	□	□	□
5.	Ich finde es wichtig, dass ich meine Arbeit innerhalb der Anwendung gut verrichte, wenn andere Personen dabei zusehen.	□	□	□	□	□	□
6.	Ich kann sehr aufgebracht sein, wenn die Anwendung etwas seltsames macht und ich unsicher bin was als nächstes zu tun ist.	□	□	□	□	□	□

Danke für Ihre Unterstützung!

APPENDIX C

CULTURAL QUESTIONS

1.				Time				
	On Time / Based on schedule	○	○	○	○	○	○	Flexible / Not on time
2.				Time				
	Do one thing at a time	○	○	○	○	○	○	Multitasking (do more things at the same time)
3.				Time orientation				
	Always looking at the future	○	○	○	○	○	○	Always remembering the past
4.				Power distance				
	We are all equal	○	○	○	○	○	○	There are distance / gap between different levels
5.				Rules				
	Always follow the rule	○	○	○	○	○	○	Depends on the situation / Rules can be handled "flexible"
6.				Group oriented				
	Individualist	○	○	○	○	○	○	Collectivist
7.				Destiny				
	I decide on how my life is going to be	○	○	○	○	○	○	I live my live based on how it is destined to be
8.				Risk				
	As a problem	○	○	○	○	○	○	As a challenge
9.				Speaking volume				
	Silent	○	○	○	○	○	○	Loud
10.				Space				
	Needs more space	○	○	○	○	○	○	Need little space
				Task – orientation				
11.	Task oriented	○	○	○	○	○	○	Personal oriented
12.				Handling conflict				
	Confront	○	○	○	○	○	○	Avoid conflict
13.				Communication Style				
	Direct, to the point	○	○	○	○	○	○	In direct, not to the point
14.				Acceptance of Changes				
	Open toward any changes	○	○	○	○	○	○	Close toward any changes

APPENDIX D

Kulturelle Fragen (Was für eine Art Mensch sind Sie?)

1.		Pünktlichkeit	
	pünktlich / nach Terminplan	□ □ □ □ □ □	flexibel / unpünktlich
2.		Zeitmanagement	
	Eins nach dem anderen bearbeitend	□ □ □ □ □ □	Multitasking (mehrere Dinge gleichzeitig bearbeitend)
3.		Zeitorientierung	
	Immer zukunftsorientiert	□ □ □ □ □ □	Immer die Vergangenheit im Kopf behaltend
4.		Machtdistanz	
	„Wir sind alle gleich“	□ □ □ □ □ □	Es gibt Abstände zwischen unterschiedlichen Ebenen
5.		Regeln	
	Immer den Regeln folgend	□ □ □ □ □ □	Es kommt auf die Situation an / Regeln werden flexibel behandelt.
6.		Gruppenorientierung	
	Individualist	□ □ □ □ □ □	Kollektivist
7.		Schicksal	
	Ich entscheide wie mein Leben sein soll.	□ □ □ □ □ □	Ich lebe mein Leben wie es vorherbestimmt ist.
8.		Risiko	
	...ist ein Problem	□ □ □ □ □ □	...ist eine Herausforderung
9.		Sprechlautstärke	
	leise	□ □ □ □ □ □	laut
10.		Raum und Platz	
	brauche mehr Raum	□ □ □ □ □ □	brauche wenig Raum
		Arbeitsorientierung	
11.	Aufgabenbezogene Orientierung	□ □ □ □ □ □	Personenbezogene Orientierung
12.		Umgang mit Konflikten	
	Konflikten entgegentreten	□ □ □ □ □ □	Konflikte vermeiden
13.		Kommuniktationsstil	
	Direkt, schnell zum Punkt kommend	□ □ □ □ □ □	Indirekt, nicht zum Punkt kommend
14.		Akzeptanz von Änderungen	
	Offen für jede Änderungen	□ □ □ □ □ □	Nicht offen für Änderungen