NTNU – Trondheim
Norwegian University of
Science and Technology

IT Implementation in Public Sector Organizations in Developing Countries

An Action Research-Based Approach in an
Higher Education Institution

I Made Agus Setiawan

Master in Information Systems
Submission date: June 2012
Supervisor: Eric Monteiro, IDI

Norwegian University of Science and Technology
Department of Computer and Information Science

ABSTRACT

Effective IT is vital in organization in the low resource settings of developing countries. This also applies to public sector organizations. However, little research has been reported regarding IT implementation in higher education institution. Meanwhile, it is widely believed that information technology could boost development, strengthen and increase the competitiveness of the university among others.

The focus of this report is to explain as well as improve the IT implementation process in public sector organizations, particularly in higher education institution in developing countries. The motivation for studying the IT implementation process is to be able to understand the underlying aspects of the successful of IT implementation process in developing countries which then give the possibility to make any improvement on the organization.

An action research approach in combination with case study method has been performed in one of Indonesia's public universities. Empirical data collection was done to support the research investigation including two-times of field work in which one of them was getting involved into the organization activity, two round pre and follow-up semi-structural interviews, direct observation, discussion, meeting, document analysis and previous involvement in the institution. An Online Questionnaire was also performed to obtain the perception of research participants regarding the proposed tools.

A one initial cycle of action research was done and the study found several factors that possibly hamper the implementation process in the university and successfully formulated several strategies that can be used to cope with those factors, e.g. limited human resources, lack of management commitment, lack of clear job description among staffs, lack of appropriate planning and strategy for systems development and implementation, ineffective communication & coordination, lack of funds, lack of rewards, and government policies. Intervention is then performed by introducing software project management into the organization as one of the formulated strategies. Even though the outcome of the interventions not clearly visible at this time, it gives a motivation for the continuity of the interventions.

In conclusion, it can be said that among other public sector organizations in developing countries, they share common barriers and challenges in general, and to deal with those challenges require substantial time and appropriate approach.

PREFACE

This thesis with title:

> IT Implementation in Public Sector Organizations in Developing Countries: An Action Research-Based Approach in an Higher Education Institution

presents an action research study approach in the field of IT implementation, which has been written to fulfill the requirement for the degree of Master of Science in Information Systems at Department of Computer and Information Science, Norwegian University of Science and Technology.

I hope that this study will provide better insight about IT implementation and its challenges in public sector organization, especially in Higher Education Institutions (HEIs) in developing countries.

I would like to take this opportunity to Thank God, "Ida Sanghyang Widhi Wasa", for the blessings in completing this thesis. I also want to thank my supervisor, Proffesor Eric Monteiro for sharing this valuable experience, and giving good feedback and advice during the project. Further i would like to thank my wife, my daughter and parrents and all relatives for their moral support as well as all friends and participants that make this project happen.

Trondheim, Jun 18^{th}, 2012

I Made Agus Setiawan

CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

1.1 Background and Motivation

Implementation of information technology (IT) into organization becomes more prominent in developing countries, particularly in public sector organizations. It is believed that adoption of IT provide many advantages for the organization such as being able to enhance policy formulation, promote participation, improve service quality, make planning more effective, resources efficiency, and become a means of empowering citizens through access to information and knowledge (Traunmiiller & Linz 1996, Bhatnagar 2000, Imran & Gregor 2005). This is also applied to the educational sector such as higher education institutions (HEIs). In fact, there are fierce competition among HEIs either domestic or international, in providing high quality facilities and services by utilizing IT. In addition, HEIs have different environment circumstances from other type of organizations in which they use IT for educational purposes as well as administrative support(Curry & Katz 2002). However, implementation of IT is not a simple construct, many issues need to be considered (Furuholt & Ø rvik 2005). Moreover, if the contexts are public organizations (public HEIs) in developing countries, it has many limitation and multi dimensions, such as resources, financial, cultural background.

Various studies have been carried out in order to ensure better understanding about IT implementation and adoption in public sector organization. Some of the studies found that they shared the same knowledge about the barriers and challenges to IT adoption in public sector in developing countries either in government agency (Imran 2006, Al-busaidy & El-haddadeh 2011, Weerakkody et al. 2009) or health information systemsBraa et al. (2001), Javier & Alvarez (2004).

Although considerable attention has been devoted to this topic, rather less research

has been paid to examine IT implementation in public HEIs, especially in developing countries. Many public HEIs have shared the same regulation, condition and limitation as well as cultural background. Even they also shared similar organizational behavior (Curry & Katz 2002). Lately, to oversee the IT implementation process in the organization, most of them established a dedicated IT unit to handle that responsibility(Imran 2006). Frequently, the IT unit also act as executor of IT development and implementation processes. One of the reasons behind this is the desire to maintain the continuity of the development and implementation process in the organization. However, many challenges would be faced, especially in the context of public HEIs, with their limitations. If this situation cannot be recognized and handled properly, then this will greatly disrupt the processes and affects the poor quality of IT services. Obviously, this will influence not only the IT unit as the responsible organization, but also other stakeholders, such as students as well as staffs of the university, either in the administration processes or academic activities. Poorly managed of IT management in public HEIs absolutely decrease the competitiveness of the institution among others. Hence, it is important to properly manage the IT implementation.

As described earlier, IT implementation also depends on condition and social settings of the organizations. By understanding the social setting and condition of the organizations will provide the capability to choose the appropriate approach/IT tools based on their situation and hopefully can perform any improvement processes. Obviously, it will help the organizations to make the IT implementation process run smoothly. The interesting thing is, it could increase the opportunity to adopt one successful approach on single organization to others, even though not necessarily apply equally.

1.2 Problem Description

The main goal of this study is to explain and improve the IT implementation process in public sector organization, particularly in higher education institutions (HEIs) in developing countries. According to wikipedia.com [1], Public HEIs or public universities is:

> " *a university that is predominantly funded by public means through a national or sub national government*"

This study will be performed in one of Indonesia's public universities, namely Udayana University which is expected to provide an insight about IT development and implementation process in public sector organization especially in educational institution in developing countries.

Several research questions are defined to attain the research goal as follows:

[1] http://en.wikipedia.org/wiki/Public_university

Q1. What is the status of IT implementation in the institution under the case?
Q2. What are the contributing factors that possibly hamper the process of IT implementation?
Q3. What are the suitable strategies to improve the IT implementation?
Q4. How the proposed approach can improve the development and implementation process?
Q5. What knowledge can be acquired from the proposed approach and its influence toward the organizational behavior?
Q6. How the proposed approach can contribute to the IT organizational change in the organization?

1.3 Scope

To clarify the topics to be discussed in this study, the discussion will be focused on the IT implementation process, especially in public university in developing countries.

The discussion will be more emphasized on information systems implementation rather than the network infrastructure and will be focused in Information Technology (IT) unit. This study is more of an organizational change process rather than software engineering.

1.4 Methodology

In order to attain the goals, this study is performed by an action research approach, in combination with case study method. To gain understanding of the IT implementation process at the selected institution and diagnosing the current situation, interpretive single case study is performed. Any findings are then interpreted in the light of established theory and contextual factors.

Furthermore, in order to improve the IT development and implementation process, action of interventions then planned and performed in order to discover the specific phenomenon / knowledge from the case through observation of participants' interaction. The outcomes are then evaluated to determine any knowledge and improvement gained to the organization.

1.5 Thesis Outline

This report is organized as follows: After Introduction, the theoretical basis for this work will be presented, mainly recent study in the field of IT implementation in developing countries, IT implementation and organizational changes theories and strategies in HEIs and software development organization as well as software project management. Then followed by description of employed data collection and methodol-

ogy as well as reflection of the researcher toward the research implementation. Next, context of the case will be described in detail. All the information found from the institution during data gathering is explained and the action research cycle will be discussed in detail. Following this, discussion and analysis of the findings in contrast with the recent studies and theories are performed followed by implications and several recommendations as well as improvement process. This report are finished with conclusion, study limitations, and prospects for further research work.

CHAPTER 2

LITERATURE REVIEW

Introduction of information and communication technology in an organization is not only about technology it self, but also concerning about the diffusion of new technology into the organization (Rogers 1995). It is a dynamic process of mutual adaptation between technology and its environment (Leonard-barton 1988), and is most likely to cause changes in the existing environment of an organization (Orlikowski 1993, Cooper 1994, Hammer 1990). Hence, implementation of technology is not a simple constructs, many issues need to be considered (Furuholt & Ø rvik 2005) and need proper strategies depend on their context.

This chapter will discuss related works previously done by many researchers as a foundation theories. IT development and implementation in developing countries with its challenges will be elaborated at the beginning. Next, established theories regarding IT implementation and adoption are conversed in relation with existing empirical study in developing countries, perception and acceptance of technology, and followed by software project management.

2.1 Challenges in Developing Countries

Information and Communication Technologies (ICTs) are now widely accepted by developing countries as a critical tool for national building. Significant benefits would be achieved if adopted properly. In fact, however, many information systems in developing countries are reported as failed, either total or partial, and only minor are fall into success (Heeks 2002). For example, investigation conducted by Braa et al. (2001) in health information systems found that the system was not functioning satisfactorily in "marginalised" parts of Mozambique (e.g. provinces and districts). Another study by Krisana Kitiyadisai (2000) in Thailand public sector reported that fail-

ure cases seem to be the norm in Thailand at all governmental levels.

Numerous studies have been conducted to investigate problems and challenges of IT adoption and implementation in developing countries, particularly in public sector. Al-busaidy & El-haddadeh (2011) performed an empirical study on Ministry of ManPower, Oman to investigate the factors influencing public sector administrators toward the e-government services implementation. Employed institutional theory perspective, a theoretical framework was made to study the organizational change by considering the key pressures from economic, political, social, and technological sides. The study concluded that the economic, political, social and technological pressures have a significant impact on the implementation of e-government projects. The listed factors as can be seen in Table 2.1 were found as the main factors that influence e-government implementation for each pressures.

Table 2.1: A Contextual Taxonomy for understanding the implementation and institutionalisation of e-government initiatives (Al-busaidy & El-haddadeh 2011).

Pressure	Factor	Description
Economic	Reduce transaction cost	Each and every change that happens within or across the boundaries of egovernment systems
	Revolution and growth of ICT	Implementing the best practices of ICT, improve the business processes by using the latest technologies
	Protect expenditures	better services at lower costs, Reduce cost for public sector and citizens
Political	Leadership	Decision makers in the organisation to understand the internal and external impacts of e-government
	Top management support	Providing the support for forming new rules, procedures, arrangements and actions towards e-government services
	Rules and regulation	Providing the support for regulatory and legal issues at all levels of government in order to achieve public sector
Sosial	Digital divide	The ability to access information and transaction services, and citizen participation.
	Citizen empowerment	Empower the citizens by reduce efforts to obtain their needs.
	Transparency policies	Sharing of information and participate the citizens with new rules and regulation
Technological	Standardisation	Standard use of different development tools within e-government implementation
	Stability	Operate e-government in a stable and secure environment (include privacy and security)
	Internal and external integration	Integrates a system across different roles that provide a full and real one stop shop"/portal.

An alternative study to identify issues pertaining to implementing e-government initiatives was performed by comparing issues occurred in a developed countries (UK) and an economically developing countries (Sri Lanka) (Weerakkody et al. 2009). They argued that "e-government initiatives in developing countries can be effectively implemented if experiences acquired by developed countries are shared proficiently". By doing semi-structure interview with observation and a review of documentation on both side, the study found that there are common challenges faced to the UK and

SriLanka in political, organizational and technical contexts. However, more specific adoption challenges were found for Sri Lanka such as lack of IT literacy, inadequate IT infrastructure and inability to access e-government services using local languages. Complete comparison of the study can be seen in Table 2.2.

Table 2.2: Issues Facing E-Government Implementation in UK and SriLanka (Weerakkody et al. 2009).

E-government challenges identified by LBX,UK	E-government challenges identified by ICTA, in Colombo, Sri Lanka
Political Context	
High level of central government support and the provision of a cohesive strategy and guidelines for local government	(i) no cohesive e-government strategy; (ii) lack of ICT awareness among government officials; (iii) negative attitude toward e-government
Government Support	
(i) high level of commitment and support for e-government from the prime minister; (ii) office of the deputy prime minister directly oversees all e-government projects	(i) limited funding for e-government; (ii) negative attitudes of government officials and agencies involved in the e-Sri Lanka initiative
Financial Constraints	
The way funding is allocated (packaged) for local councils (local egovernment implementation) is slowing down the pace of implementation	The Sri Lanka government is highly dependent on donor funding (such as theWorld Bank) and private sector contributions
Technology Constraints	
Difficulties encountered in the decision-making process when selecting ICT services and vendors (service providers) due to lack of experience in the public sector	(i) need to improve the telecommunications infrastructure; (ii) high cost of accessing the Internet/eservices; (iii) lack of access to personal computers
Paradigm Shift	
While some government/council employees were resisting change, citizens are largely neutral, and their attitudes are neither for nor against e-government	(i) government officials' and citizens' attitude to change; (ii) citizens and government officials reluctant to change
Project Management	
(i) centralized egovernment strategy which outlines a framework and guidelines for local e-service implementation; (ii) however, lack of flexibility may limit local government innovation	(i) overall lack of coordination; (ii) various e-government projects operating in isolation; (iii) lack of teamwork among ICTA, central government, and private sector
Language Problems	
(i) some ethnic minority and elderly citizens preferred face to face or telephone contact to Web-based services; (ii) some also indicated a need for hard copy-˝Ubased information in different languages	(i) English used only as a second language; (ii) many rural citizens have no knowledge of English, making the delivery and receiving of e-services in English unrealistic
ICT Literacy Rate	
(i) ICT literacy is relatively high among UK citizens; (ii) however, most elderly and retired people lack ICT knowledge; (iii) elderly and/or disabled citizens find it difficult to use e-governmentWeb sites	(i) limited access to ICT for citizens in rural areas; (ii) English language ˝Urelated constraints; (iii) need for improved and accelerated ICT training programs
Data Protection and Security Constraints	
Negative citizens attitudes toward security and trust in relation to exposing personal information on theWeb	*
Lack of Awareness	
*	(i) citizens lack of awareness of e-services; (ii) citizens uninterested in egovernment

* Indicates that the corresponding issue was unique to that country.

Examination of barriers to IT adoption in public sector was conducted by Imran (2006). 7 focus groups were employed using the 'Nominal Group Technique' (NGT), a consensus planning tool to prioritize issues by Delbecq, Van de Ven and Gustafson in 1971, ranging from academics, software developers, international organization, IT

industry leader, journalists and government officials/experts as respondents mostly in Bangladesh. The study found that *lack of knowledge and awareness* were the most influential barriers in IT adoption in the public sector. Another barriers including *attitude and mindset* (Motivation, Confusion about novelty, Resistance to change, Not ready to accept new ideas, Fear of unknown, Fear of loosing job, Lack of initiative), *political will and leadership, lack of planning and strategy, infrastructure, bureaucracy business process* (Lack of Accountability,Multi-tier decision making process in public sector, Corruption) ,*Lack of Expertise and Professionals, Socio-economic Condition, Law and Rules, Citizen Demand, Lack of Championship and Models.* In addition, the study also mentioned about weak focus on work process redesign and re-engineering the systems, lack of reward and punishments, ownership problem due to the transfer of government officials, lack of IT support services, lack of commitment, absence of a dedicated organization to oversee the eGovernment/ IT adoption. Based on emerged barriers above, they drew a concept map that show relationship among various factors as can be seen in Figure 2.1.

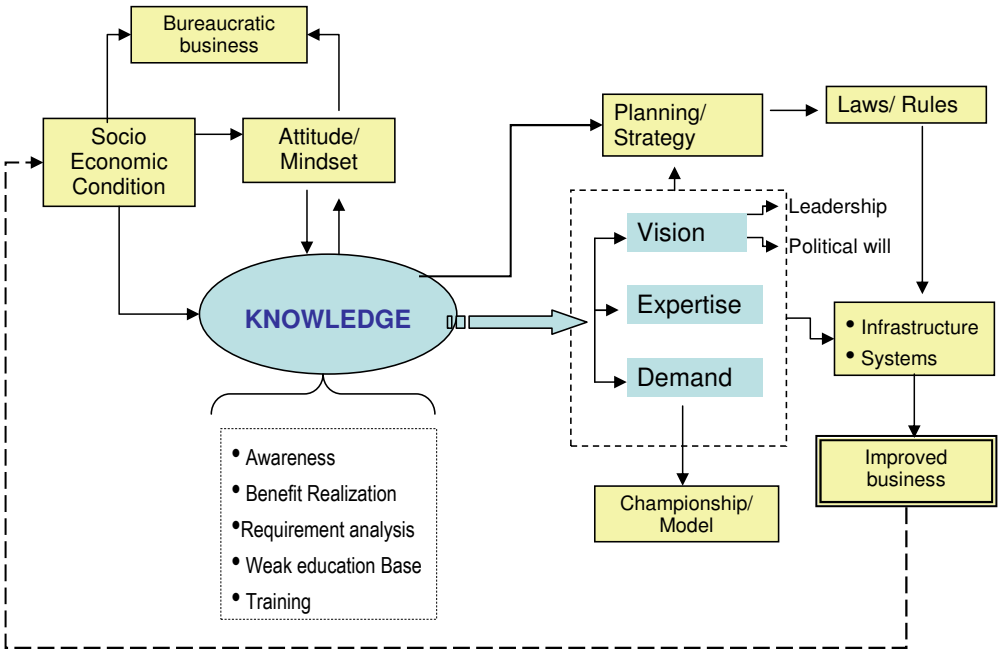

Figure 2.1: Concept map shows relationship and interdependence of various factors (Imran 2006).

According to a review of e-government implementation in developing countries by Ndou (2004), several challenges would be faced in order to reap the potential benefits of eGovernment including IT infrastructure (e.g. e-readiness, computer literacy, telecommunication equipment); Policy issues (e.g. legislation); Human capital development and life long learning (e.g. skills, capabilities, education, learning); Change management (e.g. culture, resistance to change); Partnership and collaboration (e.g. public/private partnership, community and network creation); Strategy (e.g. vision, mission); Leadership role (e.g. motivate, involve, influence, support).

Studies in different focus such as health related systems were also conducted by several scholars and found to be 'unsuccessful' due to various reasons. Javier & Alvarez (2004) conducted study on a national information systems initiative to support the decentralisation and modernisation of management functions in health districts of the Ministry of Public Health in Ecuador. They found that the IS implementation process hindered decentralisation in health districts due to paternalistic and technology-led approach by IS team, local service planning and budgeting were not integrated, district managers did not have any direct external incentive to adopt new planning methods. A 'near similar' investigation setting was done previously, performed by Braa et al. (2001) in provinces and districts areas in Mozambique. The investigation reported that the system was not functioning satisfactorily due to wrong strategy(lack of local awareness), poor feedback routine, lack of functionalities - not local need, but vertical and central, difficult to keep report due to vertical strategic reporting and lack of training. Another Survey based study in Pakistan's hospital by Anwar (2011) found that lack of infrastructure, cost, technical sophistication, lack of skilled human resources , lack of e-readiness of medical professionals, Organizational (lack of awareness, lack of motivation) and Social and Cultural (digital divide, lack of stakeholderŠs interest, less motivation, anxiety to adapt and use new technology) hampered the successful adoption of IT.

Table 2.3: IT Adoption Challenges in Education Organization Developing Countries

Literature	Geographic	Challenges
Furuholt & Ørvik (2005)	Tanzania	1. Lack of Top Management Engagement, 2. Knowledge Barriers and Staff Resistance, 3. Lack of Utilitarian Value and Other Personal Incentives, 4. The Symbolic Value of Information Technology, 5. Poor Organization, 6. Poor Infrastructure
Bii & Gichoya (2006)	Kenya	1. Conflicting Management Styles, 2. Lack of ICT Policy, 3. Training, 4. Conflicting Functions between units/departments, 5. Lack of Funds, 6. Ineffective Communication, 7. Resistance to Change, 8. Sustainability of ICT Resources, 9. Electric Power Supply, 10. Lack of Clear Job Description for IRM Staff, 11. Old Technology, 12. Lack of Feedback on IRMPerformance
Huda & Hussin (2010)	Indonesia	1. *Technological factors* (ICT product selection problems, expensive cost of ICT infrastructure, software / hardware incompatibility problems) 2. *Organizational factors* (low ICT awareness, low ICT development budget, communication among management level, hierarchical structure of the institution, inadequate use of strategic planning,lack of training, lack incentive, lack IT vision among management); 3. *Individual/Social factors* (resistance to change,Language barriers, Lack of user involvement, lack of ICT literacy, 'lack of trust' towards ICT usage) 4. *External Factor* such as Government policies

Several studies focus in education organization has been addressed. Furuholt & Ø rvik (2005) investigated 10 years implementation process of college in Tanzania using interpretive case study. They found that common barriers that occurred in other developing countries were similarly happen in the organization under investigation. Moreover, Huda & Hussin (2010) investigated IT implementation in Indonesia's Islamic-based HEIs and found several barriers that inhibit the adoption process. Meanwhile, a critical review by Bii & Gichoya (2006) for Information Resource Management (IRM) report in Kenya university listed challenges faced by the organization. All the related challenges mention above can be seen in Table 2.3.

From description above, introducing information and communication technology into public sector organization especially in developing countries deal with various challenges. Difference organization and context share common challenges in general. However specific and unique challenges exist for certain organization.

2.2 Implementation Theory

2.2.1 Implementation Models

Implementation process of IT in an organization plays an important role in the success of incorporating IT in to the organization life. At first, implementation was seen as the last stage of the system development life cycle, consisting of analysis, design, programming, and implementation, and was regarded as a stage to delivery the product to a client. Apparently, implementation process is not as that simple, rather multi-dimensional and complex process concerns both technical and social aspects within organisation (Kankaanpaa 2002).

There are various definition about the concept of IT implementation, depending on the selected approach (Kankaanpaa 2002). Lucas (1992) uses the term implementation when referring to installation of IT application. Based on extensive literature study on published management information systems research during 1976-1995, Lai & Mahapatra (1997) found that in most studies, implementation is seen as one phase of a total of technology transfer process. Curley & Cremillion (1983) seen an implementation as the process of getting a system into use. Another definition from Kwon & Zmud (1987) which view IT implementation from a technology diffusion perspective, as "*an organizational effort directed to diffusing an appropriate information technology within user community*". By including target organization in their definition, it shows that it is importance because according to Cooper (1994), introduction of new technology is likely to cause changes in the existing environment of an organization. In this study, the definition of IT implementation from Kwon & Zmud (1987) is used, accordance with the focus of this study in public sector organization.

Concerning about technology diffusion, Quaddus (1995) categorises IT diffusion models in two groups: stage models and dynamic models, as can be seen from Figure

2.2.*Stage models* are implicitly time dependent and consist of stages, while *Dynamic models* are explicitly time dependent models and deal with diffusion processes over time.

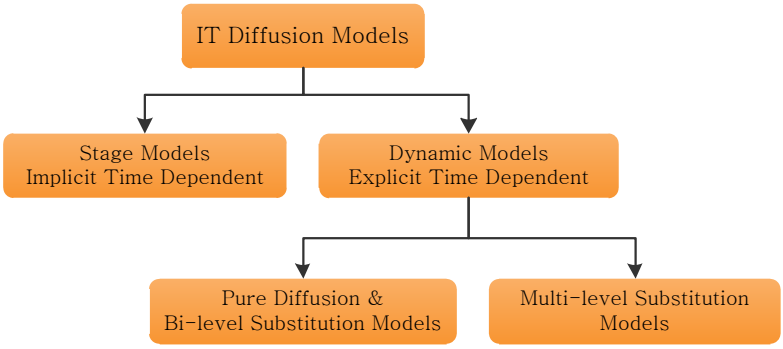

Figure 2.2: Classification of IT Diffusion Models (Quaddus 1995).

One of stage models is the IT implementation model that developed by Kwon & Zmud (1987), which is from the basis of innovation, technology diffusion, and organizational change theories. The organizational changes model such as Lewin's (1952) change model consists of three stages: *unfreezing*, *change*, and *re-freezing*. *Unfreezing* period, an organization is prepared to change in order to adapt a new order. *Change* occurs and moves a group towards the desired level. When the desired level has been reached, *re-freezing* take place and anchors the group life on the new level.

Kwon & Zmud (1987) proposed six-stages model for IT implementation activities as following;

1. *Initiation* : stage where an organizations feels pressure to change from either organizational need (pull) or technology innovation (push) forces and scan different IT alternatives.
2. *Adoption* : stage where the decision is made to invest resources necessary in an innovation (e.g. in a new technology) in order to respond to the pressure.
3. *Adaptation* : stage where IT application is developed, installed, and maintained, and is available for use in the organization. The processes are included: revise and develop organisational procedures, trained for organisational members in both the new procedures and in the IT application.
4. *Acceptance* : stage where the organisation's members are induced to commit to use new technology and it is employed in organisational work.
5. *Use* : stage where performance of the new technology and the user's satisfaction with it are determined.
6. *Incorporation* : stage where new technology is embedded into the organisation's every-day routine.

A variation of the Kwon & Zmud's (1987) six-stage model, which incorporates some of the post-adoption behaviours, developed by Cooper & Zmud (1990) in which consists of: initiation, adoption, adaptation, acceptance, *routinisation*, and *infusion*. The dif-

ference with previous model is the last two phases, while the other four stages remain the same, as can be seen from Table 2.4.

Table 2.4: six-stage difference between Kwon & Zmud (1987) with Cooper (1994)

Kwon & Zmud (1987)	Cooper (1994)
Use : Performance of the new technology and the user's satisfaction with it are determined.	**Routinisation** : The use of a new technology is encouraged as a normal activity and is perceived as a part of the routine work.
Incorporation : New technology is embedded into the organisation's every-day routine.	**Infusion** : IT application is used in a more comprehensive and integrated manner in order to increase organisational effectiveness, i.e. IT application is used to its fullest potential.

By adopting Lewin's (1952) change model, the Kwon & Zmud's (1987) model and Cooper & Zmud's (1990) model can be illustrated as shown in Figure 2.3.

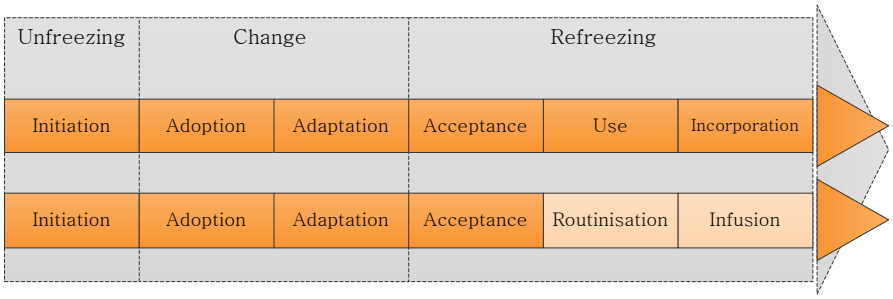

Figure 2.3: A six-stages view of the IT implementation process.

However, Orlikowski (1996) argued that the presented perspective above, which she later group it into *technological imperative*, overlook changes arising from activities of organisational actors in which are only realized in action and cannot be anticipated or planned. Therefore, she argued that those approach can not properly suit to the world where "change" plays much more important role in organizational life, and often trigger a sequence of practice-based transformation.

New perspective proposed by Orlikowski (1996), namely "*Situated Change Perspective*", offers more appropriate concept of thinking about changes for current organizations. It is grounded in the ongoing practices of organizational actors, everyday exceptions and breakdowns they encounter and local adaptations and alterations they make. Through a series of such events, the fundamental changes are achieved. It is a smooth transformation, and no deliberate orchestration of change. By focusing on change as situated change may not always be : as planned, inevitable, or discontinuous as imagine. Often realized through the ongoing variations which emerge frequently, even imperceptibly, in the slippages and improvisations of everyday activity. However, as stated by Orlikowski (1996), this change perspective is offered as a complementary to the existing change perspectives, and not as a replacement.

2.2.2 Organizational Change Strategies

Different type of organizations could shared similar properties in order to make change in organizations. However, they also have differences in their environment. Education organisations such as university, as one of the examples (Curry & Katz 2002). From the perspective of leaders or managers in the context of higher education institutions, they need to pay attention concerning organizational behaviour aspect, in addition to technology issues, in order to gain successful in IT implementation.Three lessons were suggested by Curry & Katz (2002);

1. Adopt the way people change and learn, incrementally, into the organization life, internalized.
2. Knowing the people and organizational culture for transformative change.
3. Universities are deeply decentralized, loosely coupled in nature. familiarize with it is mostly a better way rather than against. The challenge would be finding ways to get benefit from it.

According to those lessons, Curry & Katz (2002) deduced several change management tactics designated for leaders or managers in the Higher Education Institutions, in which emphasizing on those incremental change and human behaviour perspective, as can be seen in Table 2.5.

It seems common when making some changes in organizations will make uncomfortable feeling to the people who are affected by those changes. The same situation also could happen in the context of software development unit, especially when a new approach is introduced in order to build a better software, such as a formal technique by utilizing software project management processes. This uncomfortable feeling becomes one of the reasons why changes may encounter resistance from internal organization. There are also other reasons behind the resistance to changes such as listed on Stellman et al.'s (2006) book, and are considered as factors that make the changes fail, as can be seen from Figure 2.4. In an organization, people can also be afraid of change, and mostly people prefer to feel like they know what they are doing. They want their jobs to be stable and the tasks assigned to them to remain their capabilities. A new technique could be a good idea, but if they do not understand how it will benefits them, they may see it as a burden with no benefits and will resistant to adopting it.

A claim that "*we already build software well*" often appears in organizations. They feel that they built software well, completed the project and delivered it to the user, even though some of them will need patches and bug fixes afterward. Delays or any serious problems might be seen as just part of how the software is built and sometimes people fail to recognize it or simply refuse to acknoledge it. Whereas, the truth there is possible to schedule to come in on time, for teams to work normal hours, and the project can be controled. Many organizations where people claim like this, do not have standardized way of building software (Stellman et al. 2006). Sometimes there

Table 2.5: Change Management Tactics in HEIs (Curry & Katz 2002).

Tactics	Description
Embrace relentless *incrementalism* as the change approach	Incrementalism is a natural act, and measured increments will create structured opportunities to learn "as you go" and constantly refine strategies. The *action-feedback-reaction* iteration can be institutionalized to suppress resistance to change.
Walk a mile in the shoes of those whose roles you would change	Understand their worlds and learn what they need from you. Iterate between your expectations and their needs. Walk in many different shoes, and often. Teach each other. *Become comrades.*
Continuously build *trust*	The most important and time-consuming responsibility that leaders have. It is needed to make *sustainable change*. *Communication*, including the building of personal relationships, is the watchword.
Create "*demand pull*" for change rather than "*supply push*"	This will be *counter-intuitive to the technology critics* in IT department or centres.
Lead *change from the business rather than the technology* side of the house	Make the business case compelling so that others will embrace the goals. Technology may be the means, but it is not the end. *Think people first, process second, organization third, and technology fourth.*
Create *local* change *champions* and make them part of project leadership	All good people want to do better and know many of the changes that will improve their work lives. *Work collaboratively with local administrators* and they will listen to (and trust) their peers more. But don not let the local champions forget their organizational roots. They need to keep the common touch as they "walk with kings" on behalf of the whole.
Use timing and the times to advance the pace of change	*Choose the time to change carefully*. *Look for moments of organizational instability*-changes in leadership or budget crises, for example-to advance the change agenda as a preferred solution.
Create *role models* and *pilot implementations*; facilitate peer pressure for change	Sometimes change is too overwhelming to contemplate in the abstract. *Seeing others follow new ways and use new tools can reduce anxiety and motivate emulation*. Design or join peer groups.
Be an exemplar: *Do it first before others*	*Doing is more impressive than saying*. We will create believers if we can exhibit, within our span of authority, the virtues of the new ways we espouse.
Align central and local *incentives* for change	How to *encourages* all stakeholders to participate in the change, for-example by sharing obtained benefit with departments.
Under-promise and over-deliver	*Never overstate or mislead people's expectations*. Be the first to announce new knowledge of project problems. Otherwise, it can destroy trust, which is much harder to regain than lose.
Consistently learn from your successes and mistakes	Create and sustain information feedback required to learn. Always conduct *post-mortems analysis* at every project milestone to sustain information feedback required to learn.
Persist	*Everyone's time is a scarce resource*. It is a better chance to spend time appropriately in any condition.
Create *locally adaptive* business processes and technology solutions	*Universities* are organized anarchies, *loosely coupled organizations*. Different departments may need to do things differently. Knowing when to hold and when to fold is a learnable art. All implementation is local

are requirements written prior coding;other times, there are not. Sometimes there is a project schedule, but often, there is just a single deadline. Sometimes, software is tested;other times, just dumped on the users. No two projects are done in the same way. So that, when trying to introduce a way to build better software, they just excuse

"never done in that way before".

"*Not Invented Here*" syndrome is common culture in organizations where people intentionally avoid research or innovations that were not developed within the organization. They opt to build their own solution, rather than using solution that is known to have worked elsewhere, which often end up with greater cost, just because did not coming from inside organization. Many arguments behind it, such as different size of organizations, different hierachy, too bureaucratic and so on. However, in term of software project management practices, it shows that it work with either small or large organization. Hence, when it come to NIH syndrome, size really does not matter.

"Too Theoretical" and "Too Bureaucratic" often haunt the people in organizations when the idea for change come up. When the idea does not make intuitive sense, many people will dismiss it as a result of "academic research", and not practical to the real world. They sound good in a book, but would not work in the organization. Likewise, damaging attitude in some organization holds that programming is the only important activity in a software project. Project management approach is seen as distractions that drain energy and effort away from the programmers "real job", writing code. Any other activity that does not directly relate to programming is seen as "bureaucratic", such as planning project, writing down requirements, inspection meetings and schedules. Whereas in reality, programming is usually less than 40% of the effort on a successful project (Stellman et al. 2006). Most project problems are caused by the team does not understand what the software should do. Estimation problems happen due to incomplete exploration for all the defined assumptions, making the information is not handled properly on what is known and what is unknown.

Sometimes, changes in organization will increase workload for the people who related with, perform tasks that were never expected before, they often tend to be unhappy with this arrangement. They could be surprise and shock in response to those changes. Forexample, if the organization where everyone hates going to metings, and someone suddenly find out that he has to attend weekly status meeting, he might be unhappy with that. Sometimes, people will complain to their boss regarding extra work assigned to them, which show their resistance to the change. In addition, There is also a risk for the people to arrange some changes in organization, not only for the project, but also for their reputation. When the project went wrong with those changes, the person who arrange the changes will be blamed, he will be responsible the problems. Whereas in fact, without making any changes, the possibility of failure is still there. "*If you make a change to an existing process, you are now responsible for any failures that result*" (Stellman et al. 2006). So, due to this risk, instead of trying to improve the way a software is built, they will better stick with the existing process and hence make the change fails.

In order to make changes succeed, Stellman et al. (2006) provides straightforward techniques that make it easier to get an organization to change on how the software is

built. Understanding the organization is the key. By understanding the most common ways that people respond to change and learning how to convince or reassure the ones who are resistant to change as well ass make them comfortable with the change, will make it possible to overcome the obstacles and successfully make the changes that the organization needs. Those techniques can be devided into two groups, prepare the organization, and then prepare for the changes, as can be seen in Figure 2.4.

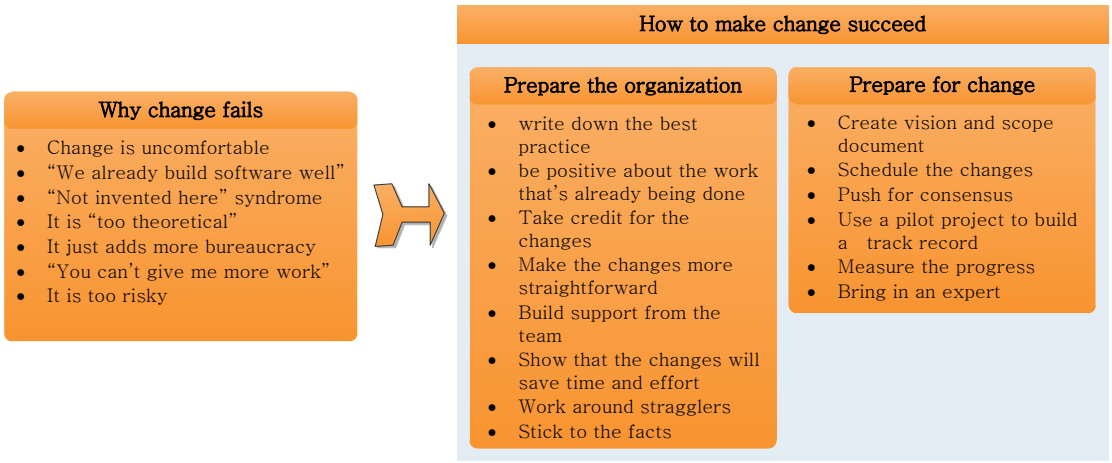

Figure 2.4: Organizational change techniques in software development unit

Before changes are implemented, it is needed to deal with the attitudes/cultures that will cause people to reject the changes in the organization. There is no single solution to any problems mentioned previously. It is depend on the implementer's analysis to figure out an approach that will work with the people in the organization. Of course, there is no absolute guarantee that the attempt will be able to change the organization, but at least we have been trying with our best.

Preparing the organization prior change can be started by writing down the best practice, how actually the organization built the software, so it can be applied consistently. Always be positive about the work that has been done in the past, and positioning the change as a way to build on those past successes. Try to keep tone positive when talking to people about the need for change, so it can motivate them on the changing process.

Consider a small chunk of problem and solve it individually, rather than step away from the big picture as a process improvement. Somehow they are not aware that what they did is part of the changes. Take credit as a whole team for changes done is also a good way to motivate the people and help them to move forward. Keep it straightforward, when trying to offer a solution of problems, as part of the changes. So it will give a good feeling, personally, from them. Build support from the team, such as bring the programming team on board with the improvements, will give better chance of convincing the rest of the organization to follow. In most organizations, people who do not have technical skills often defer to the programmers any time there is a disagreement. Show the team that the purpose of changes are to help them, not

in theoretic way, instead show how to do it, showing that there are clear benefits of doing it. For example the changes will save time and effort of the whole process, and not see it as too bureaucracy and take much time.

However, there are people in organizations who always refused any changes (stragglers), whatever approaches are used. For example, it is not unheard of for a programmer who is highly skilled with a particular platform or technology to sabotage efforts to migrate the software to an entirely different platform, simply to protect his expertise. In this situation, consistency is very important idea. One good way is to work around them, build concensus among everyone else in the organization. Keep going and do not worry too much about people who oppose the change for reasons that can not be dealt with. If the changes become part of the organization culture, as time goes by, they will either come on board or leave on their own.

Convey the idea of changes as clear as it can to the people in organization, with no hidden agendas, be a straight-talker. Make an effort to understand the audience, Learn different perspective of the people such as based on their roles in the organization, and frame the arguments in such a ways that are interesting to them. Being a straight-talker is showing that we have a solid grasp on the ideas behind the changes, and by understanding them, we can put the ideas into terms that anyone else can understand. Later on, try to convince them with facts, such as through pilot project, and show the benefits on changes on that pilot.

After prepare the organization for the overcoming resistance, then it is importance to plan the change to ensure the success of it. Scoping the change around the problem that the organization faces, and ensure that the change is necessary will help to make it focus on. Once the scope is approved, then continued by schedule and implement those changes. It is difficult to change organization alone. Hence, getting support from others, by building concensus among the participants will make it easier to do. By showing real track record through pilot project, will give more credibility in the organization. Provide measurement of improvement will give a way to track the progress as well as a way to communicate the progress to others. However, sometimes by bringing in the expert will help the changes are implemented effectively.

When looking back to the strategies offered by Curry & Katz (2002) for change management in HEIs, it seems that several strategies match with the strategies offered by Stellman et al. (2006) in the context of software development unit. Both share similar approach such as understand the participant's perspective, personal relationship to build trust for sustainable change, do it first to show the benefits,instead of only theory, through pilot project and consistently learn from previous experience by writting it down or through post-mortem-analysis.

Meanwhile, there is a contradiction between Orlikowski's (1996) concept of "situated change perspective", which advocate unplanned change, with the strategies offered by Stellman et al. (2006), which encourage the planned change approach. However, if

we examined it more carefully, both approach actually support each other. Orlikowski (1996) believe that the fundamental changes are achieved by smooth transformation, grounded in the ongoing practices, with no deliberate of changes. She also emphasized that the change may not always be as planned as imagine, and even improvisations are emerge on everyday activity. While Stellman et al. (2006) admit that it is impossible to prepare in advance for all the issues that could happen. Unanticipated situation tend to happen during the changes and not all the practices can address the situation. Hence, it will need an appropriate solution correspond to the situation, as an improvement action which is not planned. Therefore, it does not mean that both approaches compete each other, but instead support each other, as emphasized by Orlikowski (1996) that her perspective is offered as complementary rather than replacement. It does not mean that planning is not good, and vise versa, but by giving the awarness about unanticipated situation that could happen in making changes will give more chance to the success. In other hand, preparing for the change, learn from best practice will give more chance to anticipate common problems.

2.2.3 Acceptance of Information Technology

Information technology (IT) acceptance is another IT implementation issues that many researchers concern with. Explaining user acceptance of new technology is often described as one of the most mature research areas in information system (Venkatesh et al. 2003). This type of research attempt to answer question about how and why individuals adopt new information technologies. A number of well-established theories and models are exists since last few decades, e.g. *theory of planned behaviour* from Ajzen (1991), *technology acceptance model* (TAM) from Davis (1989), *innovation diffusion theory* from Rogers (1995).

Among other models, TAM is tailored to Information Systems context and was designed to predict information technology acceptance and usage and diagnose design problems before users have experience with a system. This model predicts user acceptance of any technology determined by two core constructs: *Perceived Usefulness* explaining the extent to which a person believes that using a particular system would enhance his or her job performance, *Perceived Ease of Use* explaining the extent to which a person believes that using a particular system would be free of effort. TAM has been widely applied to a diverse set of technology and users. Lastly, Venkatesh et al. (2003) presented an updated model of user acceptance of IT by unifying a lot of previous work in this area namely the "*Unified Theory of Acceptance and Use of Technology* - UTAUT".

A number of studies have been tried empirically to identify user acceptance of new technology, particularly in public sector organisation in developing countries. A questionnaire based survey was conducted by Dasgupta & Gupta (2011) in India government agency to investigate how employees use the technology in e-government setting and how can the acceptance and use of these technologies be enhanced across

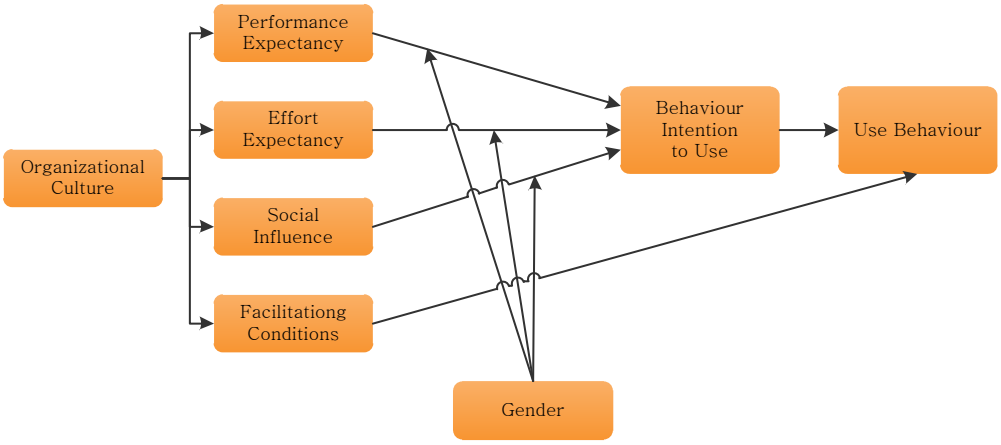

Figure 2.5: Organisational Culture and the Unified Theory of Acceptance and Use of Technology Model (Dasgupta & Gupta 2011).

government organizations. In their study, they proposed organisational culture as antecedent to the UTAUT Model as can be seen from proposed research model from Figure 2.5. Paper-based questionnaire was used on a number of constructs included organizational culture, performance expectancy, effort expectancy, facilitating conditions, social influence, behavioral intention to use, and actual use. This study found that organizational culture such as involvement (the extent of participation), consistency, adaptability (capacity of internal change in response to external conditions), and mission (purpose and long term vision) trait influence adoption of technology. It should be carefully managed for the successful adoption and diffusion of technology.

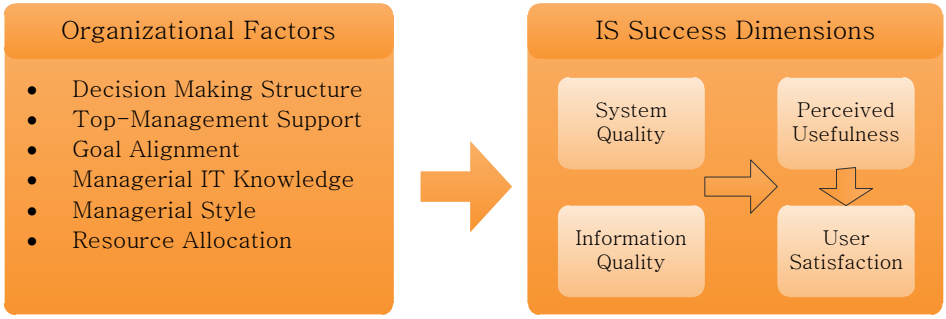

Figure 2.6: Research Framework for investigate influence of organizational factors in IS success (Hussein et al. 2007).

Another study concerning influence of organizational factors was conducted previously by Hussein et al. (2007) in 4 government agencies in Malaysia as a pilot project. Each agency was implemented by difference type of e-government systems including human resource management system, general office environment systems and project management system. Questionnaire-based survey on 450 respondents was used to measure the factors that influence the IS success, as shown in Figure 2.6. By using perceptual measure method, they found that in general, the listed factors are significantly correlated with the success criteria of information system and goal

alignment such as IS strategy and business objectives found to be the highest success predictor among others.

From description of theories and models above, it shows that IT implementation is not as simple as its look like. It is not only a matter of develop and deploy the system, but also considering about organizational/contextual issues, social culture as well as political and economic aspect, in addition to technological itself. It is also a process that will evolve gradually over the time.

2.3 Software Project Management

Software project management is sub discipline of project management, which includes the knowledge, techniques, and tools necessary to manage the development of software products. Software project management remains different from project management in other established fields for a number of reasons: *Software is a "brain product" only, unconstrained by the laws of physics or by the limits of manufacturing processes* (Tomayko & Hallman 1989).

When talking about software project management, it tends to discuss about any effort to make the software project succeed, rather than fail. This issues has long been on the minds of both researchers and practitioners. Although software has been successfully applied in a large variety of areas, software development projects have a reputation for failure.

To determine any software project categorized as success or fail, there should be criteria used in assessment. Based on the standards and tradition in the software development field, the most common combination of criteria used to measure the success of project concerns meeting time, cost, functionality and quality goals (Emam & Koru 2008, Anda et al. 2009). However, based on De Bakker et al.'s (2010) study, software development project has specific characteristic that make it different with other kind of project, in which the requirements originally defined will almost certainly change, and this will influence the schedule and costs. If then using the traditional project success criteria, i.e. time, budget and requirements, easily leads to the conclusion that a software development project has failed. They suggest a definition with additional aspects that define project success, as well as take into account the individual stakeholder's opinion of project success.

The important concepts were emphasized by Savolainen et al. (2011) on their review in which they note the distiction between the concepts *project success* and *project management success*. Borrowing the definitions presented by Munns & Bjeirmi (1996) for project and project management make the distinction between both concepts more clear. Project is defined as "*achievement of a specific objective, which involves a series of activities and tasks which consume resources*". This emphasized the importance of understanding and attaining the project goals, and a project is a means to

achieving those goals. Project management is defined as "*the process of controlling the achievement of the project objectives by applying a collection of tools and techniques*". Thus PM success is considered to be measureable (i.e. time/cost/quality) while project success focusing on longer term and customer oriented results.

The relation between both concepts has been showed by De Wit (1988) that "*a project can be a success despite poor project management performance and vice versa*". However, PM success may lead to project success, but not the opposite, as pointed out also by De Wit (1988), "*Good project management can contribute towards project success but is unlikely to be able to prevent failure*". Hence, the different between project success and PM success is obvious, and it should be evaluated as separate, but interlinked measure. Get back to software project management, surely it is a way to attain the succesful of software project.

Jalote (2002) outlines two main activity dimensions in software project: *engineering* and *project management*. The engineering dimension deals with how to build the system such as how to design, code, test and so on. The project management dimension deals with properly planning and controlling the engineering activities to meet project goals for cost, schedule, and activity (Jalote 2002).

Project execution can be using either formal or informal techniques. If project is small, for example: a team with one or two working for a few weeks, it can be executed informally. Project plan, requirements and intermidiate work products (design documents etc) might be communicated using email, personal notes or even verbally (Jalote 2002). However, it will difficult to scale up for larger project by using this techniques. Large project, which may consist of many people that work for many months, need carefull way to do each part of the project such as project plan, resource allocation, project tracking. Each task must done carefully by following well-tried methodologies, and work products must be properly documented so that others can review them. It can be said that formality must increase to succesfully execute large projects. Formality refers to *well-defined processes* that used for performing the various task so that the outcome becomes more dependent on the capability of the processes (Jalote 2002).

Technically, a *process* for a task comprises a sequence of steps that should be followed to execute the task (Jalote 2002). However, in an organization, the process are much more than a sequence of steps; they encapsulate experience previously learned about successfully executing projects. The benefits of experience are conferred to everyone, including newcomers in the organization. These processes will help to emulate past sucesses and avoid the pitfalls that lead to failures.

As ilustrated on Figure 2.7, engineering processes generally specify how to perform engineering activities such as requirement specification, design, testing and so on. In other hand, project management processes specify the way to handle the project by specifying the project plan, execution and closure including how to set milestones,

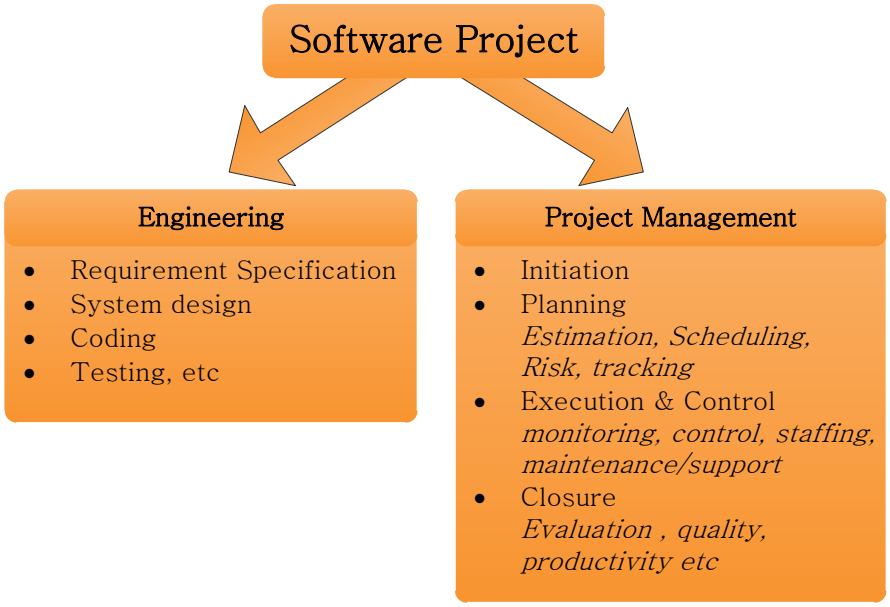

Figure 2.7: Software project dimensions (Jalote 2002).

organize personnel, manage risks, monitor progress, and so on.

However, the intention to use project management processes in software project depend on the benefits/values to be gained, not only in organizational level, but also in the personal level, the people whose working on the processes. As stated in Jalote (2002), if the processes are reasonable and will help execute their projects better, they will use it. Otherwise, they may see it as a burden with no benefits and will be resistance to adopting it. Hence, it is importance to introduce the processes in a way that help them to plan and control their projects better and that give them the flexibility to handle various situations – *a lightweight processes*. At this point, it is also importance to understand about organizational change, especially in the context of software development unit. However, it should be noted that software project management process (as described in Section 2.3.1) and the way how those process is introduced into an organization (as described in Section 2.2.2) are two different things, but related each other. Software project management process is the technique to manage the software development, meanwhile the strategy to introduce those technique is part of the organizational change process.

2.3.1 Software Project Management Process

In general, software project management process has similar phases with basic project management: *Initiation, Planning, Execution, Monitoring & Control, and Closure*. These phases work together to form the project life cycle and to deliver a quality software product on time and under budget.

- *Initiation* : The first phase of every software project is determining the software product which to be developed. This initiate phase may be short, however, it is

an essential part in the project. An idea for a project will be carefully examined to determine whether or not it benefits the organization. This phase includes defining the project, initial product description, analysing stakeholders, analyzing business needs and generating project charter.

- *Planning* : This phase is where the project is planned to an appropriate level of detail. Planning will prepare the team for efficience performance during the project execution. This phase may consist of producing a software development plan, establishing project estimation and scheduling as well as budgeting and quality assurance plan. It can also involve developing a configuration management plan, risk management plan, and producing requirement and detailed design documents. In addition, measurement and tracking planning can be prepared to support the monitoring and control phase. Various output of all planning activities are summed up in the software project management plan (SPMP) which become the baseline document guiding the overall execution of the project.
- *Execution* : This phase is where the actual work is performed. It is consists of the processes used to complete the work defined in the project plan to accomplish the project's requirements. Execution process involved coordinating people and other resources, as well as integrating and performing the activities of the project accordance with the project management plan. The following actions may be consisted in this phase: developing the code, creating test cases and establishing user documentation. Change control and risk management plans will be followed and technical reviews performed.
- *Monitoring & Control* : This phase occurs in conjuction with the execution phase. During this phase, the work is tracked to ensure the quality of the work remains high. Comparison of project status and progress to the actual plan is performed on a regular basis. Even a schedule adjustment or any necessary action may be performed to keep the project on the track. This phase may involve performing testing and correcting any defects.
- *Closure* : The closure/close phase is usually the shortest phase of a project, but no less important than the others. This phase establishes formal closure of the project, reviews project successes and failures with an eye toward improving the next project. The close phase may consist of archiving project media, capturing any lessons learned and evaluating the performance of the project against the project plan.

According to above description, many peaces of works need to be established. Some of the mentioned items are broad enough to be handled at once. In this thesis, only selected items were discussed accordance with the needs.

Software Configuration Management

Software configuration management (SCM) is a formal engineering discipline that provides the methods and tools to identify and control the software throughout its development and use (*IEEE Standard for Software Configuration Management Plans* 2005). SCM is importance not only during the development, but also for post-production/ maintenance. SCM give a chance to keep the integrity and traceability of the software system. SCM activities ranging from:

- Identification and establishment of baselines
- Review, approval, and control of changes happen during the project
- Tracking and reporting of changes done
- Audits and reviews of the evolving software product
- Management of software release and delivery activities
- Control of interface documentation and project supplier SCM.

During project planning phase, Software Configuration Management Plan (SCMP) is usually produced to provide rules and guidances for the project team in a means to give a convention for each activities taken during the development and maintenance. This document usually:

- Providing structure and naming convention for identifying and controlling documentation, code, interfaces, and databases to support all life cycle phases. It is also include document layout and storage configuration for all the project artefacts.
- Supporting a chosen tools, techniques and development/maintenance methodology that fits the requirements, standards, policies, organization, and management philosophy, such as tools for version control either code and document, issue tracking system, programming language, word processor.
- Producing management and product information concerning the status of baselines, change control, tests, releases, audits, etc.

By using Sofware Configuration Management (SCM), it is expected to enhances the reliability and quality of the software product, as well as the post-production/maintenance process of it.

Issue Tracking

The term *issue* in computer context can be seen as a unit of work to accomplish an improvement in a system. It is more of general term for any kind of work that relate to project, including bug/defect of system, feature request, feature, task, missing documentation or any other issues.

Issue tracking is process of tracking and documenting any kind of issues that related to project. This process ussually take place during development / execution of project. It does not mean that the process ended at that point, however, it is an

ongoing process as new issues arise and they may also be documented. It also can be seen as a way to maintain a product either on production or post-production time (maintenance).

The main goal of issue tracking is to get visibility into the project execution so that can determine whether any action needs to be taken to ensure that the project goals are met (Jalote 2002). Issue tracking give the possibility to the team and management for stay up to date on the project's progress, give chance to take any action for correction in case of project plan's deviation. Hence, to attain the project goals, all aspects of project execution must be monitored, and this monitoring must be planned.

In a software project, issue tracking is planned by defining type of work need to be monitored and documented, by utilizing the term *Tracker*. Several tracker may be used in software project:

- *Feature* : This type of issue is used to define the functionality of the system that must be developed. It can be related to requirements.
- *Bug / Defect* : This type of issue is used to define defect of the system that arise either during testing or operational/maintenance time. This logging give a clear picture about which part of the system need to be corrected/fixed.
- *Task* : This type of issue can be used to define a unit of work that related to project. Sometimes it used interchangeable with *feature*. However, on the other times, it is used to differentiate work that related to the software aside from feature, such as software design, server configuration etc.
- *Feature Request* : This type of issue is used to define idea/feature of the system that proposed by someone related to the project, hoping that it will become part of the system. This kind of issue can be accepted or rejected by the manager depend on their analysis.

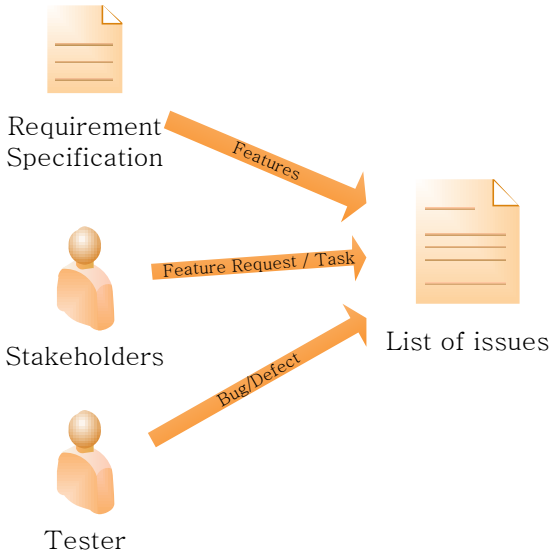

Figure 2.8: Ilustration for source of Issue for software project

Selection of the tracker depend on the project manager accordance with the needs

of the software project. Figure 2.8 ilustrate about where each type of issue can come from.

Issues are often categorized according to their priority and severity level. *Priority* represent the importance of how soon the issue has to be done. Meanwhile, *severity* represent how big the affect and impact of the issue to the developed system. The effect of a bug on the software does not automatically correlate with the priority for fixing it. However, sometimes they use only one of them, either priority or severity, which will cover all those condition. The common definition for priorities/severities are *Low, Middle/Normal, High, Urgent, Immediate/Critical.* Critical issues are the most severe and have great impact to the system, and should be done as soon as possible. Low issues are minor, and should be done as time permits.

In order to monitor the progress of each issue, there is *issue status* usually available. Every type of issue might be has their own set of status. An *issue workflow* is used to define the status transition, which will show the issue's life cycle, as can be seen from Figure 2.9.

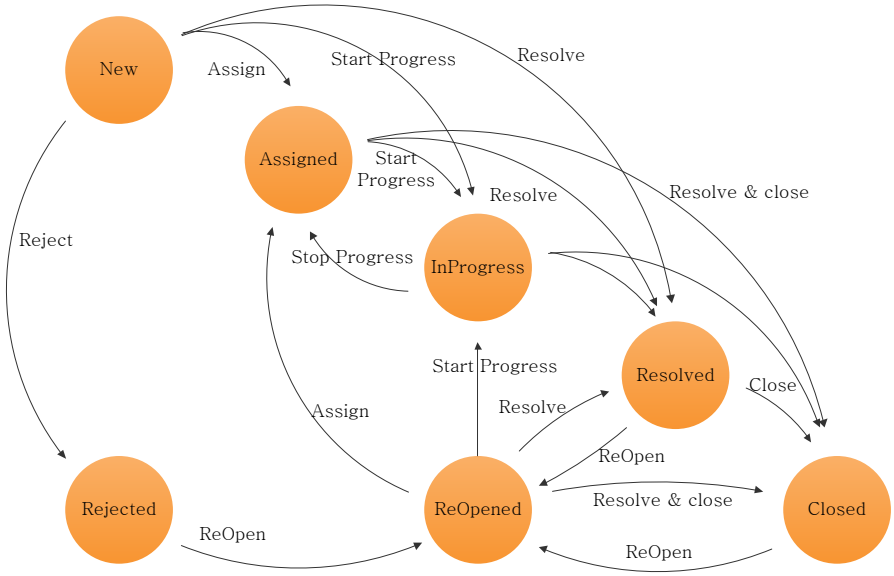

Figure 2.9: Example of Issue Workflow

To manage and maintain all the available issues on a project, all the above concepts are wrapped and packaged into a system called *issue tracking system.*

Version Control

In the context of software development, it is common to work on the software code simultaneously with other developers, also for multiple versions of the same software to be deployed in different sites. Software features or bugs often only present in certain versions. Sometimes, in this kind of situation, the developers just simply retain multiple copies of different code or version of the program and give proper

label. However, this method is ineficient as many near-identical copies of the program have to be maintained, and as time goes, number of code artifacts growing into certain level and make the situation more complex.

Version, revision or source control is the management of change to documents, software code and other collections of information. It is an excellent way to encounter problems of sharing files between workers, especially when working collaboratively with other people. Working on the same file, inadvertent overwriting content and loss track of document are some of those common problems.

Version Control System (VCS) is a computer package that offer efficient version control of any artifacts in the computer, especially document artifacts. VCS mostly run as stand-alone application, but, it is also embedded in various types of software such as word processor and spreadsheet.

There are two approaches for version control system (VCS):

- *Centralized VCS* systems are designed with the intent that there is only one true good source, centralized. All other developers will use this source through checkout, and then add (commit) the changes, and later will keep the source up to date.
- *Distributed VCS* systems are designed with the intent that one repository is similarly as good as other repositories, and that merges process from one repository to another are just another form of communication.

Subversion is one example of Centralized VCS. Apache Subversion is an open source software for versioning and control system. Commonly, programmers or developers use Subversion to maintain historical versions of files such as source code, web pages, and documentation. Subverison was created since 2000 and it is now a top-level apache project being used by global community. Subversion is widely used by open source community such as Apache Software Foundation, FreeBSD, GCC, Django, Ruby and SourceForge.

2.3.2 Project Management Tools

There are many project management tools exist out-there. It can comprises of single specific type of software as well as integrated/complete set, including issue tracking, estimation and planning, scheduling, cost control and budget management, resource allocation, collaboration software, workflow system, communication, quality management and documentation or administration systems.

There are several approaches for project management tools such as desktop-based, web-based, personal-single user and integrated-collaborative system. The systems are also offered as either proprietary or open source license. It ranging from simple one, cover only certain type of work, until the complex one that cover all part of project management aspect, especially for huge project. However, there is no system that suits to all kind of projects. It is depend on the size, budget and needs of the project.

Following are several project management tools that are commonly used for software project management and limited only web-based, open source software.

Trac

According to its official website[1], Trac is:

> an enhanced wiki and issue tracking system for software development projects. Trac uses a minimalistic approach to web-based software project management...

Trac mission is to help developers write great software while staying out of the way and it should impose as little as possible on a team's established development process and policies. Trac features allow wiki markup in issue descriptions and commit message, creating links and references among aspect on the system such as bugs, task, file and wiki pages.

Trac is developed using Python programming language with GNU General Public License. However, since mid-2005, it has been released under a modified BSD license.

Other Trac features include: Project management (Roadmap, Milestones, etc.), Ticket system (bug tracking, tasks, etc.), Fine-grained permissions, Timeline of all recent activity, Wiki (syntax similar to MoinMoin), Customized reporting, VCS web interface, RSS Feeds, Multiple project support , Environment extensibility, iCalendar export, Multiple Repository Support per environment, Interface localizations.

[1] http://trac.edgewall.org/

Redmine

Redmine[2] is a free and open source, flexible project management web application. Redmine is developed using the Ruby on Rails framework and it is cross-platform and cross-database. The design of Redmine is influenced by Trac, a software package with some similar features.

Redmine main features including Multiple projects support, Flexible role based access control. Redmine provides integrated project management features, issue tracking, and for multiple version control system-SCM integration (SVN, CVS, Git, Mercurial, Bazaar and Darcs).

Other Redmine features are: supporting Gantt chart and calendar, News, documents & files management Feeds & email notifications, Per project wiki, Per project forums Time tracking, Custom fields for issues, time-entries, projects and users, Issue creation via email, Multiple LDAP authentication support, User self-registration support, Multilanguage support, Multiple databases support.

In this thesis, Redmine is chose as a tool for software project management which will be introduced to the selected organization, considering the simplicity of the tool and the needs of the project.

[2]http://www.redmine.org/

CHAPTER 3

METHODOLOGY

This chapter will provide an overview of the research agenda and explaining how the study was performed. The data collection processes and the roles of the researcher during this study are explained. In addition, reflection of the researcher regarding execution of the research will be described at the end of this chapter.

3.1 Research Agenda

Accordance with the underlying background of this research, the research agenda for the present project is: *"to explain and improve the IT implementation process in public sector organization, particularly in higher education institutions in developing countries"*.

Several research questions are defined to carry out the research agenda as follows:

Q1. What is the status of IT implementation in the institution under the case?
Q2. What are the contributing factors that possibly hamper the process of IT implementation?
Q3. What are the suitable strategies to improve the IT implementation?
Q4. How the proposed approach can improve the development and implementation process?
Q5. What knowledge can be acquired from the proposed approach and its influence toward the organizational behavior?
Q6. How the proposed approach can contribute to the IT organizational change in the organization?

3.2 Research Approach

It is important to choose appropriate research method in order to answer the research questions. Oates (2005) defines research method as a strategy, overall approach or technique to answering research questions. According to Myers (1997), a research method is "a strategy of inquiry which moves from the underlying philosophical assumptions to research design and data collection". Difference strategy influences the way in collecting data.

As articulated by Myers's (1997), there is various ways to classify research methods, however the most common distinctions is qualitative and quantitative research methods.

Quantitative research methods were originally developed in the natural sciences to study natural phenomena. It relies on a host of scientific methods that produce numerical and alphanumeric data. Examples of quantitative methods include survey methods, design and creation, experiment (laboratory), formal method and numerical methods such as mathematical modeling. Taking the definition from Oates (2005), *Survey* focuses on obtaining the same kind of data from a large group of people (or events), in a standardized and systematic way and continue to look for patterns in the data and try to generalize it to a larger population. *Design and creation* focus on developing new IT products or artifacts, it could be computer-based systems or new constructs/model/method of development process.*Experiment* focus on investigating cause and effect relationships, testing hypothesis and seeking to prove or disprove a causal link between a factor and an observed outcome.

Qualitative research methods were developed in the social sciences to study social and cultural phenomena. It include case study, action research and ethnography methods. Taking the definition from Oates (2005), *Case study* focuses on one instance of the "thing" that is to be investigated: an organization, a department, an information systems, a discussion forum, a systems developer, a development project, a decision or else, which the goal is to obtain a rich, detailed insight into the life of that case and its complex relationships and processes. *Action research* focuses on research into *action*, which the researchers follow *plan-act-reflect* cycle, plan to do something in a real-world situation, do it, and then reflect on what happened or was learnt. *Ethnography* focuses on understanding the culture and ways of seeing of a particular group of people, in which the researcher spends time in the field and taking part in the life of the people rather then being a detached observer.

Myers (1997) emphasized that qualitative is not synonym for interpretive, depending upon the underlying philosophical assumption of the researcher. He frame the qualitative research into three philosophical perspectives: *interpretive, positivist and critical*, as can be seen from Figure 3.1. *Positivist* generally assume that reality is objectively given and can be described by measurable properties which are independent of the observer (researcher) and his or her instruments. *Interpretive* start out with the

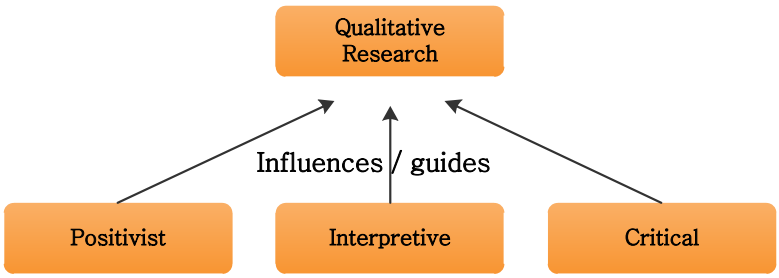

Figure 3.1: Underlying philosophical assumptions.

assumption that access to reality (given or socially constructed) is only through social constructions such as language, consciousness and shared meanings. *Critical* assume that social reality is historically constituted and that it is produced and reproduced by people.

According to available research methods above, and considering the intend of the present project, a combination between case study and action research method seems appropriate in order to answer the defined research questions, which can provide deeper insight into a situation of the selected organization for which validated theory is not available. An interpretive case study was chosen in order to understand the social context under the study, the social processes by which it is developed and interpreted by people and through which it influences, and is influenced by, its social setting (Walsham 1995). This approach will enable to identify, explore and explain how all the factors in a particular social setting are related and often interdependent each others, or contrasting what was found in the case against the theories from the literature in order to see whether one theory matches the case better than the others. To support the study in the real situation and attempt to improve the problematic situation occurred during IT implementation, an interpretive action research is used by creating organizational change and simultaneously studies the impact of the change (organization dynamics) to gain better understanding of the institution (Avison et al. 2007).

This study was carried out in one of public university located in Indonesia, namely Udayana University. The university just started IT establishment since 2006. Therefore, the selected institution is expected to provide an insight about IT implementation process in public sector organization especially in educational institution in developing countries. This case study focuses on organization as the level of study, specifically in IS development unit in IT division.

3.3 Data Collection

To attain the goal of this research, data collection activities were performed in the selected institution. According to the action research cycle described in Section 3.5, the first phase is *Diagnosing* the organization. In order to do this, initial empirical

data collection was done during summer 2011, for 2 weeks duration in total, with 3 - 4 hours for each day in away to understand the contextual situation of the institution. Data gathering was based on several sources. Semi-structured interviews and informal discussions were used to obtain information from stakeholders. Interviews were performed in Bahasa Indonesia as language, and later translated into English. All the interviews were performed by note taking, but not for tape recording, due to the uncomfortable feeling of the interviewees.

Table 3.1: Summary of Interview's Participants

Event	Count
Initial Semi-structured interviews	**20**
- Administrative staffs	8
- IT People	7
- University & Faculty Management	5
Follow-up Semi-structural interviews	**14**
- Software Project Coordinator	6
- Programmer	6
- IT Management	2

However, limited interviews were performed only staffs and management of the institutions excluding the students, align with the project scope to get clear picture of the situation from the internal stakeholders. 20 people from the institution were interviewed, of whom 8 people were administrative staffs, 7 from IT related person including Head of IT Division and Head of Computer Centre of the institution as well as Internal System Developer, 5 people from Management and Faculty such as Dean, Finance Manager, deputy of academic and human resource department. Table 3.1 shows the summary of the participants.

The interview focus on how the system was going so far, what problems was encountered during the implementation and future need to succeed with IT in the institution. In addition to this, valuable information was collected from available documents, direct observation and previous involvement in the development and implementation process in the selected institution.

In attempt to solve the issues revealed from the previous diagnosis, an *action* was *planned* and *performed* in IT division, specifically in IS development unit. The empirical data collection was done in early of Spring 2012, for one and half months, on site. As an action research, data gathering was conducted by getting involved into the organization activity by introducing tools that support the software development process. Two softwares were introduced, *Redmine* as the project management tool (the main point is issue tracking system), the second one is *Subversion* as version control system (VCS). Redmine support the VCS integration so that the content of the Subversion VCS can be monitored through Redmine interface.

Several activities were undertaken during the second fieldwork. The first step was doing some initial observation about the current condition and planning for the activity. Then followed by tools installation, providing guidance either tutorial document or

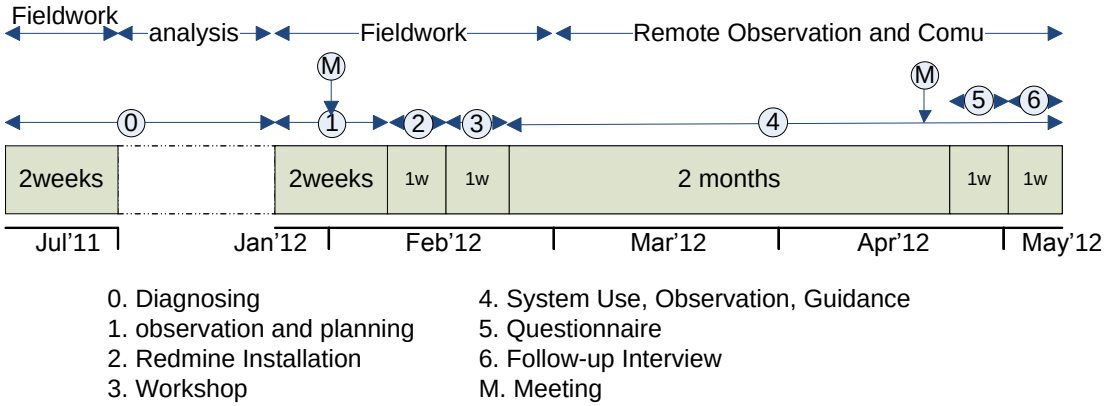

Figure 3.2: Action Research schedule.

practical assistance and workshop to the development team. During the system use, an observation and guidance were also performed to help the participants with the new tools. Meeting with the development team and informal discussion were also performed to gain the current issues of the organization. The *evaluation* for the action were conducted by performing questionnaire and follow-up interviews to obtain perception of the participants regarding the proposed approach. Figure 3.2 shows the longitudinal data collection schedule during action research activities. The diagnosing stage was conducted from middle of July 2011 until end of 2011. The action planning stage began from the last week of January 2012 for two weeks. The action taking stage began from the second week of February 2012 until first week of May 2012.

However, some of the data was collected remotely due to the limited allocation time and geographical distance such as the utilization of the redmine through the redmine local website, meeting through video conference and interview through telephone/voip.

Figure 3.3: Picture for some performed activities (LEFT) workshop about redmine and subversion for the participants - 23.2.2012 (RIGHT) meeting with the software project coordinators and IT director via Video Conference - 24.4.2012

The online questionnaire was selected to make it simple, considering the far distance between the researcher and the institution location. The questionnaire was focused on what were the characteristics of the participants and how their perception regarding the proposed tool, including the usefulness, ease of use, attitude toward using the tool, facilitating condition, self efficacy and intention in using the tool. The questionnaire contents were borrowed from Venkatesh et al. (2003) - see Appendix B. The summary of the participants can be seen in Table 3.2.

Semi structured interview was carried out to follow-up the questionnaire result in order to get in-depth understanding about the implemented tool and opinion from the participant's perspective. Interview processes were performed similarly with the previous initial interviews, except that in this time, the interviews were performed using telephone due to the remote distance. 14 people from the IT division were interviewed, including 2 people from IT management (Head of IS unit & IT Director), 6 people from software project coordinators (the person who lead the project) and 6 people from programmers. Summary of participants can be seen in Table 3.1.

Table 3.2: Summary of Questionnaire's Participants

Event	Count
Questionnaire	**20**
- Coordinator	8
- Programmer	11
- IT Management	1

3.4 Role of the researcher

As mentioned in the previous section, one of the data source on this research was the researcher's experience on previous involvement in the development and implementation process. This situation possibly happen since the researcher originally come from the internal part of the institution.

The researcher actually lecturer in computer science department in the institution since 2005. In the following year, when the institution started the initiation of IT implementation, the researcher became part of the IT division in which take the role as system analyst and developer in the IS development unit. Hence the researcher has the basic knowledge about the institution.

Usually, the action researcher is someone who is external to the organization, provide expertise in an organizational intervention and systematically evaluates the intervention to gain knowledge from the action (Baskerville & Myers 2004). However, in this research, the researcher coming from the institution itself (insider). This condition may give more advantages to the researcher, more flexible, compare with an outsider. An outsider may not have access to participants, and most importantly, organizational participants may not sufficiently trust someone who is perceived to be an outsider to share important, but sensitive, data (Levin et al. 2002).

The main role of the researcher (as action researcher) in this research is to improve the software development process and maintenance on the IS development unit. To accomplish this, the researcher adopt several different roles at various stages of the process including (O'Brien 1998):

- *planner*: planning the intervention
- *catalyst/facilitator*: providing the tool that can help the process
- *teacher*: providing guidance/workshop to the participants
- *observer*: observe the situation and condition
- *listener*: listen comment/feedback or any information related to the research from the participants.

The researcher has no experience previously in conducting interpretive case study and action research, and also was not trained as action researcher previously.This was the first experience. Hence, some problems occur during the research. However, through reflection on the methodology (on the next section) give more insight about the method to the researcher.

3.5 Action Research in Information Systems

Action research is an established research methods in use in the social and medical science long time ago since twentieth century (Baskerville 1999). Action research was explicitly introduced to the information systems community as a purely research methodology by Wood-Harper (1985) through incorporating action research concepts into an action based system development methodology. Towards the end of 1990s, it began growing in popularity for use in investigation of information systems, and become an important qualitative research method for this field (Myers 1997). The use of action research method in information systems is based on the assumption that human organizations/complex social systems, as a context that interacts with information technologies, can only be understood as whole entities, in which those social settings cannot be reduced for meaningful study, and through the action it take, will brings the understanding (Baskerville 1999).

The essence of action research is a simple two-stage process: (i)*diagnostic stage* that involves a collaborative analysis of the social situation, (ii) *therapeutic stage* / *intervention* that involves change experiments, action. Action research in information systems has four major characteristics that are distinguishable(Baskerville 1999):

1. Action research aims at an increased understanding of an immediate social situation, with emphasis on the complex and multivariate nature of this social setting in the IS domain.
2. Action research simultaneously (i) assist in practical problem solving and (ii) expands scientific knowledge.
3. Action research is performed collaboratively, between researchers and practi-

tioners, and enhances the competencies of those actors.

4. Action research is primarily applicable for the understanding of change processes in social systems. It means that through introducing and understanding changes will develop an understanding of the interaction of the complex social organization and their information systems.

Baskerville (1999) also mentioned that one clear area of importance in the ideal domain of action research is new or changed systems development methodologies. Studying new or changed methodologies implicitly involves the introduction of such changes, and is necessarily interventionist.

One interesting issue regarding action research is, its relation with *consulting*. Some scholars criticize that both action research and consulting are synonymous. However, some other scholars have attempted to identify the differences. They commonly assert that among other differences, consultants work exclusively for a client, whereas action researchers work for both a client and the broader research community, to which they must report their findings (Baskerville 1999). Differences that are more complete can be seen from Table 3.3.

Table 3.3: The differences of action research and consulting (Baskerville 1999).

Action Research	Consulting
Motivation	
Motivated by its **scientific prospects**, such as scientific publications.	Motivated by **commercial benefits**, including profits and additional stocks of proprietary knowledge about solutions to organizational problems.
Commitment	
Makes a commitment to the **research community** for the production of scientific knowledge, as well as to the **client**	The commitment is **only** to the **client**
Approach	
Collaboration is essential in action research because of its idiographic assumptions	typically values its "**outsider's**", unbiased viewpoint, providing an objective perspective on the organizational problems.
Foundation for recommendation	
Foundation is a **theoretical** framework.	Expected to suggest solutions that, in their **experience**, proved successful in similar situations.
Essence of the organizational understanding	
Organizational understanding is founded on practical success from **iterative experimental** changes in the organization.	Develop an understanding through their **independent critical analysis** of the problem situation.

3.5.1 Action Research Cycle

Basically, Action research focus into *action*, which the researchers follow some kind of cycle (*plan-act-reflect*), plan to do something in a real-world situation, do it, and then reflect on what happened or learnt. The cycle can be done iteratively accordance with the need on the research, which will be refined over the time.

More elaborate listing of action research cycle provide by Susman (1983). Susman distinguishes five phases to be conducted within each research cycle, as can be seen from Figure 3.4. However, the approach first requires the establishment of research environment – client-server infrastructure(Baskerville 1999).

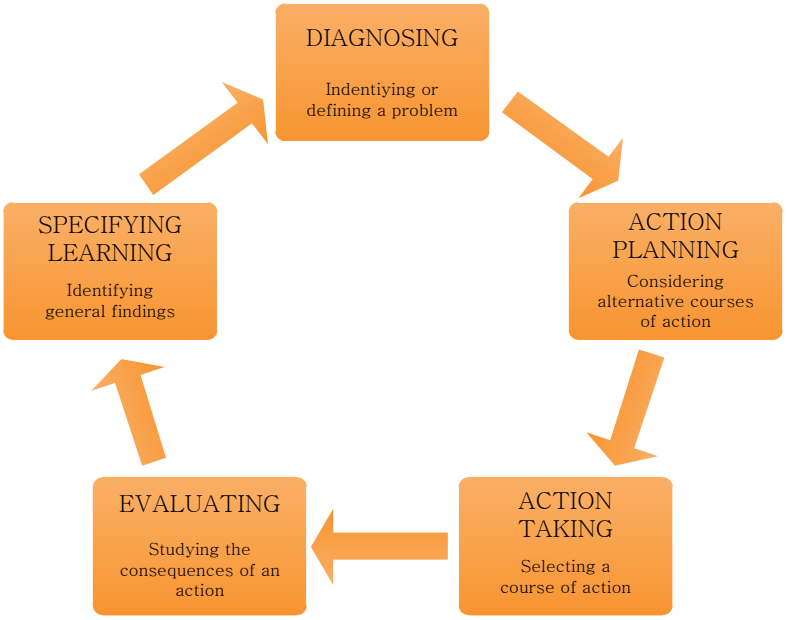

Figure 3.4: Action Research Model (adopted from Susman (1983)).

Client-System Infrastructure is the specification and agreement that constitutes the research environment. It provide the authority, or sanctions under which the researchers and host practitioners may specify actions. *Diagnosing* stages involves the identification of the primary problems those are the underlying causes of the organization's for change. It provide an improvement opportunity in the institution that is likely to lead to the development of relevant knowledge. Diagnosing involves self-interpretation of the organization, not through reduction and simplification, but rather in a holistic fashion. This stage will end up with theoretical assumptions/working hypothesis.

Action planning involves the joint development and consideration of alternative courses of action between researchers and practitioners to attain the improvement and knowledge development. This stage is guided by the theoretical framework, which indicates both some, desired future state for the organization and the changes that would achieve such a state. The plan establishes the target for change and the approach to change. *Action taking* involves the selection and implementation of one of the courses of action considered in the previous stage. The researchers and practitioners collaborate in the active intervention into the organization causing certain changes to be made. The strategy might be directive or non-directive.

Evaluating involves the study of the outcomes of the selected course of action by the researchers and practitioners. Evaluation includes determining whether the theoretical effects of the action were realized, and whether these effects relieved the

problems. Where the change was successful, the evaluation must critically question whether the action undertaken, among the myriad routine and non-routine organizational actions, was the sole cause of success. Where the change was unsuccessful, some framework for the next iteration of the action research cycle (including adjusting the hypotheses) should be established. *Specifying learning* involves assessing the outcomes of the evaluation stage and, based on this assessment, knowledge generation in the form of a conceptual or theoretical model describing the situation under study (whether the action was successful or unsuccessful).

In this research, as listed in Section 3.4, several different roles of the researcher are applied in the mentioned stages above accordingly. At the beginning of the cycle, *diagnosing stage*, the researcher acts as *observer* as well as *listener*. In this roles, the researcher carried out data collection activity to gather all kind of information, listening all the comments, opinions of the practitioners / participants through interview and discussion as well as observing the situation of the organization. Become an insider give more chances to the researcher to get better information at this point. Some of these activities were done during first fieldwork in summer 2011. All the obtained data then processed and analyzed during autumn 2011 to gain better understanding of the organization, in order to discover any challenge situations that need further improvement. This diagnosing stage revealed several problematic situations, and one of them was a poor handling of in-house software development process. Even though the software products are there, used by the users, the knowledge behind each developed system known only by the programmers. This would be problematic later on when problems occur i.e. bugs, extension of system features, or even a change personnel happen in the development team. There is no proper version control for the software code, only "traditional" method such as duplicating files/folder/projects based on its version. This will give difficulty for the team and IT unit to track the latest version of the system, even the system that is being used. Other issue was no written documentations regarding the software requirements, the list of features possessed by the systems, on almost all the systems. This situation gives a problematic situation when bugs found or planning for feature extensions.

After the problems were found, which acts as the reason behind of action for the improvement in the organization, then the next phase is performed, *Action Planning*. In this phase, the researcher acts as *planner*, which in collaboration with the practitioners, prepare some possible courses of actions to do which able to improve and solve the problems. At an IT division meeting, the researcher conveyed an idea about implementing common software project management processes, which is focusing on code management and issue tracking. In addition to its desire to improve the founded problems from previous stage, at the same time, this idea was also intended to use to manage a number of programmers (approximately 18), which was newly hired to help the coordinators to develop each system. The response from the meeting participants, which mostly coordinator of each system, regarding the idea was positive.

Based on this positive reaction, the researcher then planning the action for intervention, such as selecting the tools, preparing the workshops to introduce the tools to the participants and preparing the way to get feedback from the participants regarding the introduced tools. At this point, the researcher chose *Redmine* to handle the software project and issue tracking during software development and maintenance, and *Subversion* to handle code version management. The good thing is, this code version system can be integrated into the Redmine application, so it will be easy to use by the participants. In addition, Redmine application is less complex, compare with other project management systems.

Time to do the intervention, *Action taking stage*, the researcher performed almost all its roles in this research i.e. *facilitator, teacher, observer and listener*. The researcher facilitated the process by installing the Redmine and Subversion system, in one of the provided server. The system is web based, and currently, can be accessed locally, from inside the university. The action then followed by introducing the tools to the development teams, including its coordinators and programmers. Workshop was held to show where it can be accessed, how the system works and how to use it. At this point, the researcher intensively acts as teacher.

Due to the limited time available, the second fieldwork can only cover the action planning stage and little part of the action taking stage, on site. While the tools were used by the participants; the researcher actively monitored and observed the process. However, due to the far distance between researcher and the organization, this observation can only be performed remotely, through all the activities recorded in the Redmine application. At this point, the researcher intensively acts as observer. When the activity is very low, the researcher immediately contacts the participants, either by email or by chat, even by calling them, to find out the reasons behind it. Sometimes, the researcher response any issues that questioned by the participants regarding the tools. However, there are some things that have been planned did not go well. At this point, some small cyclic processes for adjustments were performed based on the appeared situation.

After the tools were used by the participants almost for two months, then the researcher performed *evaluation stage*, where at this time, the researcher evaluating the overall outcome of the intervention. Online questionnaire and then given to all the participants to obtained their perception regarding the introduced tools, how their feeling about using the tools, usefulness, and their intention to use it in the future. Interviews then performed to obtain detailed information, in order to follow up the questionnaire result. These interviews were conducted by chat and phone call to the participants. In addition, the evaluation also performed by observing the outcome showed in the Redmine application.

End of cycle stage, *Specifying learning*, then performed. At this time, the researcher overview the evaluation result, and generated any knowledge learned from the case. It also provided possible follow-up steps as recommendation, based on the outcome,

which was not work well previously, and then suggested it for the next action research cycle.

3.6 Reflection on Methodology

3.6.1 Principles of Interpretive studies

According to Klein & Myers (1999), there are seven principles can be used as guidelines for conducting and evaluating interpretive field studies in information systems research. However, it is not a mandatory to follow all the principles, rather it depend on the person in deciding how and which of the principles should be applied and worth to notice that, basically, they are interdependent each other. Following are those principles in detail.

The Fundamental Principle of the Hermeneutic Circle. This principle suggests that "all human understanding is achieved by iterating between considering the interdependent meaning of parts and the whole that they form"(Klein & Myers 1999). In this context, the parts can be the preconceptions of researchers and participants in the study, while the whole consists of the shared meanings that emerge from the interaction between them. With a number of iterations of this hermeneutic circle, a complex whole understanding will emerges.

During the investigation process, this principle was employed in order to obtained better understanding of the institution. Preconception of the researcher was obtained from the literature, as described in Chapter 2. In addition, it was also influenced by involvement experiences of the researcher in the institution. In other hand, preconception of the participants were coming from their knowledge of the institution situation. Interaction between both of them shape the understanding, and new understanding sometimes requires confirmation from additional literature study and interview (cycle). However, in this project, additional interview was not possible to be conducted due to geographical issue.

The Principle of Contextualization. This principle requires that the research object is placed in its social and historical background context, so that the intended audience can see how the current situation under investigation emerged (Klein & Myers 1999). In this project, the context of the case under study is described in detail including the historical background and current situation of the institution as can be seen in Chapter 4.

The Principle of Interaction Between the Researchers and the Subjects. As pointed out previously, interaction between researchers and participants will stimulate the emergence of shared meanings among them. This principle requires critical reflection on how the research materials/data were socially constructed through this interactions (Klein & Myers 1999).

Following the difference roles described in Section 3.4 give me a chance to wear "different hat" and observed the interaction with the participants, understanding their reaction, response and situation during the intervention. In addition, being part of the institution under the case (insider) give more advantages to me and more easily to get trust from the participants. However, lack of knowledge in this field research, especially action research, and conducted in the wrong sequence (due to distance and time limitation, data collection were conducted at the beginning of every phase) on the first attempt led me to get imperfect data, not thorough, and not fit with what was supposed to get. One situation that make me doubt with my own research is that when I have to interview participant as follow-up of the questionnaire. In the questionnaire, I omit the participantsŠ identity question in the hope that they will give objective answer to the questions. But, after analyzing the questionnaire result, many follow-up questions occur in my mind and curious to know the answer. However, I cannot track back the participants. This condition made my chance to gain better data is gone. As a result, I did the interview with those questions to the random participants. Although I cannot make any confirmation about the question to the "right participant", at least I can get the opinion from them.

Moreover I had limited time to perform the intervention on site, and mostly located in the remote place make the intervention more difficult to control and give any follow-up action i.e. additional training/workshop session, which was realized when the participants still do not understand much regarding the concept of the tools, how to use and manage it.

The Principle of Abstraction and Generalization. This principle requires relating the details about individual perspective revealed by the data interpretation through the application of first and second principles with theoretical aspect, the general concepts that describe the nature of human understanding and social action.

The Principle of Dialogical Reasoning. This principle focus on the contradiction that emerge between the theoretical preconceptions of the researcher, in which guide the research design, with the actual findings from the context under study. This rule can be applied several times (cycle) in order to improve the understanding about the phenomenon. The new understanding from one cycle becomes the preconception for the next, an so on (Klein & Myers 1999). This principle shows that the preconception of the researcher in interpretive studies, particularly hermeneutic-based, is the necessary starting point for the investigation in order to obtain understanding about phenomenon. From theoretical preconception, which can be obtained from the literature, can then proceed with data gathering process, and confront both the preconception and actual findings. This sequence can be applied several times in cycle to get better understanding.

However, the first part of this research does not follow the exact sequence suggested by this principle. Due to geographical issue (the field's location was far away from the school, Norway - Indonesia) and time constraint (the available time only in the

holiday), the project was conducted in the opposite way. The data were firstly collected during summer holiday 2011 and then followed by literature study, to get the background knowledge of the related topic - theories and research strategies, on the autumn 2011.

The consequence with such condition was very pronounced. Without sufficient theoretical knowledge and preconception of the case during data collection, the data gathering process (i.e. interview materials) was not well maintained. Some of the informants and the type of questions asked to them were less fit with what was supposed to get, and these things were realized later on literature review process, which was too late. Refinement can actually be done by performing additional iteration for data collection (i.e. interviews), to obtain additional confirmation from previous finding. Nevertheless, this iteration was impossible to be performed during the time due to geographical and time issues. Hence, the analysis process was done by relying on existing data only, with additional information from the documents and previous involvement in the implementation process and contrasting with the theories and empirical result from the literature.

The Principle of Multiple Interpretations. This principle emphasize that it requires differences interpretations among the participants (multiple points of view) in order to understand the influences that the social context has upon the action under study. In this case, it is possible for researchers to understand conflict that emerge among multiple interpretation, which can be related to power, economics, or values (Klein & Myers 1999). Multiple interpretation were trying to be covered in this present project, by involving different type of informants, as can be seen from Table 3.1. By doing so, it hope that a comprehensive interpretation will be obtained and lead to better understanding of the situation.

The Principle of Suspicion. This principle requires sensitivity to possible "biases" and systematic "distortions" in the narratives collected from the participants (Klein & Myers 1999). At the time, this principle was not emphasized in this project.

According to above experience, these principles were actually very helpful and valid as guidance in order to perform an interpretive study. Several lessons the researcher got from this experience when do the research with action research approach for the first time:

1. Try to understand the method appropriately through literature, and find a guideline (best practice and experience) about it, and try to understand the context as well.
2. Plan what you want to do, but remain aware of the possibility of an unanticipated situation arises.
3. Do it appropriately, in normal way/sequence, considering it as the first attempt, according to the available guidance from the literature. As explained in dialogical reasoning principle, if we are doing an opposite way with what is suggested, it likely to cause several problems, which in fact could be avoided.

CHAPTER 4

CASE STUDY

4.1 Context Of The Case

This study took place in an educational organization, Higher Education Institution, namely Udayana University, abbreviated as UNUD. It is one of public universities in Indonesia located in Bali, island with area 5.632 km^2 and population approximately 3.9 million people. UNUD is the oldest public university in Bali. UNUD existence began from Faculty of Letters on September 29, 1958, which was a branch of University of Airlangga from East Java. This Faculty became an embryo for official establishment of Udayana University on August 17, 1962.

Figure 4.1: Bali Map and its location in Indonesia Archipelago

Currently, the university has 12 Faculties and 1 Postgraduate program with approximately 19.000 students in total. Around 8% are international students. The organization was supported by approx. 1600 educational staffs and 700 administration and technical staffs.

Its campus place spread in three locations, in which two of them are 25km in distance. The first one is location for the main office and most of the bachelor programs, university library and research institute. The second place is location for the postgraduate programs, faculty of medicine, and health science and faculty of veterinary medicine. In this location, it also can be found the Network Operations Center of the university. The last location was the first campus built in the early development of the university. It is now the location for the faculty of letters, faculty of law, and postgraduate programs of cultural studies.

As an educational organization, the university has vision to be able to compete with other higher education institutions, nationally and internationally , and deliver an eminent, independent and cultured human resources. To achieve the organization's vision, the development of the university will be carried out gradually and sustained based on the institutional development roadmap. The themes are managing the institution capacity building, educational reform and best practices. One-step of the development is becoming a world class university based on culture in South-East Asia (ASEAN) level in 2021 as part of ASEAN University Network criteria.

To do so, in 2005 the university determined the strategic planning of the development into *Institutional Development Master-plan* and in 2009, the university published a white book [1] contain general policy and roadmap of the university development and act as guidance for institutional development.

The university realized that the use of IT is a necessity. Employing IT was considered as a key point toward reaching the institutional goals and increase the institution competitiveness in this era. Therefore, they reflected this into the institutional master plan. It was realized that there would be many challenges in order to implement and develop IT in the institution. As emphasized in the document, it would be dominated by non-technical factors such as leadership commitment, budget allocation, human resources capability and organizational structure. These non-technical factors need to be addressed besides the technical part.

In addition, white-book also outlined three stages of the development toward the institutional goals by setting year 2012, 2017 and 2021 as the destination point, change the organization form into a *Public Service Agency* or abbreviated as BLU in 2012, lift up the institution accreditation into ŞAŤ in 2017 and become an excellent university based on culture in 2021.

In the context of development and implementation of IT, several strategic plans were outlined as follows:

- **Information System**
  The planned information systems will be used to handle approx. 19000 students and 2000 staffs. It will become a huge and complex and is impossible to

[1] White-Book of the University, General Policy and Roadmap of University development, 2009.

build it at once. Hence, the following strategies should be applied:

- Development of information systems will be conducted and managed independently by one internal institution in the University.
- Develop a basic framework, which is used for the construction of data centers.
- Information systems will be developed gradually and consist of several sub-applications. The application will be operated independently. However, the system is not standalone, rather an integrated system. The overall system will comprise; Executive information system, operational information system (academic and student related system, financial/ planning and budgeting related system, resource management system), and information system related for public services.

The applications are expected to be developed using open source technology to make less binding with licenses and in the form of web application, so it will be easy to access by the stakeholders every time and everywhere.

- **Network Infrastructure**
  Network infrastructure is the foundation for the communication. Many ways can be chose to implement the infrastructure ranging from the technology and the network topology. However, it should consider the advantages and disadvantages of the technology as well as the physical condition of the institution, number of users in each department and funding. In addition to use by applications, network infrastructures is used also for internal communication services such as VoIP etc. By using this infrastructure, many benefits can be gained such as loosely coupled with external services, cost saving and productivity. To increase accessibility, wireless access point will be installed in various strategic places around campus so that the stakeholders can access both intranet and internet easily.
- **Network, application and information integration**
  Various applications and information systems that will be developed should be integrated one another with various communication media. By integrating all supporting component, it would become an integrated information services, which can be accessed from various media.
- **Organization structure and management**
  By implementing the information systems in the university, it will affect the work culture, organization structure and management of the university. all the stakeholders will be involved to make it success. Hence, it will need to; (1) improve the staff capability, (2) participation of stakeholders to maintain the validity of data, (3) participation of stakeholders obeying the procedure in use of the system, (4) consideration of e-document legality and digital approval toward the paperless office concept.
- **Human resource capability and supporting facilities**
  Reliable resources are the key points to success in implementation process such

IT. Therefore, several things should be done such as: (1) Mapping and assessment of the resources, especially human resource capabilities, to what extent of their mastery of IT, (2) Obligate the stakeholders in the use of information systems toward the paperless office concept (3) Continuous improvement in mastering IT for the stakeholders (4) Improvement of facilities and infrastructure under effectiveness and efficiency principles.

- **Maintenance** Continuous maintenance is a necessity for the infrastructure and application to prevent fatal damages and preserve the services. Therefore, it will need sufficient financial support and supported by skilled and competent human resources. There should be a standard procedure for maintenance purposes as guidance. Manual documents for each developed application is a must as part of the maintenance plan and all the developer should obey this standard.

Strategic plans that mentioned above are divided into three stages to make an easy accomplishment, there are the short-term plan, medium-term plan, and long-term plan. These stages can be seen in Figure 4.2

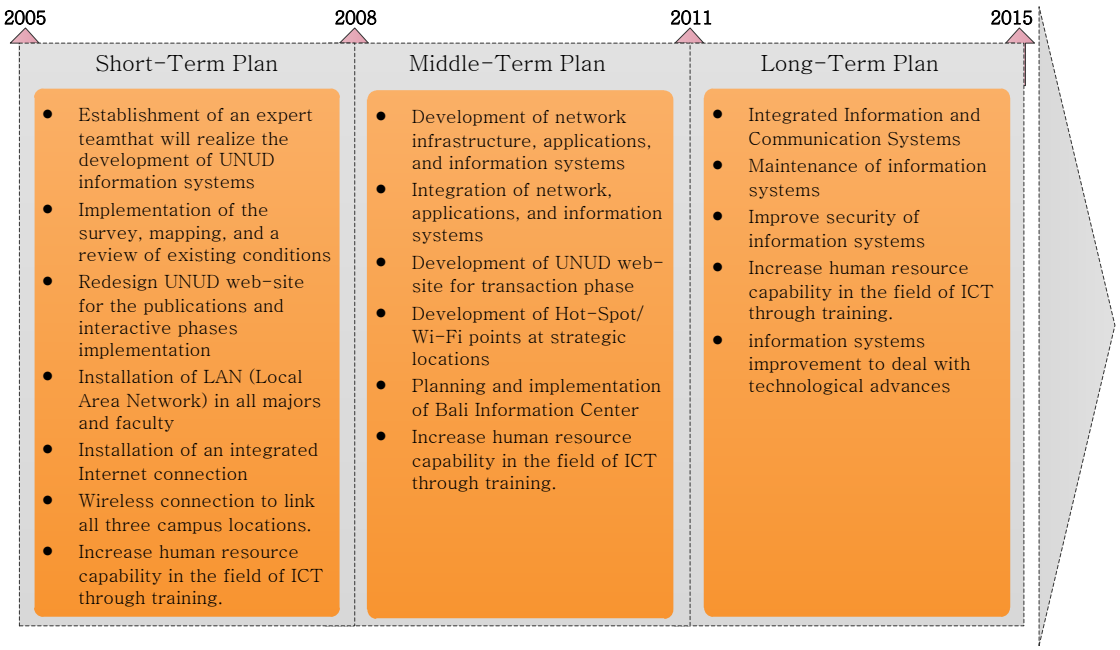

Figure 4.2: Strategic Plan Universitas Udayana 2005 - 2015

Board's of the University begun to provide a high priority in IT development and implementation since 2006, for both organizational structure and IT infrastructure. Since that, The University received funding support from several sources for the development of IT, namely Competitive Grant Program (PHK) INHERENT K-2 from DIKTI, Grant from banking Company (Bank Mandiri) in 2007, self funding and PHK TIK K1 in 2008. Since that the university has IT foundation facilities that include an integrated network infrastructure and some information systems.

In organizational structure, since 2006, The University has established a special di-

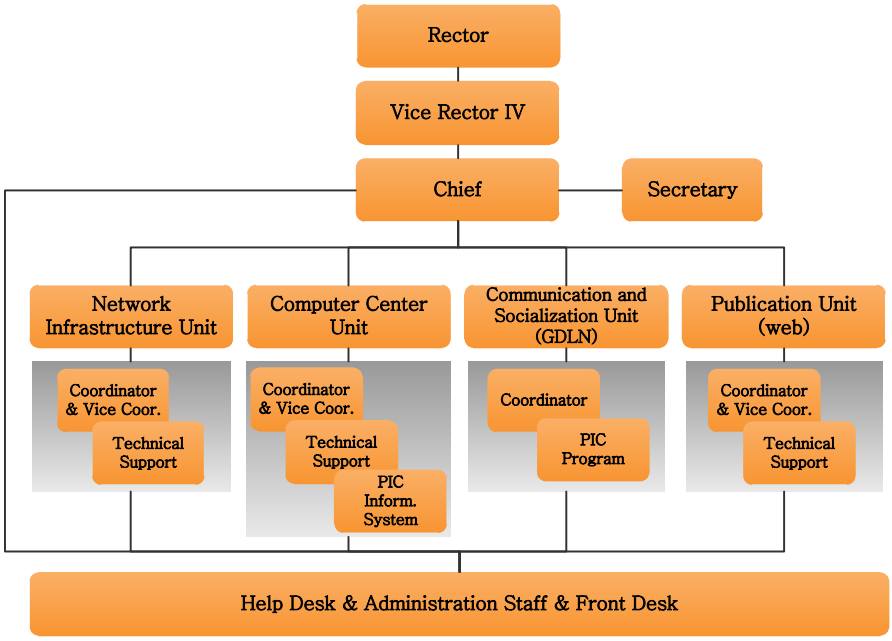

Figure 4.3: New Organization Structure for IT Division

vision that deal with IT development and implementation, namely *Information and Communication Division - Divinkom* in which initially divided into two units, *Computer Center* and *Global Development Learning Network*. Computer Center is a university supporting unit in which deal with development and implementation of information systems and GDLN focus on infrastructure and telecommunication system. 6 people in total were assigned for both units in which two of them act as head unit. They act as planner, designer and developer as well as implementer of the information systems and infrastructure. In addition, 3-5 people were assigned either from the students or educational staff to support the information system development and maintenance, but excluded from the structure. However, along with the time, it seems that the responsibility were getting complex, hence the structure was refined to fit the needs. Since early 2011, new organization structure for IT division was applied, as can be seen from Figure 4.3. Approximately 8 positions are available in the structure for coordinate tasks and 8 technician support positions distributed into four sections. Currently, some positions are already occupied, but some other are not. They are mostly coming from educational staffs and not working as a dedicated job. These situations happen because of the regulation in state-own university that makes it difficult to hire people for specific task, professionally.

4.2 Organization Structure

A brief overview about organization in the University can be seen from Figure 4.4, specifically units that will play a lot with IT.

Following are list and short description of units showed in Figure 4.4;

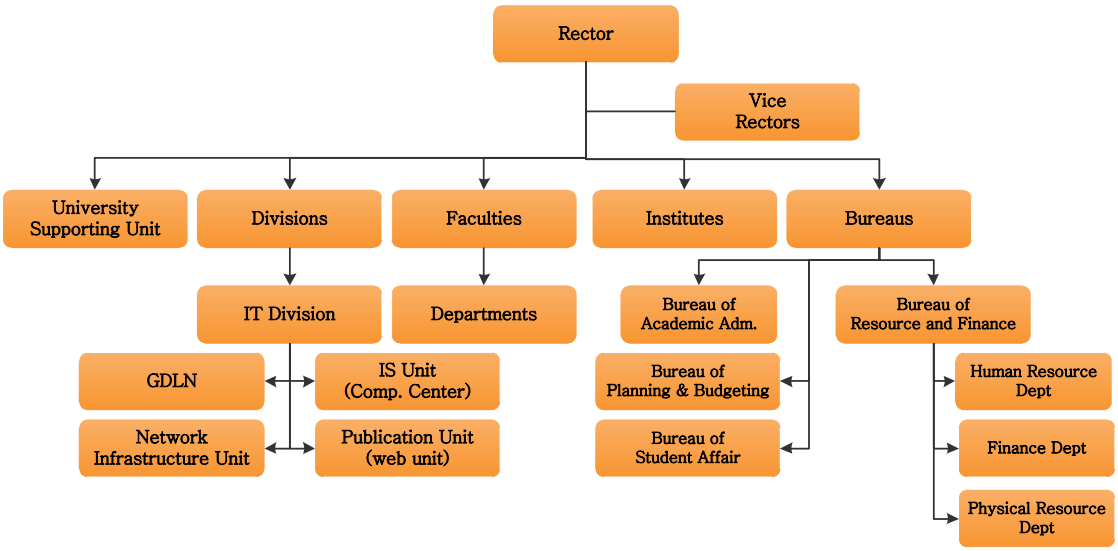

Figure 4.4: Udayana University Organization Overview

- **Institutes** : Practically, there are several institutes exist in the organization. Some of the institutes are Research Community service Institute, Quality Assurance Board etc.
- **Faculties** : There are exist 12 Faculties and 1 postgraduate program in the organization.
- **University Supporting Unit** : units that exist for supporting the organization such as University Library, Language center, University press, and some laboratory.
- **Bureau of Planning and Budgeting** : this unit responsible for the overall planning / budgeting needed by the organization and handle the information statistic of the organization. In line with the organization planning, there exists Planning Division that cooperates with this department.
- **Bureau of Academic Administration** : this unit responsible for the academic administration including students admission, administration as well as graduation.
- **Bureau of Students affairs** : deal with something related to student activities as well as the available scholarship for the students.
- **IT Division** : this division focus on IT development and implementation supporting the organization works including network and application support. Under this division, there are 4 sub units as follows:
  - *UPT. Pusat Komputer - Computer Center* : this sub unit responsible for developing and implementing information systems (applications) that support the organization.
  - *Global Development Learning Network* : GDLN is a partnership of over 120 recognized global institutions, collaborating in the design of customized learning solutions for people working in development. This unit was initiated by World Bank with many universities around the world this unit

responsible for communication and socialization in organization as well as teleconference and distance learning.
  - *Network Infrastructure* : this sub unit responsible for the availability of network infrastructure services.
  - *Web - publication* : this unit responsible for development and maintenance as well as content management of the official website and email services.
- **Finance Department** : focus on the financial part of the organization.
- **Human Resource Department** : handling the academic and administrative staff administration in the organization.
- **Physical Resource Department** : deal with all physical resources (asset) in the organization.

4.3 Network Infrastructure

Since the commencement of IT implementation, tremendous change were happen in the context of network infrastructure. At the beginning, there was less network infrastructure that connect some units in the university. But now, up to 90% of the units are connected *intranet* as well as *internet*.

Intranet connection on each campus location is equipped with fiber optic to all faculties with bandwidth up to 100 Mbps. Whereas intranet connection between different campus locations utilize *radio link* connection. One of the Connection has bandwidth up to 45 Mbps by utilizing two pairs of radio link. Unfortunately, on March 26^{th} -2011, the radio equipments were struck by lightning. This incident resulted in damage to some radio equipment. Currently, only one pair of radio link is installed, which obviously decreases the connection capacity.

Integrated Hotspot/wifi points have been installed and have 90% coverage of university area in three locations. Voice over Internet Protocol (VoIP) has been installed in many units. However, the utilization is less optimal due to lack of socialization.

Video Conference facilities are available in three campus locations. Three equipments, in which one is portable, are in GDLN from World Bank and Yamaguchi University. 1 equipment is placed in Law Faculty, from Indonesia Constitutional Court. The last one is placed in electrical engineering department. The same lightning strike has happened with video conference equipment, which made two of the equipments were in damage.

Several IP camera have been installed in limited location such as conference hall, GDLN, house of rector, to support surveillance activity and to know the ongoing activity held in there.

Talking about the bandwidth capacity for outgoing connection (*internet*), there has been a gradual improvement since the initiation. At the beginning, the internet band-

width was 2 Mbps. Now, the overall bandwidth reaches 25 Mbps.

4.4 Information Systems

In order to support the organization, UNUD has planned the development of several information systems, which mostly in web-based applications. Those systems can be separated into three groups: (1) Student academic and administration related, (2) Planning and Budgeting and (3) Resource Management. Figure 4.5 shows the overall architecture of the UNUD information systems.

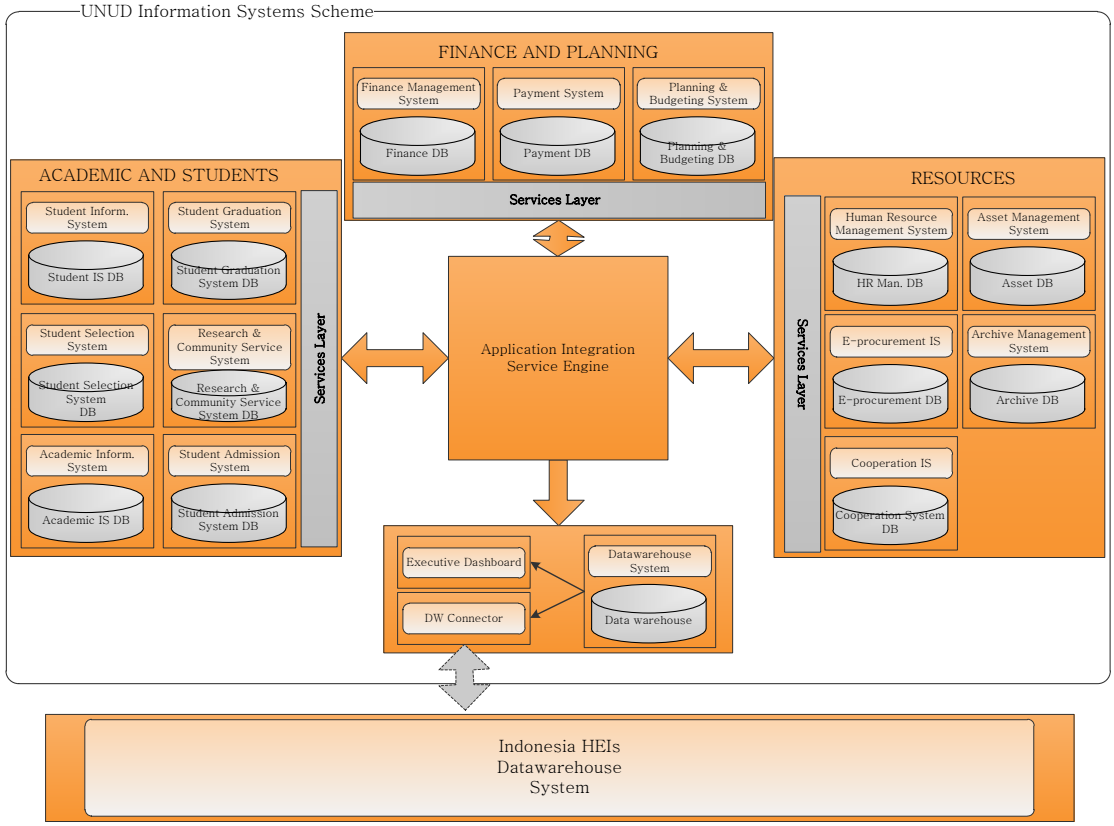

Figure 4.5: UNUD Information Systems scheme

Within the last 5 years, some of the information system are successfully developed and is used by the organization and some other still under development (new developed system). In addition, some of the existing systems are extended to support more functionality. However, there are also systems that is not developed yet, due to interdependency with other system and the resource limitation (future). Following section will discuss those systems in more detail.

4.4.1 Existing System

Following are the existing systems with short description and their functionalities.

Student Administration related systems

There are some systems for student administration process. These systems are intended to simplifies the former process (which is manual) into computerized version so that all the relevant stakeholders such as students and operational staffs will be facilitated and make the process more efficient in term of time and cost saving. Following are several systems that have been developed:

1. **Academic Information System** - *Sistem Informasi Akademik (SImAk)*.
   Academic information system has a long historical background. This system was previously developed and used for engineering faculty prior to the initiation of IT establishment. Because deemed necessary and has been tested in the faculty, the university then decides to adopt the system and scale up the implementation into university level. Since 2007, *SImAk* was implemented gradually into several faculties based on the similar behavior of the curriculum model and the readiness for each faculty such as network infrastructure and resources. Different curriculum behavior was happen for Medical faculty, hence major adjustment of the system was needed to be done and implemented at the last term.
   This system was intended to help the faculty administration staff to manage the academic activities among the departments under the faculty including student data management, courses management, grading system and reporting. For every semester, faculty staff will register all the opened courses in that term based on the submitted list from departments. Meanwhile, the student will do the registration process for the courses they will take during semester using a specific registration form that they can get from the faculty after they paid the semester fee. Later on, the form needs to be approved by the student's academic supervisor before they hand it in to the faculty to further record processing into the system.One of the important reports will be generated by the staff, the attendance sheet, for each course that will be used during the class to note the presence of the students. The illustration for this process can be seen in Figure 4.6.
   At the end of the semester period, every course responsible will submit their course grade list to the faculty. The responsible staff then records the grade to the system and make possible for the students to request their semester grade result as illustrated in Figure 4.7.
   Generally, the functionalities of the system can be listed as follows:
   - √ Students Management includes CRUD operations into the system as well as personal information of the students.
   - √ Courses Management including course registration and grading system
   - √ Report generator: semester based report for student academic progress, report of student academic transcript, attendance list sheet, courses statistic, studentsŠ statistic.

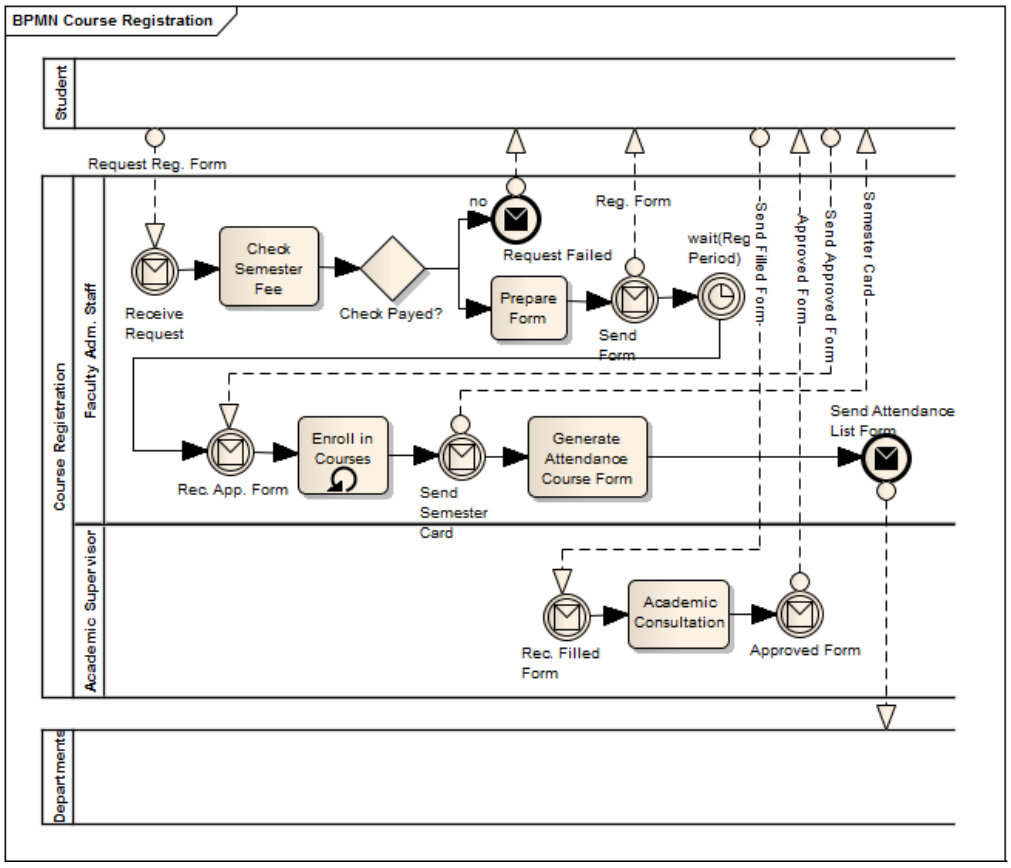

Figure 4.6: Business Process for Course Registration

Currently the system was used by the facultiesŠ staffs only for all processes. The student can only see their personal information and academic progress without possibility to register any courses by them self. All faculties already utilized the system, except graduate program.

During the use of the system, no serious problem was exists regarding the functionality and procedure. However, not for the technical problem that support the system, for example network connection, computer customization etc, and some of the faculties have no staff specifically handle this kind of problems. Mostly, the users or the responsible staffs for the system are lack of knowledge about IT, technically. Once the problem occur, it will need more time to solve it, and sometimes waiting for a couple of days for the availability of IT staffs from the university, as one of the staff said:

> *"...when the problem occur, we try to solve it first. But if we cannot solve it, we will contact staff from other department that used to help us. However, he will come here depend on his available time. If he is busy, we have to be patient for it, because this is not his main responsibility..."*

Different faculty has different behavior to handle such kind of problems. As one of the faculty management said that:

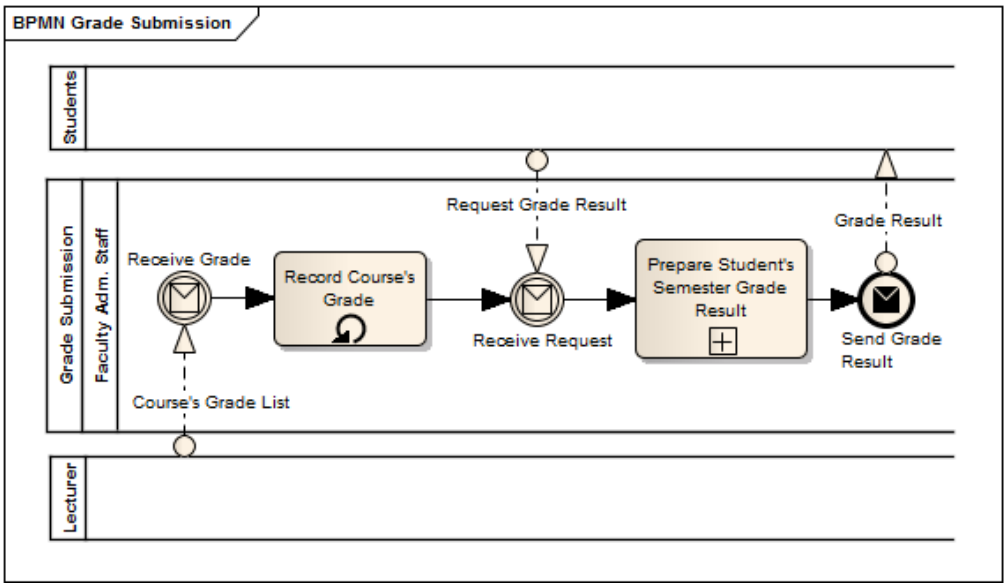

Figure 4.7: Business Process for Grade Submission

> *"...we designate one of the staffs to use the system as an operator. Whenever there are problems occur, he will try to figure it out. If failed, we will contact an IT specialist from external to fix it; indeed, it should be prepared with some cash. If we report it to the IT specialist from the university, it will take more time to be done. Maybe due to the limitation of number of maintenance staffs or else ..."*

However, the existence of this system helps the faculty very much, especially at the operational level, for the staffs that executing the tasks. Indirectly, this system also support the monitoring and decision making processes of the faculty, academic administration department as well as the management of the university through data and information resulted by the system.

2. **Student Admission System**.
   To accelerate the enrollment process of new students, in 2010, the university changed how the enrollment process is performed, by changing manual procedure into online process. For bachelor students, there are two types of students: Regular[2] and Non-Regular[3], and both types treated differently. Regular bachelor students have two procedures: first, handled by national consortium in which this system was not used, second, handled by local committee in which this system was used along with student selection system. For non-regular students, a separate but similar system was used. Since 2011, online enrollment process also applied for graduate students, but limited only for the early stages of the enrollment process. Hence they called '*semi-online*' process.
   This system aims to simplify the admission process of new students, which are handled by academic administration department. Previously, students need to

[2] students candidate who apply for the admission processes right after they finish their high school or at maximum 3 years

[3] students who apply for the admission processes have finish their high school more than 3 years

filled in the registration form and submit all the requirements by bringing it to the administration office and received the enrollment examination related material such as schedule, pass card, location etc. After finished all the selection processes, the selected students will do the remaining admission process such as payment for admission and tuition fee, further document verification, student id etc.

In this system, prospective students do the registration through an online application and complete all the information needed there. To make it possible to continue the process, they need to pay the registration fee beforehand. However, Computer Center who is responsible for the payment data preparation has sent all the necessary information to the bank before the registration process was opened. Following completion of the registration, the candidate will receive the schedule, location, and exam card for the enrollment examination by downloading the document from the sites. After the selection process is completed, the rest of the admission processes remain the same with former one that involving academic administration department as explained above.

Following are functionalities possessed by the system:

- √ Record personal information of candidates
- √ Record academic history of candidates
- √ Upload necessary documents such as transcript, photo
- √ Record major that selected by candidates
- √ Generate token for registration feeŠs payment.
- √ Generate reports i.e. exam card, enrollment page, data statistic of candidates, attendance list.

By using the new system, the candidate does not need to go to the university for registration processes except for the examination. This procedure provides benefits for the candidate who lives far away from the campus. This also provide a shorter procedure for the academic administration department in handling the enrollment processes.

However, there are some problems occur during utilization of the system. The system apparently generated duplicate candidate ID during the registration process. This problem was realized after the registration period has ended. From the discussion with system developers, it seems that this problem occur because of the improper implementation of the candidate ID generator module in an attempt to deal with the concurrence access of the system. One of the developers said:

> *"... we have tested the module, and no problems occurred during the time. We found it difficult to test the module that related to concurrence access ..."*

By a personal approach to the applicants, this problem can be solved by the committee. Another problem stated by deputy of academic in academic administration department:

> *"... quite a lot of candidates call and complaint us during the registration period because the website is very slow or inaccessible. Maybe the server cannot handle too much applicants at the same time Another sensitive issue also arise after the distribution of the incentive ..."*

Another sensitive issue also arise after the distribution of the incentive, for example the selection process for Non-Regular Students. One of the person in charged in this process complained that:

> *"... we did all the data processing part and support all the material needed for fastening the selection process, day and night. But we did not get incentive that appropriate with what we did, even compare with others' ..."*

It seems that the incentive was not transparent from the beginning and the basis for determining the incentive was also not clear.
Despite the fact that many problems occur, overall, the system is up and running well, considering this is the first attempt of the system implementation. Some improvements need to be done for the next registration period.

3. **PMDK Student Selection System**.
   In order to support the student admission process, besides the national selection organized by the universities consortium, there is a process called PMDK, which is a university level or local student selection process. PMDK aims to select outstanding student candidates that have an academic achievement as well as sports and arts. There is a commission called Tim-12, which is a combination of representatives from 12 faculties that in charge to select the prospective students based on their academic performances in high school plus any achievements in organization, sport as well as art. The committee is supported by Academic Administration Department and Puskom during the selection process. However, sometimes there are unfair conditions regarding confidentiality of the selection processes, and the former system cannot accommodate the current selection procedures. Hence, since 2007 UNUD developed and implemented a new PMDK selection system to accommodate it. It was designed to make it easy to modify because some of the procedures tend to change every year. In addition, the system also designed to keep the fairness and confidentiality of information and selection process. Even Tim-12 Commission did not know which participants they processed because the participants were represented by encrypted code. By this way, the selection process purely select students based on their achievements as well as their enrollment examination result. Moreover, the operator, Computer Center staffs, also did not know which participants were selected during the selection process.
   Following are the functionalities possessed by the system:
   - √ Candidate Data Management including CRUD operation
   - √ Supporting Data Management including High School Grade Report, Any academic, sports or arts achievements

- √ Grade calculation process based on specific criteria stated beforehand, Rank the candidate and select the candidates who pass the selection.
- √ Generate report such as report to support selection process by the committee, announcement for the selection result, data statistics.
- √ Features for keeping the confidentiality of the process.

In general, there will be a committee created every year to handle this process. All people that support the process will included in this structure such as Tim-12 commission, Academic Administration Department as well as Puskom. However, there are some complaints from the staffs regarding the unfair condition between the amounts of incentive they got compare with the load they have in the process, as one of the members said:

> *"... we work on the system almost all the time during the selection process compare with other section did, but we did not get decent incentive for it. Even, it worse than other section got ..."*

In 2011 period, this system was integrated with the admission system, hence some data are imported from admission system using intermediate application. However, few adjustment are made as required.

4. **Students Graduation System**
   The University annually organizes graduation ceremony as much as 4 times. Every student who will graduate and follow the graduation ceremony on particular period need to register himself to the organizer, that is Academic Administration Department (BAA). Formerly, registration process was done by coming to the BAA from the beginning, pay the graduation fee to the bank continued by verification at faculty and BAA and ended by taking graduation toga in Resource Department.
   To simplify and facilitate the registration process, since 2009, UNUD developed and implemented a system to manage it, online. Thus, students do not need to visit BAA first, but register them self by online application, and prepare all the requirements such as payment and other documents. If all are ready, and then students do the validation in the faculty office and BAA, and then ended with the same way as previous procedure.
   Following are list of the functionalities of the system:
   - √ Manage the students who will follow the graduation ceremony
   - √ Confirmation for Personal Information used in certificate
   - √ Collect information needed for graduation ceremony
   - √ Gathering resources such as valid photo for Alumni Book

Finance related systems

There are some systems for finance related process. These systems are intended to make the process more accountable and transparent among the stakeholders, provide an efficient way for the operational staffs in preparing the data, faster recapitu-

lation for finance department and higher management. In addition, provide better services to the students during payment process. Following are several systems that have been developed:

1. **Students Payment System**.
   Since 2007, payment for admission and tuition fee was changed from manual invoice, which the students need to take the invoice to the school prior to payment process, into semi automatic in which the students only need to go to the chosen bank and mention their student ID to pay their bill, or using Internet banking or others bank channel. However, manual invoice still available in case of any problems occur during payment period.
   Basically, on each payment period Puskom staff will setup the students invoice based on data stored in the system. Specifically for new students, invoice specification are obtained from the agreement involving the university board, Finance department, BAA and faculty and represented in a university decree. If changes happen for the specific invoice setting, it should be made prior to the payment period by the faculty through BAA. Three or four days prior the beginning of payment period, all the invoices data are sent to the Bank via email.
   Following are list of functionalities of the system:
   - √ Management of Students Invoice.
   - √ Generated Data conform to the bank format
   - √ Generating report, list of invoice that have been paid, pending or not paid.

   However, many problems occurred since this system was implemented, both technical and non-technical. At the beginning, they expect that with this approach, the payment process will be simple and less work than manual procedure. In fact, many changes happen for amount of fee from the faculty during the payment period and sometimes, faculty did not submit the invoice detail specification on time and disrupt the payment setup because they have to re-send the payment data to the bank (semi automatic). Consequently, complaints are coming from students. More and more changes occur, more frequent they have to re-send the payment data to the bank and it will need more time to be ready at the Bank side.
   Currently, person that responsible for sending the data to the Bank is the Head of Computer Center, because he feels that no one is capable yet to do that. He is also being a contact person if something wrong with payment data, besides the BAA. However, he feels that there was something wrong with the way it works, like he said:

   > *"...during payment period, it seems like I work on another job, as a **help desk** who receive all complain from the students who cannot pay the invoice, wrong amount, wrong id etc..."*

   One times, mistake was made by the staff in determining the invoice item and it is known after complaint was received from the students during the payment

period. The Head of Puskom said:

> *"...at that time, I am overconfidence with the staff's work without any re-checking procedure before sending it to the Bank. All invoices from one faculty has invalid amount. We should improve our internal procedure to avoid that kind of mistakes in the future..."*

Another comment regarding utilization of this system is coming from the Computer Center staffs, who is the person operate this system. He said:

> *"...at the beginning, it is sound good anyway. But this simply move the workload from academic administration department to our unit (Computer Center) and it become harder than before. there is also no appropriate incentive for us to do it ..."*

It seems like the workload is not distributed well and there are no guidance for any roles exist. No clear responsibilities for all the parties, they sometimes did not follow the rule very well. Consequently, problems cannot be avoided.

2. **Planning and Budgeting Management System**.
   As a public university, every year university must submit work and budgeting plan for the year ahead to the government through ministry of finance. Consequently, university has to collect all work and budgeting plan from their units. To make it simpler and well documented, in 2007, Planning division, Planning and budgeting department and IT Division designed and implemented an online planning and budgeting management system.
   Basically, in the middle of each year, each department will estimate the amount of income they will get from the tuition fee on the upcoming year and this automatically estimate the university income from the students. They also estimate the number of new students will be enrolled on the upcoming year. Based on those estimated income, every units i.e. faculty and departments, institutes, divisions, and Head Office, then creating their own work planning and the detail-estimating budget. All that information is recorded through this system within a certain period. At the end of the period, BAPSI will recapitulate all the information gathered into university work and budgeting plan that ready to use by the management.
   Following are list of the functionalities of the system:
   - √ Manage the estimated revenue from admission and tuition fee based on estimated new students in upcoming year and existing students in faculties/departments
   - √ Record work plan for upcoming year and budgeting strategy based on revenue they have.
   - √ Automatic estimated revenue sharing between universities, institutes and departments.
   - √ Generating report such as estimated revenue, work and budgeting plan.

   The difficulty encountered during implementation of this system was to make

the users from each unit become familiar with computer-based approach in order to make work and budget planning. There are almost 120 units exists at the beginning of the implementation and the users are lack of IT literacy. However, along with the time, the process is getting better and there are a lot of improvements made every year in order to meet the requirements and solved the problems arise in previous year.

Resource Management related systems

This system is intended to provide a better system in managing the university's resources. Provide a fast and detail information about resource condition for the stakeholders (staffs and management) starting from human resource information as well as asset own by the university.

1. **Human Resource Management System**
   In order to mediate the university's staffs with Human Resource Department including the administration process and current information about staff status, since 2008 UNUD developed and implemented human resource management system.
   Basically, HRD manage all the administration processes related to the staffs including open vacancies for new staffs and process promotion or demotion of the staffs. All the information regarding those processes is recorded through this system. Following are list of functionalities of the system:
   - √ Manage university staffs information (academic, administration, technician) including CRUD operation
   - √ Manage ranks information of the staffs as a civil servant.
   - √ Generating reports such as list of employee would be based on group, i.e. academic staffs, administration staffs, technicians etc, List of estimating retiring staffs.
   - √ Sharing information about personal to the staffs

   To keep the information consistent in the system, the data should be maintained on a regular basis. However, it did not happen all the time, and seems that the system did not meet the needs that occur in the following year. Because of the limitation of the IT staffs and no follow up on the existing system, the Head of HR Department took the initiative to develop new system with external developer to solve the problems. One of HRD staff said:

   > *"...at the beginning of the implementation, we update the system in regular basis. However, when the workload is high because of the urgent task, and requires most of the HRD staffs, we pending the updating process..."*

   other staff said:

   > *"...when we attempt to update information into the system, the system cannot cover all kind of data, some features are missing. When we*

> *report this issue into the IT department, there is no quick follow-up to update the system. Inevitably, our head of department took the initiative to develop desktop-based system by external developer to quicken this process, and recently, we actively use it. However, we will utilize the web-based system once the system is updated and ready for use . . . "*

It seems that the system implementation was not running well. The director of IT Division encourage all the system to be developed as web based application to made it easy to access. With this behavior, It will need more effort to make this system work better and integrated.

4.4.2 Extension and New System

There are some improvements made from the existing systems to meet the requirements in the organization and some new systems are under development listed as follows:

Improvement Systems

1. **Online Course Registration in Academic Information System**

   After implementing the SIMAK almost in all faculties, the upcoming phases is involving the students and academic supervisor in processing the course registration by them self through online application. Instead of using manual procedure by registration form sheet, course registration process is done by students by selecting the open courses through the SIMAK website using their own account. The consultation with academic supervisor can be done upon request depend on the agreement with the supervisor. The approval of student semester plan can be done also through the system by the supervisor directly.
   The overall functionalities of the system, former and the latest one can be listed as follow:

   - √ Students Management, include CRUD operation into the system as well as personal information of the students.
   - √ Courses Management including course registration and grading system
   - √ Report generator: semester based report for student academic progress, report of student academic transcript, attendance list sheet, courses statistic, studentsŠ statistic.
   - √ Front-end window for students including features for editing their personal information.
   - √ Features for register and un-register course for student based on list of opened courses in particular term.
   - √ Features for student to view and generate student related reports by them self, such as academic plans for particular term, student academic progress

(semester based grade report), overall academic transcript and their current GPA.

By using this approach, it is expected to simplify the course registration process. However, worth to note that it needs more attention for concurrence access capability as well as the payment module that check the payment status of the students so that the system performance will get better.

2. **Online Payment in Payment System**
   After series of problems during implementation of the payment system within past 3 years, besides improving non-technical part, it is also necessary also support by technical part. Previous limitation is found that the process was too dependent with bank officer who receive the email during invoice data update. In fact, they also update the data into their Bank system manually triggered by the officer.
   To encounter this problem, they change the way to communicate the payment data between payment systems with the Bank using Host to Host (H2H) communication in which supported by the Bank System. H2H is a SOA system that makes two systems possible to communicate each other automatically.
   Following are the additional functionalities added to the system:
   - √ Management of Students Invoice.
   - √ Generating Data conform to the bank format
   - √ Generating report, list of invoice that have been paid, pending or not paid.
   - √ Provide SOA services for “Host to Host" communication between payment systems with Bank Channel that:
     - supply detail invoice of a student based on unique identity.
     - Online transaction for payment processes directly from Bank channel to university payment system.

   By utilizing the H2H communication system, they hope that the payment process will getting better in the future.

New Systems

1. **Finance management system**
   In collaboration with Work and Budgeting Plan system, which record all the up coming year work plan and income estimation, this system will record all the realization of those planning. Utilizing the income information from payment system and approved budget by the government, finance department will manage the distribution of the budget to all unit, proportionally based on their previous work plan obtained from Work and Budget Planning System. Following are list of functionalities possessed by the system:
   - √ Manage the real income, supported by payment system
   - √ Manage the expense for each unit, supported by the planning and budget-

ing system

√ Generate reports such as list of revenue and expense grouped by units.

By utilizing this system, they hope that it will make the budgeting distribution transparent for all the units and make it easy to control and monitor work plan accomplishment.

2. **E-Procurement System**
   To support a good governance and clean government campaign, every public institution is encouraged to do a transparent management including procurement process. In order to do that, UNUD develop a system that can support procurement activities, electronically. Resource Department who in-charge on the procurement process will invite all prospective vendors to get involve in UNUD development through this system. Following are list of functionalities of the system:
   √ Publish information related to open procurement.
   √ Manage tender processes
   √ Generate report that support transparencies
   By using this system, they hope that every vendor can be participated in the procurement process in transparent way.

4.4.3 Future System

There are systems that will be developed in the future to support the improvement process of the organization as follow:

1. **Archive Management System** This system is intended to organize all the archive documents owned by the university including decree collection, MoU with other institution, All Administration documents etc. By using electronic version, it is expected to be much easier to share to stakeholders and manage it.
2. **Executive Information Systems(Executive Dashboard)** This system is intended to provide any information that supports the university board (executive) in making the decision upon the organization improvement process. All information needed is combination/summary that can be obtained from others system. Academic information can be obtained from SImAk, income, expense can be obtained from payment system, and finance management system, the information of work planning can be obtained from work and budgeting plan system and for others. It seems that to make this system work better, the integration strategy should be made beforehand and make sure that all the systems are running well and stable.

4.5 Software Development Process

4.5.1 Procedure for new system proposal

Recently, IT Division arranges a draft of standard operating procedure (SOP) for development and utilization in the university. This document will be use to share common procedure regarding utilization of IT including bandwidth rules, obligation among units, maintenance, content policy, IT services, system development and so on. One of the main issues regarding development of information systems is about "in house" development. They realized that the limitation of IT staffs and developers could lead to the emergence of problems. Throughout this document, they provide procedure for application request from units in which can be done by internal developer or external developer depend on the unit. The procedure can be seen in Figure 4.8. The purpose of this strand is to ensure the successful implementation of the SI / application and overcome the limited resources.

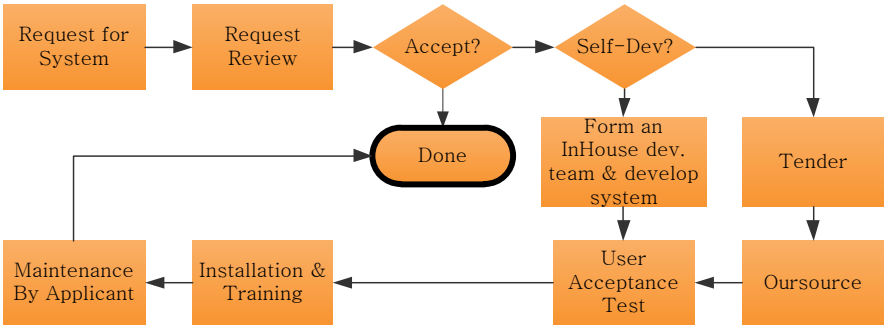

Figure 4.8: Sample Procedure for New System Request on SOP Document Draft

4.5.2 In-house software development

From the beginning of the IT implementation initiative, the development processes are expected to be done internaly, through in-house development team, considering the sustainability of the system maintenance and improve the staff's experience in developing information systems. The selection of the development approach is in fact, has considered the lack of human resources/personnel, and they must deal with that, rather than giving the project to external developer / outsource.

Figure 4.9 may help to show the flow of software project in the institution. Usually, board of director/management/other unit request computerized solution for their work to the IT Director, which it is mean that they request for software package. Sometimes, it is not only one, but also several applications. Due to unavailability of dedicated developer in the department, IT director seeks the developer that want and willing to do the project. Mostly, the developers are lecturer from IT department, and sometimes are supported by their students. It seems that the process can be said far from "professional" approach, instead, it is more personal and informal. The one obvious objective from the IT director is:

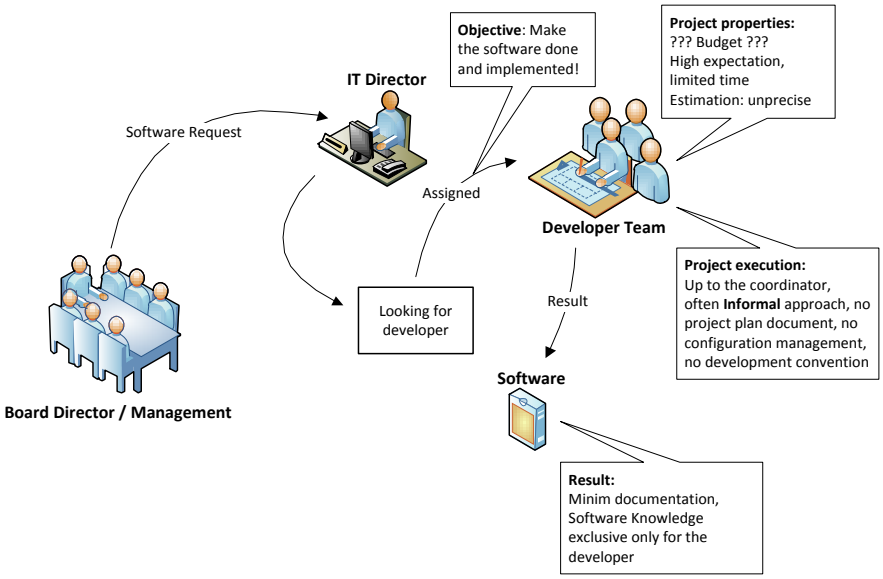

Figure 4.9: Ilustration of the flow of software project in the institution

"Make the software done and implemented, up to you to execute the project in any way".

The IT director fully believes that, the developers are competence in its discipline and give all the project execution and control to the developer.

Due to the freedom of the developer to execute their project, every projects has their own specific way, depend on the coordinator itself. Mostly they performed it in informal approach, and not following formal software project management. There is no written documentation, which represents the requirement specification and architecture design of the software as a basis for the development. There is also no general convention regarding the development of software such as naming convention, change control, progress tracking and so on. It can be said that there is no project management plan that can be used as guideline for the development process as in the formal approach. Instead, they communicate any issue regarding development verbally, in the meeting or through telephone, or just personal note or email. Using this approach does not mean that the software is failed to be developed, it is done, installed and use by the user. However, the problematic situation may arise when bugs are found or systems are down and willingness to do some extension of the system features. It become worst when the personnel of development team are changes, i.e. new programmers, or the coordinator of the system , which is mostly lecturer, is unable to get involved again due to another task or on leave for study. The software knowledge is exclusively available only for the developers, either in their head or in the code itself. No documents that record the complete list of features are available in each of the systems, except directly review the system or the code.

After almost 5 years since the IT initiative was started, in early 2012, the IT division officially able to hire programmers. Around 18 programmers were hired to help the

coordinators build the system. All the programmers are distributed to every software projects and during their work, they will be provided with special workspace, a development office equipped with several set of personal computer and internet connection. However, this situation also stimulates several questions, how to manage those resources as effective as possible, How to control and monitor their work? and so on. This should be more "professional", because they are hired, so they should be best utilized.

4.6 Cycle of Action Research in Udayana University

The purpose of this study was to explain the implementation process of IT in universities in developing countries and attempt to improve some aspects of the problematic situation occur in the organization during their implementation process. The study was performed at Indonesia's state-own university, namely Udayana University. In order to attain the goals of this research, an action research approach was selected. In this research, the researcher performed only one cycle of the action research activity described in Section 3.5. Following section will discuss more detail about this cycle.

This action research cycle was perhaps the most excited activity was performed, but was an awakening to the researcher, as it showed lack of preparation to deal with the many challenges posed by field research in general and action research in particular. This was the first experience for the researcher in conducting interpretive case study and action research approach and was not trained as action researcher previously.

4.6.1 Diagnosing Stage

After five years implementation of IT, many things have been achieved so far, including network infrastructure, and information systems. Almost all the units have been connected each other, either using fiber optic/cable or wireless backbone connection, depend on their condition. Several information systems have been made to support administrative work. Official website was available for publishing information related to the institution. However, many problems also arise and inevitable affecting IT development and implementation process, especially in information systems. Based on the interview result and observation, which have been held during the first fieldwork, and interpretation of the data, following section will attempt to identify factors that hamper IT development and implementation process, and the discussion will be focused on information systems aspect rather than network infrastructure.

Factors that hamper the implementation

Following are several factors that identified as factors that hamper the IT implementation process in the organization.

1. *Limited Human Resources*
   Absence of dedicated unit for organizing IT was identified as one of the barrier that hamper IT implementation in organization (Imran 2006). However, the university was aware with this barrier from the beginning of IT initiation. This is evident from its emergence in the university master plan and subsequent with establishment of IT Division. Indeed, it helps the university in organizing the development and implementation of IT.
   Despite the fact that there exists a dedicated unit for organizing IT, however, less support were obtained in term of human resources. the number of people in IT division is relatively few if compare with the amount of works should be done, especially technical support and system developers. IT division has difficulty to recruit or request new personnel to the human resource department due to either regulation or limited quota.
   At present, it is impossible to hire professional staff to handle internal tasks, in daily manner. Financing regulation is one of the reasons why it is so difficult to do. Consequently, head of IT division have to appointing academic staff for IT positions. Currently, Key person in IT division are mostly academic staffs belonging to department/faculty. As consequence, they are responsible for both full academic workload as well as academic related work. Obviously, their focus will fall apart and disrupt the work performance.
   The capability of the staffs in IT also be a problem. recently, computer center unit has 10 people in which 5 people are coming from academic staffs, and 5 other people are dedicated staffs. Unfortunately, only two staffs from those dedicated staffs have an IT background, and the rest only have basic skill with computer.
   Because of limited, skilled personnel, and high demand of new tasks/systems from the institution, frequently one task was ignored for a while, for other tasks. For examples, an implementation and maintenance process of human resource management system was suspended due to implementation of on-line student admission system that needs to be finished soon. As one of the developer said:

   > " *we do not have time to think about SIMPEG for a while, due to being busy implementing new admissions application*".

   This circumstance obviously affects the implementation process. The selected strategic plan for developing systems as "in house" cannot run properly and it could affect the quality of the developed systems.
   Other issue regarding human resources is the user capability in using IT, especially administrative staffs, are very low. In fact, most of senior staffs are relatively new in technology. This situation was shown when IT department conducted training for plan and budget management system. In addition, Other developers also admitted this condition,

   > "*limitation of operator capability in IT cause the progress of implementation process of academic information system is slow*".

2. *Lack of management commitment*
   Management commitment is one of the key issues that emerged during empirical research in the organization. One example of this problem was mentioned by head of Computer Center:

   > *"last year, we were asked to develop system by one of the bureau with a predetermined cost. Due to limited personnel in IT department, we ask alumni to help us to work in the project together with our staffs. The system was deployed 6 months ago, up and running. However, no fund was accepted yet by the developers, until now. I have uncomfortable feeling with this condition. How we can find the money for him as wages, after what he did for us? Management supposed to provide the funding appropriately, based on the plan."*

   Lack of commitment could decrease level of "trust" to the management, in which it suppose to be maintained continuously (Curry & Katz 2002). It might affect the motivation of staffs in carrying out tasks/projects assigned to them. Consequently, they might be resisted, or at least try to stay away from, when asked to get involved in a new project.
   According to (Curry & Katz 2002), higher education institution such universities are deeply decentralized and loosely coupled by nature. It is mean that the implementation process depends on the sub organization management. This situation is true, indeed, as one of the developer complained,

   > "*Lack of management support in some of the faculties*".

   It shows that, even though the university management, rector, encourage all the stakeholders to support the implementation process, it always depend on the "small empire" in faculties.
   In situation with limited human resources as mentioned previously, the problems mentioned above will make the implementation process more difficult to handle.
3. *Lack of clear job description among staffs*
   The establishment of IT Division with its subunit aim to divide the workload and focus of the assigned tasks. It is clearly separated that which unit is responsible with network infrastructure, information systems, communication and socialization, and publication. However, unclear situation emerge in the unit level, i.e. in Computer Center unit.
   It can be realized that due to limited number of staffs, all of them engage almost on all tasks, mutually assist one another. The consequence is when something goes wrong, as previously mention in subsection 4.4.1, specifically in payment system. There were invalid amount occur for all invoices from one faculty. With clear job description and proper standard procedure, will give clear understanding about responsibility. Even-though everyone is working with the task, prior before submission, or "ready" status, the one who has the responsi-

bility with the task or sub-task should perform their standard procedure such as checking validity etc. An *explicit* job description, *standard procedure* on executing a routine task, "when to do what" on a sequence of sub-task, and alternative way in response with unintended event should be available and should be clearly understood by the staff, especially in this kind of situation. This condition was admitted by the head of Computer Center unit and he is aware about these problems, as he put:

> "*yes, there is no explicit job description and SOP yet in my unit. We should improve this to avoid any mistakes in the future*"

Providing explicit job description and standard procedure will help not only current staffs, but also for new staffs, new head of unit and all related personnel, to understand the working behavior. This approach makes it easy for head of computer center when sharing the knowledge (training) and managing tasks. One thing that was captured from him, regarding the clear responsibility for the staffs, it seems that they fear with clear, personal responsibility and prefer to chose a shared responsibility.

4. *Lack of appropriate planning and strategy for systems development and implementation*

   Imprecise system due to inaccuracies in requirement elicitation prior the system development, and deal with limited resources made the system failed to meet the user's need. For examples, Human Resource Management System is missing some of functionality they should provide. This situation makes the head of HR department initiated local solution, develop another similar application by external developer, in which can support their work more precisely. With high workload of IT staffs and limited resources, this becomes inevitable. Implementation of payment system is also experiencing some problems. The implementer chose inappropriate strategy, in which the system was applied to all students in all years, instead of several selected groups. With unstable system, no wonder that during the payment period many problems occurred.
   One possibility that come in mind regarding above situation is desire to complete and implement the system at once with complete features and applied to all levels. By considering the limitation they have, it would be difficult to achieve. No wonder then the system is considered inadequate. It could be said that there was lack of appropriate planning and strategy for implementing and deploying a new system, put into use. Heeks (2002) suggested that in order to design and develop a system, particularly in developing countries with many limitation, it should be also considered to design and implement the system in modular and incremental fashion, supporting one business function at a time and put into use in stepped levels.
   Moreover, it is also difficult to find the technical documentation for each developed systems. This condition makes it more difficult to keep track of status of the systems, whereas often times the developer jumps to one system to another

during development. This condition becomes problematic when new person want to continue the other person's work.
In this condition, they should start to introduce or utilize a better system development management that can keep track of the requirement document, code version and bug tracking system so that everyone who want to be engaged into the development process will be easy to understand. It is understood that with time pressure and limited resources make the developer have no time and focus in providing the document, instead only focus on finishing the system. That is why, it is importance to find proper development management in this situation.

5. *Ineffective communication & coordination*
Several systems were already developed and running in the university and some of them are under improvement. In addition, new systems are also being developed. Each of those systems was developed by group of developers. However, referring back to the context description and latest status of the systems early in this chapter, many of those systems were experiencing problems. Every system has no technical guidance on how to develop the system, no common framework were used among the developers, only general boundaries provided in master plan, such as must be web-based application and using open source software solution (i.e. mysql, php etc).
It is realized that with above situation will give a huge chance for developers to use their thought and creativity to make a better system. Unfortunately, there were limited sessions for brainstorming and knowledge sharing among them regarding development and strategy for system implementation. It can be seen from difference implementation's experience between Academic Information System and Payment System. Academic Information System employed systematic, incremental strategy from the beginning of implementation, experiencing less problems compare with Payment System in which was implemented at once to all levels. If they communicate and share their knowledge among the developers, it would decrease occurrence of problems.
This issue is strongly associated with the future work of IT implementation process, that is "*System Integration*". If from the beginning, we can share common understanding about anything related with system development and implementation strategy, it would give more chance to make the implementation process clearer and easier. A good, effective communication is a way to construct common understanding among IT people particularly in the IT Division in the hope that can lead to standardization.

6. *Lack of Funds*
As mentioned early in this chapter, most of the projects were initiated and supported by either donor or competitive grant, and only small parts were funded by the institution. It would become problematic once the donors or grants pull out, especially for operational and maintenance activities, either for infrastructure or information systems. This situation was admitted by IT Director,

> "*We have limited budget for IT operational and maintenance*".

The Head of Computer Center also comment on this situation,

> "*one of the main constraint in developing and implementing IT is the limitation of allocated budget for application development and infrastructure such as computer server* ".

The sustainability of funding was outlined in master plan, however, in fact, it was not happen. Hence, it needs more effort to encourage awareness of top management regarding this issue.

7. *Lack of Rewards*
   It is well known among the staffs in the university that there are no differences between staffs with good or bad performance in term of reward they get. This situation affects the motivation of the staffs to enhance their work's performance. It is already known from the theory of participation (Miller 1993, Ehn 1993), that reward, could be promotion or incentive/bonus, can increase the intention of user to participate during IT implementation, either by emergence of creative thinking or more active in the organization, in which will increase their performance.
   Consequently, as pointed out in factor - #2, they might be resisted, or at least try to stay away from, when asked to get involved in a project. If they have to, they might perform their work in standard fashion. One of the examples, the educational staffs prefer to give lectures, doing researches instead of selected to occupy position in IT division.
8. *Government policies*
   As a public, state-own university, the institution has to obey to government regulation, especially concerning financial issues. Indeed, this regulation aims to reduce the likelihood of financial fraud or corruption. However, this also affects the flexibility and autonomy regarding financial utilization. This led to the other aspect of the organization as a whole, such as difficulty to increase performance and service quality, hard to accelerate the development and implementation due to limited resources.

Further analysis

To cope with factors that hamper the implementation process as described in Section 4.6.1, several strategies could be considered toward the successful of the IT implementation process in Udayana University, such as:

1. *Introduce new system development and implementation management.*
   Organize the development of many systems with many group of developers is not a simple task, especially if the developers work independently, as what have been happen in the university. In fact, this situation cast off the opportunities to obtain knowledge sharing and experiences among developers, if they

can work in collaborative manner. Introducing a project management application with certain background concept such as agile software development (SCRUM), would be one of the examples. In addition, code version system and bug tracking system can be used to obtain better communication in term of software development process. With a good, effective communication, it could construct common understanding among IT people particularly in the IT Division in the hope that can lead to standardization and further for system integration. Indeed, this approach will introduce new behavior to the developers, hence, need to put into consideration about effort to increase the awareness of the developers with the offered benefits to reduce their resistance to change, rewards to increase participation, and implementation strategy of this approach. Further theory regarding organization change and software project management can be found in Section 2.2.2 and 2.3. According to the theories, utilization of software project management in software development should lead to:

- Collaborative work among project teams.
- Task Delegation is more clearly.
- Keep track of the project's progress.
- Provide easy snapshot regarding the project to the new staff/developer.
- Lead to shared understanding/knowledge sharing and experiences among developers, which later on can lead to standardization.
- Keep the integrity and traceability of the software systems, not only during development, but also for post-production/maintenance.
- Enhance the reliability and quality of the software product.

2. *Involve students in system development and implementation.*
   To cope with the limited human resources, limited funding, and constraint of government policies, it would be a good idea to involve students in system development and implementation, where students are educated human resources in the university. However, they are in learning stages. Thus, it needs a proper management so that the chosen strategy could support the acceleration of development and implementation process. The challenges are how to distribute the tasks, to keep track on what they already did, and make it easy to transfer the tasks to another student/person. The type of involvement could be through internship or part of their final project and the task ranging from operational task, involving in system development and maintenance. This strategy might be done previously, but it seems that there are lack of control and no mechanism to transfer work to one another.
3. *Increase the effort to looking for grant/donor from government or private sector.*
   Actually, the funding issues to a certain degree can be solved if the university can change their form into BLU (see Appendix A). However, while waiting the process to be completed, worth to consider to seeks another source funding such as competitive grant from the government or cooperation with private sectors. This approach needs awareness of the management to encourage the

stakeholders to support the effort.

4. *Development and implementation strategy.*
   It is very helpful if we can learn about development and implementation strategy from existing theories or experiences from other study that have been carried out in similar context, such as in developing countries. With the existing limitation faced by organization in developing countries, Heeks (2002) argues that if there is design divisibility, modular approach and systematic incremental implementation, it increases the opportunities for successful local improvisation, learning, and allows improvisations that reduce design-actuality gaps. It means that staff could learn from early relatively small failures, and could address subsequent improvisation of both design and actuality to manage the project. In addition, Local social-culture-behavior of the users is worth to put into consideration during arrangement of the implementation strategy, as many have been studied by the researchers (Ndou 2004, Furuholt & Ø rvik 2005, Imran 2006, Bii & Gichoya 2006, Weerakkody et al. 2009, Huda & Hussin 2010).
5. *Standard Operating Procedure (SOP).*
   Start to produce explicit standard procedure to give a clear understanding about activities and responsibilities as well as job description among parties. This is not limited only SOP between units, as what recently initiated by IT Division, as shown in Chapter4, but also SOP for staffs in a unit. This approach obviously will introduce new behavior into the organization. Hence, need to put into consideration about awareness of the staffs to reduce their resistance and management policies that support the SOP implementation.
6. *Socialization and Training.*
   IT Division needs to increase the socialization activities in order to improve the awareness of stakeholders regarding benefits of IT. Regular training can be conducted to upgrade the IT capability of the staffs. In addition, commitment of university/faculty management could be increased by stimulate their awareness in IT.

4.6.2 Action Planning Stage

Based on several strategies those have been described in the diagnosing stage, then at this stage, those strategies are selected to be implemented. According to the researcher's point of view abd based on widely used by developers including open source communities, implementing new way to manage the software development, such as software project management process, will support the in-house software development unit to attain the sustainability of the software development and keep the traceability of the software product.

Then, this idea was expressed in the IT division meeting, during the second fieldwork, which was attended by the IT management and coordinator of every software

project. The proposed idea was focusing on the code management technique and issue tracking. In addition to its desire to improve the software development process, at the same time, this idea was also intended to use to manage a number of programmers (approximately 18), which was newly hired to help the coordinators to develop each system.

The response from the meeting participants regarding the idea was very positive. One of the IT management supports the idea by saying:

> "*It seems that your idea will be good for our organization. Just try it out!*".

Another coordinator corroborates what has been said by the management:

> "*yes, its true! especially with our code management*".

Based on these positive reactions, the researcher then planning the action for intervention. There are several points that need to be planned, as listed follows:

- *Selecting the tools*
  At this point, among several project management software available out there (Section 2.3.2), the researcher chose *Redmine* to handle the software project and issue tracking during software development and maintenance. In order to manage the versioning of the software code, *Subversion* was chose. This VCS is also act as repository system, where the code will be stored. The good thing is the Redmine application support integration of several VCS, subversion is one of them. With this capability, these two tools can easily be used by the participants. In addition, Redmine application is less complex, compare with other project management systems, and as an open source web application, the development of the application is still in active mode.
- *Preparing the way to introduce the tools to the participants*
  In order to introduce the selected tools to the participants, workshop session was planned. Two workshop sessions were planned, one for coordinators, and the other for programmers. Manual guide regarding the use of the tools will be provided, for both programmers and coordinators.
- *Preparing the transition process*
  As described in Section 4.4, there are several information systems were planned since 5 years ago. At the time this research was performed, some of the systems were already developed and in use, some others are still under development. In addition, some of the existing systems are extended to support more functionality. However, there are still leave some undeveloped systems.
  Due to the limited time, and the fieldwork must be performed in the selected period, there is no way to arrange specific software project just for supporting this research. Therefore, the transition processes were performed to the exist-

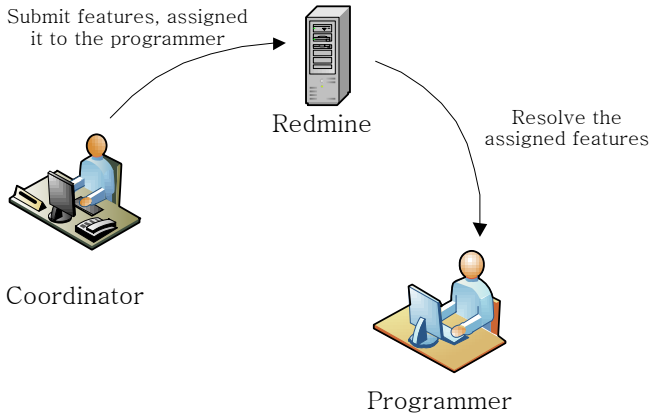

Figure 4.10: Simple workflow plan between coordinator and programmer.

ing systems, the running software project, either at the early phase, middle or at the end phase of the project.
The simple flow of work in software development is defining the requirement of software, and then continues with coding. The same concept is also applied in this research, in which the coordinators take the responsibility to provide the requirements, and the programmers build the code for each the related requirements. The illustration can be seen on Figure 4.10.
In order to do the transition, the process is divided according to the condition of the projects and workspace will be provided for each system/project in Redmine application.

- Existing systems: the existing code is stored in the repository, for future maintenance purposes. Moreover, as time goes by, the list of features they have gradually incorporated into redmine roadmap. When any defects found on the running system, then those defect must be recorded on the issue (defect) tracking system by those who find the defect.
  The latest statuses of the system/project within this group are Payment System, Student Selection System, Student Graduation System, and Student Admission System.
- Under-development (programming phase) systems : the existing code is stored in the repository, to control the code version, and the developers should always keep the repository code up-to-date. The requirements must be right away imported to the redmine both resolved and unresolved requirements, by the coordinator through issue (features) management, and each requirement must be assigned to the programmers.
  The latest statuses of the system/project within this group are Student information system, Asset Management System, Research and Community Management System, Data warehouse System, DW Connector.
- Under-improvement/extension systems: this type of systems is given as combined treatment between existing systems and under-development systems.

The latest statuses of the system/project within this group are Human Resource Management System, Planning and Budgeting System, Academic Information System.

  - New systems: the requirements should be imported to the redmine issue management by coordinators. From the beginning of coding, the code should be committed to the repository.
    The latest status of the system/project within this group is Finance Management System

- *Preparing the way to get feedback from the participants regarding the introduced tools*
  In order to get the participantsŠ perceptions regarding the proposed tools, at the evaluation stage, the participants will be expected to fill out questionnaire, which will contain question about the usefulness of the tools, the ease of use and intention to use the tools in the future as listed in Appendix B. Due to the distance limitations, the questionnaire will be provided online. Moreover, the follow-up interview will be performed remotely by phone call, or chat.

In addition to this, the researcher then defined the participants of this intervention, there are the IT management, the coordinator of each software projects and its programmers.

4.6.3 Action Taking Stage

Tools Installation

In order to perform the intervention in the software development process, the researcher facilitating the process by installing the selected tools in the previous stage, Redmine and Subversion, on one server that has been prepared. The system is web-based application, and currently can only be accessed locally, from inside the university network. The address of the installed tools is: `http://devserver1.unud.ac.id/redmine`. Figure 4.11 shows how redmine look like, and Figure 4.12 shows integrated subversion on Redmine.

The installed redmine application provides several features, which will help software development process. Each project will be possible to have some of this features, such as:

- Issue tracking system, to keep track of project progress, and manage the features/bugs life cycle.
- Repository or Version Control System is to control code versioning, and at the same time as a place to store and backup all the software code.
- Wiki, to share all the knowledge regarding the system, tutorial, FAQ and so on
- Document Management, to store the documents related with the system, such as software architecture design, software requirement specification and so on,

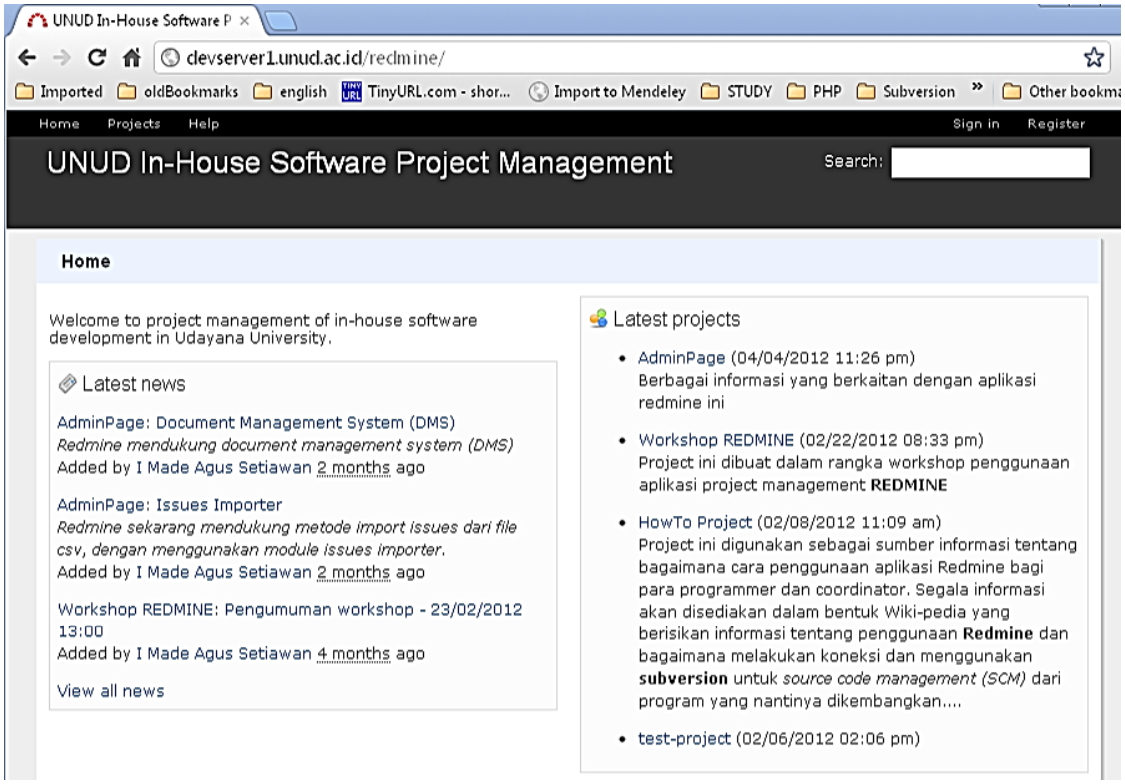

Figure 4.11: Ilustration of Installed redmine application

which usually in word, excel or pdf format.

- It also provides Calendar, Gantt Chart and News management for monitoring the project.

Training through workshop sessions are then performed in order to introduce the tools to the participants. A manual guide about how to use the redmine and subversion as well as common terms used in the application were prepared. To make it easy to access and maintain, this guide is stored in the redmine application, as a specific How-to Project, which redmine apparently provide wiki feature, and can be used as medium for knowledge sharing. Figure 4.13 illustrate the prepared manual guide.

The Workshop Session

Because of the difficulty in determining appropriate schedule for the workshop, then two workshop sessions were held for the development teams. The first session was held for the coordinators, and then few days later the second session was held for the programmers. This workshop was intended to show about the tools, how it can be accessed, how the tools work, how to use it and how to move the project into redmine. A small demonstration is also performed to show how its looks like.

A little bit different approach was used between the first and the second workshop. Because of being too hasty for its execution, and worried about the time constraint, the first workshop was not prepared well. The activity was only presentation and a bit

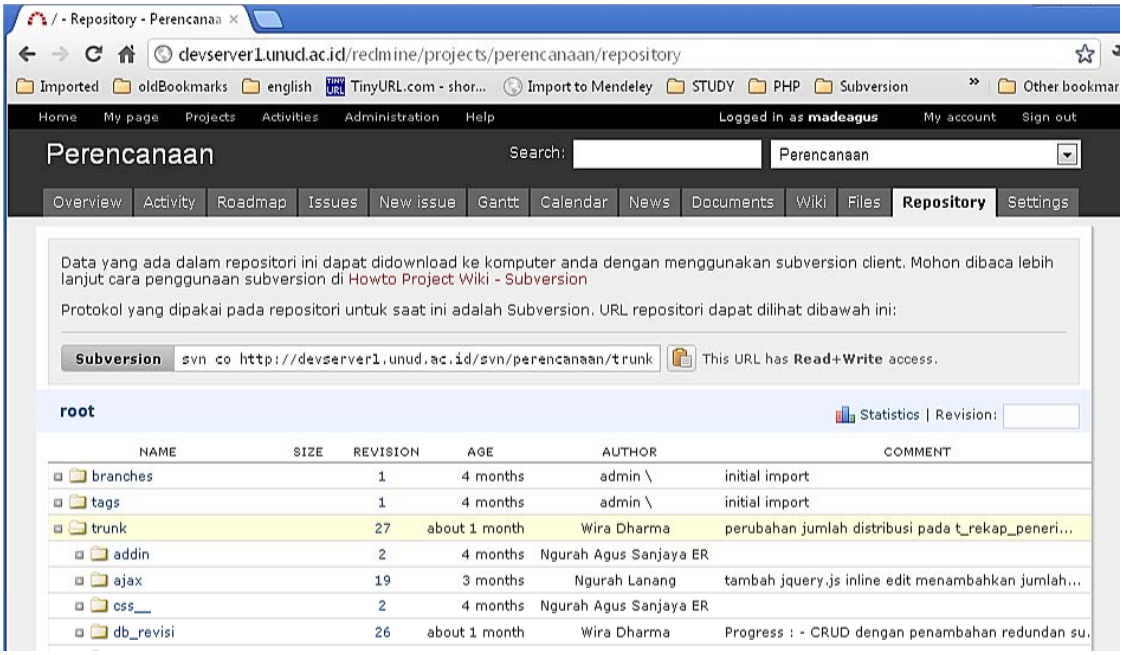

Figure 4.12: Ilustration of Integrated Subverison on Redmine application

of demonstration of the tools. It also informed them regarding the access to the tools such as the website address and redmine account. Nevertheless, overall activities were going well.

The second workshop (which was targeted for programmers) was executed much more detail, with additional collaboration activities. In addition to the material presentation and demo tools, the participants also had a time to try the tools and follow some scenario. After the workshop was held, they were positively support the use of the tools and ready to use it.

As a background information, based on the pre-questionnaire[4] result, most of the participants have less knowledge about project management software, such as described in Section 2.3.2, Moderate knowledge regarding issue-tracking system, as well as source code management systems i.e. subversion, git, etc.

The Observation and Guidance

Due to the limited time, the second fieldwork can only cover the action planning stage and little part of the action taking stage, on site. While the tools were used by the participants, the researcher actively monitored and observed the process. However, due to the far distance between researcher and the organization, this observation can only be performed remotely, through all the activities recorded in the Redmine application.

Few days after the first workshop, one of the coordinator was very enthusiastic to try

[4]The pre-questionnaire intend to reveal the characteristic of the participants. It was given a bit late, along with the evaluation post-questionnaire, which it should be given before the workshop

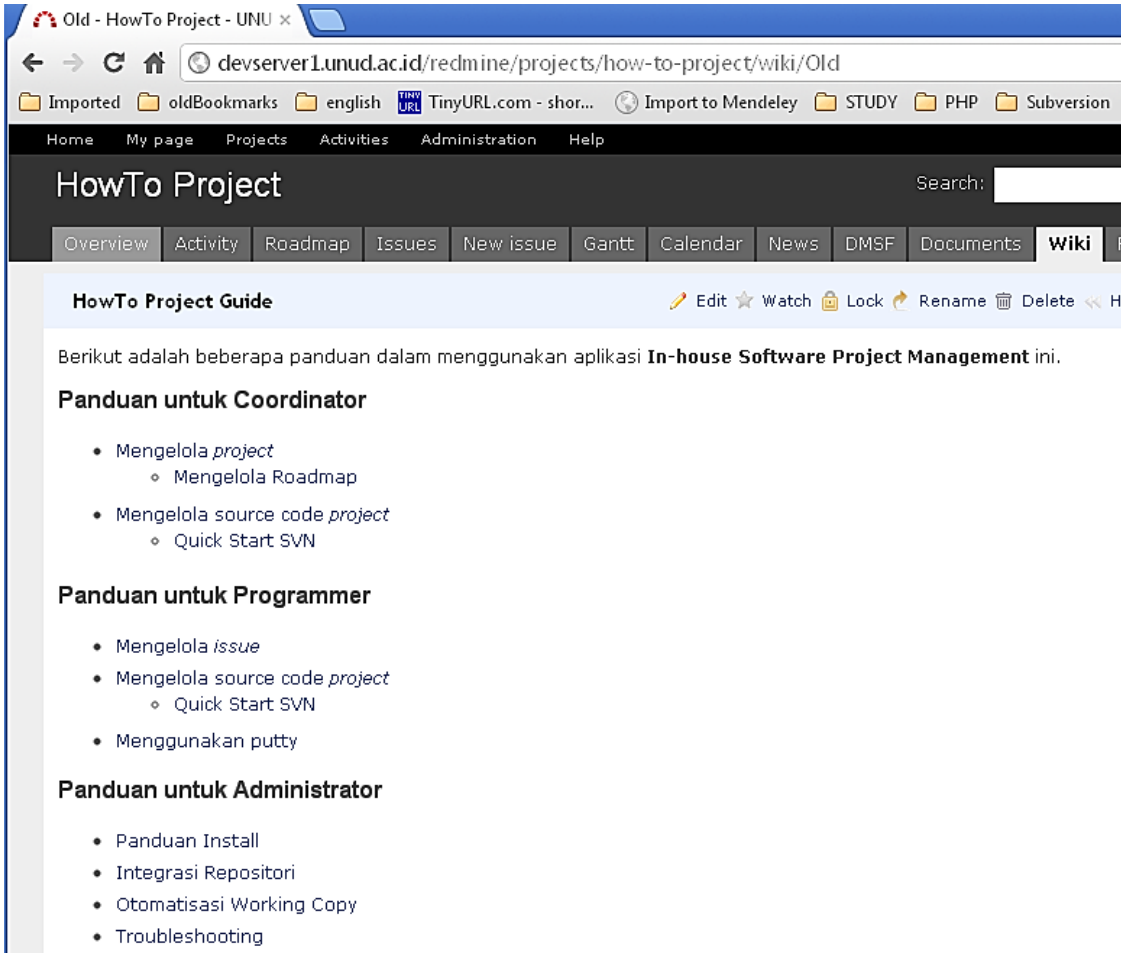

Figure 4.13: Ilustration of HowTo Guide in Redmine

to use the tools and actively contact the researcher for further transition process, especially for his project. Incidentally, he is one of the researcher's colleagues in the computer science department and is in charge for planning and budgeting system. This is an existing system, which is improved annually as part of adjustment to the new regulation. He followed the workflow according to the plan very well. He imports the existing code into the repository and adds several new features and defects to the issue tracking. Then he utilizes redmine application to communicate with programmers by assigning issues to them. In other hand, the researcher was deliberately introduced the tools to two programmers, prior programmer's workshop session, to help the implementation process, administer the tools, and act as a local champions on the programmers side. And incidentally both of them were in charge in the same project, planning and budgeting system. Therefore, it seems that it makes the workflow between coordinator and programmers in planning and budgeting project works smoothly.

The redmine utilization remains active several days after the workshop. one-two project coordinators start to prepare their project in redmine, and upload several document and code to the repository. Coordinator of Academic IS project and Co-

ordinator of Data Warehouse Connector project performing several activities including migrates the base existing code, registering found bugs on the system, and update the code repository. Planning and budgeting system project also actively used redmine, both the coordinator and programmers. Sometimes the participants ask the researcher regarding conceptual or technical issue of the tools, i.e. "*How to commit/import our software code to our repository*", "*How to add new issue to our project*", etc. The researcher also actively monitors their work, and sometimes adjusts their work in to the correct way, i.e. fixes the issue properties. It seems promising at that moment.

But as the time goes by, during the first three weeks after the workshop, the activity gradually decreased, no activity was performed in the issue tracking and code version system except the planning and budgeting project. From total nine active projects during that time, six projects were using redmine, but basically three were actively use it and then decreased into only one project. One of the programmer, which was the "representative" local champion as mentioned previously, said:

> "*most of the programmers still working on their way, not using versioning control yet*".

Asset Management System project and Student IS project at that time were categorized as under-development projects. It should be easy to migrate the code and the list of features into issue tracking, because they were working on it, all features were new, considering the system was new as well. However, there was no activity from those projects.

Valuable information was obtained after had a chat session with one of the coordinator from Academic IS project. He reports that his programmer was not able to use the redmine, whereas the programmer's account has been created already. He said:

> "*my programmer actually create progress report regarding the software code every end of the week, but due inability to access the redmine, especially the subversion, they cannot put the latest code in the repository* ".

Later on, the problem was found, and it is because of improper project setting in redmine. He also gives some suggestion regarding the slow process of using the tools, by forcing all of the participants to use the tools, as he said:

> "*it would be better to force them using the tools, make it as an obligation. But you need to provide them proper and thorough tutorial document, so it will help them and no need to be confused to find the solution. If you do that, i am sure that they will use the tools*".

Speaking about “forcing” something to the people, sometimes it will work to certain condition, especially if you have power to do it. However in this situation, the researcher have no power to force it. There may be a chance on the Head of IS unit or IT Director to obligate the coordinators to use the tools, but it seems not. Looking back to the background behind the selection of the project coordinators, they want to get involved because they want to help the IT development. There were no good bargains that can be used to support the “force" action. Moreover, regarding the salary, there is no clear agreement about it. The Head of IS unit also admits this situation as he said:

> “*I am uncomfortable when forcing them to use the tool, because we still cannot give a decent appreciation. At most, I can only encourage them to use it* ".

The IT Director also seems fully belief about the competence of the coordinator to develop the system, in their own way. As she said that:

> “*might be there is a coordinator cannot use the tools yet, but from the progress of his work, he showed pretty good results, even better than the others. The task delegation is quite good and clear enough and a bit fast*”.

First Adjustment

At this time, the researcher try to analyze the situation and evaluate the supporting material previously prepared as well as considering the discussion result with some of the participants. The researcher thought of some possible causes:

1. Difficulties in using the redmine application
2. The bustle of all the coordinators
3. The project currently in design stage, and have not implemented yet
4. System improvement project, software code already exists, but cannot upload it to redmine
5. Do not know the account for redmine application

According to the above issues, it might be due to insufficient “how-to guide” on the Redmine Wiki, which make them difficult to perform the task. Based on that, the researcher performed small adjustment by providing more complete How-to Guide with more issues sample. Then notice all the participants via email regarding the latest update of the How-to Guide, as well as some guidance for the rest of the above issues. The researcher also provides guidance to solve the busy problem by doing the task gradually,

1. Start by creating project workspace in redmine
2. Upload an existing source code to the svn repository, or if not at the programming stage, you can upload the required documents (design stage)

3. Start adding the most basic issue (features) (either a feature or task for the design) so that developers can deliver a recorded report.

The complete content of the email can be seen in Appendix C.1.1.

Additional analysis was performed, and try to find a proper solution for the issues, especially the "busy" situation. Additional thought was whether by adding the list of features one by one to the redmine application, with the same sequence, over and over again, make them bored and take much time, considering that some part of this task were a re-writing procedure of features that have been done. Thought about "batch processing" then appeared. If there any possibility to perform batch import of a number of features at a time, it will cut a lot of time. Apparently, as an open source application, there was developer who provide plug-in for those batch import processing by using CSV (comma separated) files.

Then, another additional adjustment was made to support the previous one. The plug-in was downloaded and installed, and prepare some basic How-to information and sample of the process, completed with sample CSV file. The action then followed by notifying all the coordinators via email, just three days after previous adjustment, as can be seen from Appendix C.1.2.

After two weeks of observation, some changes occurred, but not too significant. Some projects which were previously active using the redmine, keep using it, but not as much as at the first, time. Programmers of Planning and Budgeting system working on their tasks, keep recording the issue's progress, and updating the related code on the repository. Programmer of Academic IS project start to work with code version control, updating the code on the repository.

Two projects, which were not using the redmine before, start to using it, especially version control for the software code through subversion. Programmer of Asset MS project uploads the code for the first time to the repository. Then keep recording any changes in the code. The same thing also happens with Student IS project. The programmer starts to upload the code to their repository, but the activity not as much as programmer of Asset MS project.

One serious incident, that could be considered very severe, was happen. The damage of one of the application server where the payment system and student selection system was hosted. And the bad thing, the server were "dead", no chance to make it up and the disk recovery were not working at all. All the data and software code of those systems were gone. Even their backup, because the backup files were placed on the same server. The situation became so worrying, because on the next few weeks, there will be a payment process. Fortunately, one of the coordinator had backed up the payment data on the previous semester, and the raw data for the current semester was still available. Another lucky was the system code was still available from the developer. However, it was not sure regarding the version lastly used against the available backup. The most important thing is; the code is safe. This incident providing a real

learning for IS unit, especially it convince the head of IS unit about the important of code versioning and repository

One thing that make the researcher wonder, there was less activities related to submitting list of features to the issue tracking. Whereas this features, is the basis for programmer to be able to work. Assignment of a task should be through this system, as planned before, because it will provide facilities to monitoring the progress of the programmers work. In addition, his assignment is also recorded, and at the end, the list of system features is recorded. But, in fact, it did not work as it should be.

Second Adjustment

Again, at this time, the researcher tries to reflect the result with the previous assumption and expectation made before. Another thought occur, "*whether the busyness of the coordinators makes the situation like this. ", "Is it because the salary agreement was not so clear enough?*". Then the researcher try to discuss these matters to some of the participants, but still, bear in mind that speaking about salary is a sensitive issue. The researcher tries to question the coordinator, regarding the salary, but not in direct way. Instead, asking their opinion about other coordinator. "*What would cause the coordinator has not been able to insert the features into redmine, Is it because the salary agreement was not so clear enough?*". One of the coordinator said jokingly:

> "*maybe because of no clear statement of the salary*".

In contrary, the IT Director said:

> "*I am sure it is not about the salary, because we have prepared about it, maybe as not great as expected. I think the main problem is about their busyness, doing lecture, activity in their department as well as working as project coordinator. May be they a bit overload*".

It seems that it is difficult to provide a decent salary for their work, and difficult to provide an agreement before hand. However, the IT Director is still working on it. As far as the researcher know, this is the typical situation in public HEIs and little bit difficult to deal with.

Therefore, the next possible solution is still around their "busyness". The programmer's activity against issue tracking was very low. It was due to waiting for the coordinator to register the features for their task. Meanwhile the coordinator did not make it and this made the process becomes stunted. Then another small adjustment was performed by the researcher, by changing the flow of the work. Instead of waiting the coordinator to register the features, programmers can also register the features by them self where in fact, they have more knowledge about what they have done and

what they were doing about the system. Illustration about this workflow can be seen from Figure 4.14

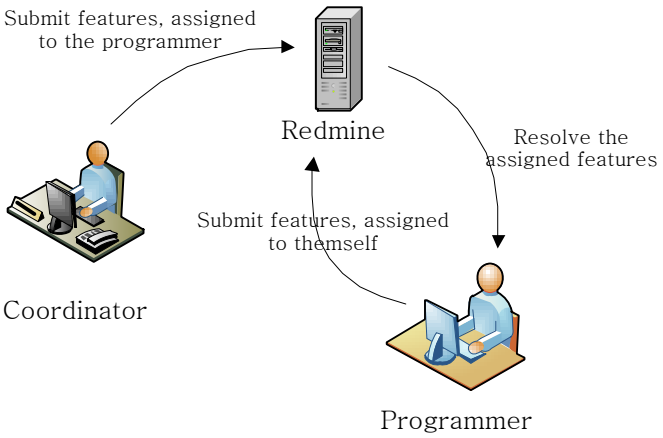

Figure 4.14: New workflow plan between coordinator and programmer.

The researcher notified all the participants regarding the change of workflow through email, as can be seen from Appendix C.2. The researcher also provide a sample task in one of the project, Asset Management System, and assigned the programmer to collect and register the features to issue tracking on redmine application. Figure 4.15 shows the illustration of that "sample issue".

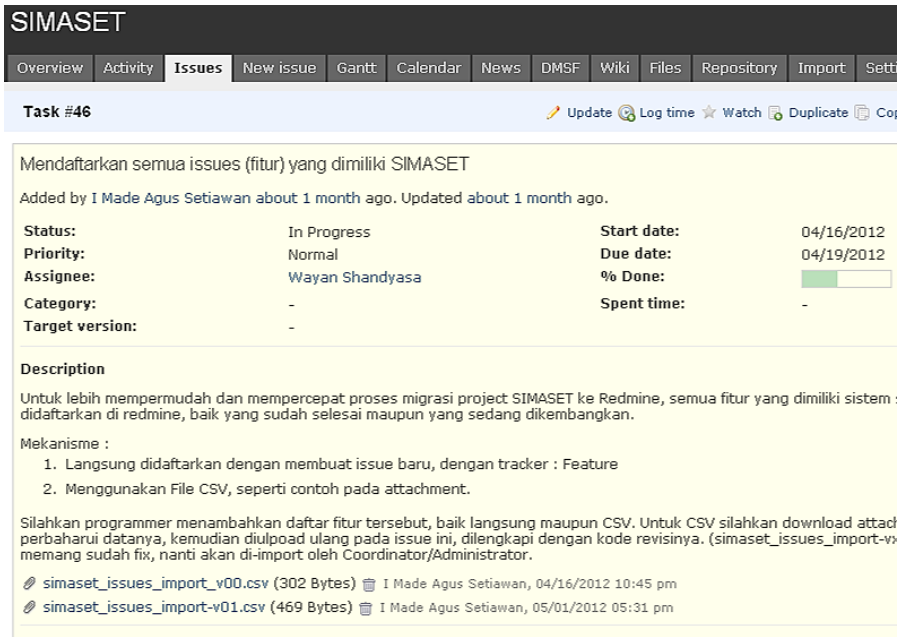

Figure 4.15: Ilustration for second adjustment through issue sample

The Observation activity then continued. No replies were received from them, even to say a confirmation or something else like "*OK*" or "*I will try it*". However, luckily, several activities were shown in redmine application. Programmer from Asset Management System project gave a response to the task assigned to him, which was created by the researcher, and tried to give his best on registering the features. The coordinator and programmers of Academic IS project began to actively using redmine again,

register some bugs which was found while the system in use, and update the repository. The development team of Planning and Budgeting project also kept the activity up to date and fixed some bugs, but not much.

Coordinator of Human Resource Management System project also seen to practice using redmine application on a “test-project”, which was prepared for that purpose. And later on He tried to do it on its project workspace. Even though the activity was not significant, at least He gave his best shot. Meanwhile, programmer of Student Information System project also continue to interact with readmine application, add several documents to redmine application and update several part of the software code.

After a bad experience happen with the payment system, the researcher took an initiative to utilize redmine application to manage the recovery and maintenance processes. The researcher created the Ş payment systemŤ project workspace on the redmine application. After a few days of searching, the software code was found and then put it in subversion repository. The database backup, which was luckily available, then restored in a new server, although not the latest. Several tasks were created to manage the recovery process. These tasks were then used as a basis for communicating the issues between the researcher and the person in charge at the university. In the end, the payment system successfully recovered and all part of the recovery process was recorded in the redmine application, which will be useful in the next maintenance process. Putting the code under version control system will provide the possibility to control the changes that would happen. A few things to do later on are, registering all the features that the system has.

Overall, there were increasing activities for both coordinators and programmers, although not too significant. They are using both the code versioning system as well as issue tracking system. However, there was one thing that worth to note: there seems to be a misunderstanding in the use of issue tracking system, but not all of them. The programmer of Asset Management System project adds a feature to the issue tracking system in the wrong way. He wrote the feature description like a description in manual book on how to use the features, whereas in fact, it does not like that. It supposed to contain an explanation of the feature that must be owned by the system. Improper use of issue tracking was also performed by the coordinator of Academic IS project. He put a sql script as a feature in the issue tracking, which should be placed on the code repository, and then linked it back to the feature description. To cope with this misunderstanding, the researcher then tried to fix the issues and notified them.

In order to obtained feedback from the participants, several days before the end of the intervention, the researcher joins a meeting with the coordinators and IT Director at the university through video conference. At this time, the researcher present the

plan to perform a questionnaire survey to all the participants through online survey[5]. In addition, the researcher also discuss little bit about the progress of redmine utilization with the coordinators and still keep encouraging them to use the tool. Lastly, performed follow up interview to the participants to convince the experiences during the action for intervention.

4.6.4 Evaluating Stage

To provide an overview of the activities performed at action taking stage, Figure 4.16 illustrate the timeline from installation until the end of observation. This figure also provide statistical data regarding number of *visit* [6] per day to redmine application during the intervention, which was extracted by webalizer[7] engine from the apache accesslog file. However, this statistical data not only shows the participants' visit, but also the researcher's visit as part of observation and guidance such as preparation of manual HowTo Guide and several adjustments on the tools, especially in the installation, workshop and adjustment periods. Therefore, some parts of it were excluded in the evaluation (overshadowed by yellow rectangle) when illustrate the progress of the intervention.

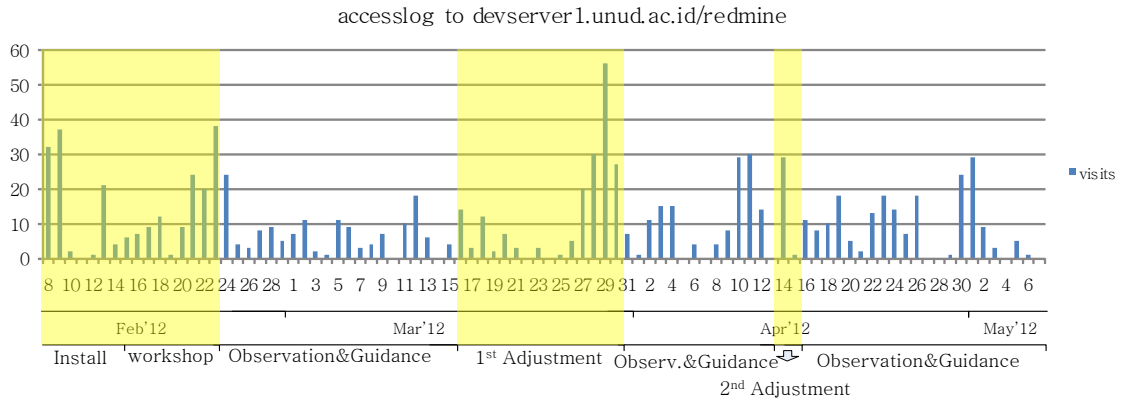

Figure 4.16: Visit Statistics to Redmine Application with Timeline Activity

As indicated in Figure 4.16, the participants' visits are low at the first period of observation. Although the visit statistic can not reflect the redmine utilization precisely, it can be roughly said that the utilization of redmine application at this period was not

[5]Survey was performed using limesurvey application available at the university website – http://unud.ac.id/survey

[6]A **Visit** is recorded when some remote site makes a request for a page on your server for the first time. As long as the same site keeps making requests within a given timeout period, they will all be considered part of the same visit. If the site makes a request to your server, and the length of time since the last request is greater than the specified timeout (default is 30 minutes), a new visit is counted. Since only pages will trigger a visit, remote sites that link to graphic and other non-page URLs will not be counted in the visit totals.
http://www.panix.com/web/faq/logs/webalizer_interp.html

[7]The **Webalizer** is a fast, free web server log file analysis program. It produces highly detailed, easily configurable usage reports in HTML format, for viewing with a standard web browser.
http://www.webalizer.org/

so active. According to the description of activities undertaken during this period, the activity of participants at first quite promising, but then gradually decreased to only one project that keep in using it. It seems that the coordinators not good enough to encourage the programmers and them self in using redmine application. This is indicated by the situation where programmers were mostly working by its own way, and not using code versioning control through subversion.

The bustle of coordinators also brings over that situation. This was admitted by one of the coordinators during the last meeting. When the researcher encourages them to use the tools, one of them said:

> "*I am sorry, I have not gotten around to it because too much work have to be done.*"

In other session, Head of IS unit also admit this situation:

> "*It little bit different with other big university, where they have staffs that dedicatedly in charge in this position, but not here. With that much of workload, as project coordinator, handle several courses in the department and other adhoc task, making them difficult to focus only on this task. The priority also affects the task that should be done first.*"

Other possible causes might be due to not enough tutorial document and unclear information regarding the tools, make the participants have difficulty in using redmine. Later on, good information about programmer's understanding of the selected tools and its terms was given by one of the programmer:

> "*It is new for us, so it will take time to get used to it*".

Other programmer also said,

> "*Many of us are still confused with the concept and terms used in this tools, I think we need to have more workshop session, in addition to Wiki documents*".

After performed some adjustments by improving the tutorial documents and providing an easier way to import features (by csv batch import) to cope with the busyness of the coordinators, there is some improvements in the utilization of redmine application, even though not too significant. Projects that previously used redmine are still active. Two new projects were start using redmine especially version control system, and upload their software code to the repository.

However, it seems that most of the activities are related only to the software code in the repository and less activities in issue tracking system. This situation indicated

that one of the adjustments made previously (csv batch import) has no significant effect. It was expected that the plug-in will encourage the coordinators to use redmine more active, but, it did not work. One of the programmers said that:

> "*it is likely that the programmers will actively use redmine, if their coordinator delegate its task through redmine. In fact, after I asked other programmers, they said that they did not receive any task in redmine.*".

But in fact, the coordinators tend to communicate directly, as said by other programmer:

> "*coordinator is more often to communicate via sms or phone, and the same way was also used to give the report back. It is more fast and simple*".

After the change of scenario, by encouraging the programmers to register any issues (features/bugs) into redmine, instead of keep it only for the coordinators, an improvement of the redmine utilization occurred for both the version control system and issue tracking system. The reason behind this adjustment was the fact that the programmers have more knowledge about what they have done and what they were doing about the system. Programmers start to register the system features, and surprisingly, some of the coordinators also start practicing to use the issue tracking. It seems that the adjustment has a positive side effect to the coordinators. At first guess, all of them will hand over the task of registering features to their programmers. But in fact, some of them did not do that. However, this situation also revealed valuable information about their understanding of "issue" in issue tracking, for both programmers and coordinators. There were some misunderstanding about it, and apparently, they have difficulty to determine which should be a feature and how to represent it in the redmine, in words. This is understandable, because in addition of a new experience, most of the systems were developed in informal approach and no written documents regarding requirement specification of the software were exist.

Another misunderstanding also happen with coordinator of Student IS project regarding the scenario in using the tools. He deliberately waited until the Student Information System is completed. Then he starts to push the code into the repository. In fact, this is not the point, but the tools supposed to be part that manages the development process. This situation indicated that the overall scenario of the intervention was not delivered well.

Overall, the initial outcome of the intervention met only with mixed success. The participants including the IT management were response positively and motivated to continue the implementation of the tools, Redmine and Subversion. This can be seen from the response of questionnaire regarding the usefulness of the tools. Almost 75% of the participants agree that the tools will enhance their effectiveness on the job. They mostly agree that the tools will useful and make their job become easier

(80%). However, only 50% said that the tools will decrease the time needed for their job. They also show their motivation by saying that the idea of using this tools are a good idea and will make their work more interesting (80%) and much fun (75%). It can be said that mostly they like in working with the system. In addition to this, the IT Director and Head of IS unit admit that by saying:

> "*In fact, this is actually a good tools to manage the software project, especially here in our unit*".

Their future participation also can be seen from their response regarding the intention toward using the tools on the future project. As much as 75% of the participants will use the tools in their remaining or their future project.

However, the practical part was less successful. The extensive workload of the coordinators, make them difficult to focus on the scenario, and cause lack of interaction with the tools. Lack of tutorial document at the first time makes the participants difficult to understand how to use the tools, especially for them who did not attend the workshop previously. Although the tutorial document has been completed and almost 70%-75% participants agree that the system easy to learn and use as well as less complicated (45%), they said that they still confuse with the concept and its terms, which give an indication that a follow-up tutorial or workshop session need to be performed. 40% participants feel that by using this tools will take too much time from their normal duties, which will affect their comfort zone.

Although most of the participants (75%) agree that the facilitating conditions during the intervention are available, such as guidance (Wiki Tutorial), assistance (email or chat), the limitation of the researcher's time to perform intervention on site, also reduce the level of success. Performing observation and guidance from remote distance make the researcher has less control and interaction with the participants, whereas in fact, that aspects will give the adoption process more striking and feedback-response cycle will much faster.

Surprisingly, almost 70% of the participants promote to make this tools as mandatory, as part of the development process. Whereas on the earlier section, the researcher tried not to put it into the first consideration. If like this, then this can be reconsidered. However, a thorough preparation needs to be done to make the change more smoothly.

4.6.5 Specifying Learning Stage

The introduction of selected tools, Redmine as project management application (issue tracking system) and Subversion as source code management (version control system), into the In-House software development process at the first attempt could be called a "success" because from the participants' view point (software develop-

ers), the adoptions of these tools give a good prospect for their software development and maintenance process. Several positive responses regarding the usefulness and their intention in using the tools as well as their attitude toward using this technology would be a good foundation for the next following step of the adoption process. Their experiences in using the tools will give pictures about the common approach in software development process.

Although there were small improvements on each part of the action process as described earlier, however, the approach itself was called "unsuccessful" because the action of interventions were not going well. Immature preparation before the execution of action, make its performance very slow. Many things were just realized as time goes on, either come in from the observation, or obtained from the literatures. This could happen because the researcher is new in this kind of field research, with no experience and training beforehand.

Moreover, the researcher has limited time to perform the intervention on site, and mostly located in the remote place make the intervention more difficult to control and to give any follow-up action. For example: after the researcher realized that the participants still do not understand much regarding the concept of the tools and how to use and manage it, additional training/workshop session was difficult to carried out due to the remote distance. The researcher unconsciously assume that the participants will understand the concept with only one session of workshop, whereas the characteristic of the participants especially the programmers were less experience with the tools, even some of them were new to it.

Inexistence of clear and detail agreement between researcher and participants prior the intervention to constitute the research environment make the execution of actions were less intense. This situation was even worse when the participants, especially the coordinators which were expected to perform features elicitation from the existing system, have an extensive workload and make them difficult to focus on the scenario, and cause lack of interaction with the tools. In addition, the approach scenario of action also not delivered well to the participants, with no written document; make the direction of the process less controllable.

Written document of software configuration management, which may contain configuration identification i.e. naming conventions, configuration control, i.e. library and change control, and agreement on procedures for the use of tools and techniques i.e. version controls (subversion) and issue tracking system, will give the participants a handbook guide during execution of software development process. Inexistence of this document make the participants have no standard reference when they face some problems.

Due to the execution of actions were not going well, therefore, some further adjustments were necessary. Some additional theories may be used as foundations for the next action research interventions cycle such as Software Configuration Management

and its template provided in *IEEE Standard for Software Configuration Management Plans* (2005).

CHAPTER 5

DISCUSSION

This chapter will discuss the activities and outcome of this research, which was explained in Chapter 4, in connection with the research questions that guided this study to reach the research goal. Following this, the implication of the findings with the theories in Chapter 2 will be explained. This chapter ended by the recommendation for the organization under the case.

5.1 Evaluation

The main goal of this study is to explain and improve the IT implementation process in public sector organization, particularly in higher education institutions (HEIs) in developing countries. The study was performed in one of Indonesia's public university, namely Udayana University. In order to attain the goal of this research, an action research approach was selected, where according to Baskerville (1999), this approach is suitable for the understanding of change process. In this research, the researcher performed only one cycle of action research activity as described in Section 3.5.

As described earlier in Chapter 4, one cycle of action research was done in attempt to attain the research goal. In order to evaluate this research, whether it can response the issues questioned in Chapter 3, then the following list will clarify that.

Q1. What is the status of IT implementation in the institution under the case?

In response to this issue, the researcher has been performing a field study to collect any information related to the IT implementation. The detail result regarding the status of IT implementation in Udayana University can be seen in Section 4.1, 4.2, 4.3,4.4 and 4.5.

In summary, after five years of IT implementation, many things have been achieved so far, including network infrastructure, and information systems. Almost all the units have been connected each other, either using fiber optic, cable or wireless backbone connection, depend on their condition. Several information systems have been made to support administrative work. Official website was available for publishing information related to the institution.

However, many problems also arise and inevitable during the process which affecting IT development and implementation process, especially in information systems. These problems will be explained later.

Q2. What are the contributing factors that possibly hamper the process of IT implementation?

In response to this issue, the researcher has been performing a thorough analysis regarding the factors that possibly hamper the IT implementation, which included those analyzing the data from the results of discussions, interviews and direct observation in the field as well as the available documents. This study found several factors that possibly hamper the implementation process in the institution, either from internal or external organization. Evidently, these findings are tie in well with the barriers and challenges found in the literatures.

Following are the list of those factors: (1) Limited human resources, (2) Lack of management commitment, (3) lack of clear job description among staffs, (4) lack of appropriate planning and strategy for systems development and implementation, (5) ineffective communication & coordination, (6) lack of funds, (7) Lack of Rewards, and (8) government policies. More detail regarding this factors can be seen in Section 4.6.1.

Q3. What are the suitable strategies to improve the IT implementation?

In order to improve the IT implementation process, several possible strategies are identified, with taking into account the institution situation and condition. These strategies may worth to consider towards the successful of IT implementation process.

Introduction of new system development and implementation management into organization, especially into the IT unit can be considered to help organize the development and maintenance of many information systems owned and planned by the institution. The utilization of software project management equipped with issue tracking system and integrated source code management may be one of the way to perform this strategy.

As an education institution, students are one of the stakeholders in the organization. The idea of involving students in the development and implementation process can be considered to address the issue of limited human resources, limited funding and constraint of government policies. The involvement can be through internship or

part of their final project. However, it should be noted that students are immature resources; they are in their learning stage. Thus it need proper managements to organize their involvement in such a way that their works are integrated with the existing condition.

Another important strategy is the tactics for executing system development and implementation. It is difficult to develop and implement large systems at once with a short time. Hence, a proper tactics are necessary such as applying incremental implementation with systematic approach or modular system that can give opportunity for local improvisations. With the support of software development management mentioned previously, this strategy will be easier to realize.

Due to many occurrence of unclear job descriptions, then worth to think about explicit standard procedure (SOP) to give more understanding about activities and responsibilities among staffs. This strategy can also associate with software project management mentioned previously. Implementation of project management will indirectly introduce standard procedure in performing a task. However, need to put into consideration about awareness of the staffs to reduce their resistance because this strategy tends to introduce new behavior in organization.

The last two strategies that can be considered are increase the effort to looking for grant/donor from government or private sector as away to address the funding issue, and increase the training activities for the stakeholders to improve their awareness.

Q4. How the proposed approach can improve the development and implementation process?

In response to this issue, the researcher then continued the next step of action research, "plan-action-reflect" stages. By considering several strategies which was identified previously, the researcher in collaboration with the participants then decide to select the first proposed strategy, "introducing new system project management" to be implemented into the IS development unit.

As described earlier (Section 4.4), the university has planned several web-based applications to support the organization. Some of them have been developed and some others are under development. The systems are developed by several teams. However, most of the teams (if cannot say all) use informal approach to execute the development process and they are working independently each other. informal means they develop the system without any development plan document, no written document for requirement specification, no code versioning system was used except manual versioning, and no facility to track any changes happen during development and maintenance including bugs/defects. Even though the system was done and is used by the user, the challenge then is in the maintenance process and expansion of the system features, especially if there are plans to integrate the systems.

By introducing software project management tools, it is expected that there will be

a collaborative work between teams, a clear task delegation, knowledge sharing and can keep track the progress of project in which at the end will produce reliable and good quality software products.

To do so, two applications were selected and installed: (1) Redmine, a web-based project management application, which provides an issue tracking system, and (2) Subversion, a centralized version control system that can be integrated into Redmine application. In addition, workshops were held as well as observation to monitor the progress of utilization the tools.

In result, The executions of actions were not going well. The utilization of the tools were low. During the action period, small adjustment was made for twice, expected that the utilization will increase. Indeed, it increased, but not significant. Even one of the adjustments has no effect.

However, the adjustment revealed valuable information from the participants that is a positive feedback for the next process. UnconsciousnessŠ assumption from the researcher, "*the participants understand the concepts, terms and how to use the tools after the workshops*", was unproven. They used the tools in improper way, and they admitted it.

Another good feedback for this cycle is their positive response toward the use of the tools in software development process. They are very motivated to follow the next process, and from their perspective, these tools will give a good prospect in the future.

Technically, it is hard to say and see the proposed approach successfully improve the development process at this time. However, it shows the proposed approach made the participants very motivated and enthusiasm for the next cycle. This is very important, considering that this is the first cycle of action research.

Q5. What knowledge can be acquired from the proposed approach and its influence toward the organizational behavior?

Considering only one cycle of action research was done at this time, and the outcome of this cycle was not clearly visible yet, then it is difficult to say there is enough knowledge acquired already in response to the proposed approach.

However, this cycle showed that the need of software configuration management (SCM) document is necessary to provide a "handbook" for the participants, especially coordinators and programmers, which contain a set of convention for organizing the course of projects, including document control and tools-techniques used in the projects. In addition, that is part of the theory in software engineering.

In relation with the influence of the proposed approach toward the organizational behavior, it is not clearly visible as well. The researcher cannot say that there is resistance from the participants, but due to lack of preparation and the remote distance location, the guidance process was difficult to perform.

However, the assumption is if the overall cycles of action research are done, the behavior of the organization on developing software will change, from informal approach into formal one, which is more controllable and trackable for either development or maintenance. At that time, it should clearly visible that it will influence the behavior of the organization.

Q6. How the proposed approach can contribute to the IT organizational change in the organization?

Because it is still in early stages of the overall action research cycle, there are no significant contribution yet to the IT organizational change. However, the researcher hypothesis is if the overall process is done and success, then the IT organization will have a nature of work where "process" is the key for the development and implementation. It can simply saying that it does not depends largely on the capability of the team and the project leader, but the outcome of the project is less dependent on people, and more on the processes (Jalote 2002).

5.2 Implication

The findings in this research especially factors that hamper the IT implementation process are tie in well with the barriers and challenges found in the literature. Even though they have little bit differences in type and context with others, public sector organizations in developing countries share common challenges in general.

Some of the literatures introduced in Chapter 2 deal with organizational issues that hamper the IT implementation. Weerakkody et al. (2009) performed a study to identify issues concerning e-government implementation by comparing issues occurred in UK (representing developed countries) and SriLanka (representing developing countries). They found that the project management in SriLanka is lack of coordination, and lack of government support in term of funding, which is in line with findings in this study in factor 4.6.1-5 and 4.6.1-6. Imran (2006) examined of barriers to IT adoption in public sector mostly in Bangladesh. He found that lack of planning and strategy is in top 4 most influential barriers in IT adoption, as discussed in factor 4.6.1-4, and he found less influential barriers in IT adoption such as lack of commitment and lack of reward and punishment. somewhat parallel with description in factor 4.6.1-2 and 4.6.1-7.

Although they took place in different continent, what Bii & Gichoya (2006) found in their critical review for IRM report in Kenya university somehow similar with findings described in factor 4.6.1-3, 4.6.1-5, and 4.6.1-6 that are lack of clear job description among staffs, ineffective communication and lack of funds. Huda & Hussin (2010) investigated IT implementation in Islamic-based university in Indonesia, the same country with this study, however, little bit different with the type of the university. They found that several barriers that inhibit the adoption process including inade-

quate use of strategic planning, low IT development budget, lack of incentive and government policies, in a way similar with findings described in factor 4.6.1-4, 4.6.1-6, 4.6.1-7, and 4.6.1-8.

Considering that, this study is still in the early stages of the overall action research cycle, not much findings related with action research approach that can be contrasted with the other works. However, in this particular study, the existing research setting, where the researcher performed part of the interventions remotely, make the effort to do some intervention or follow-up directly to participants more difficult. In addition, it gives less control to the action process. According to (McKay & Marshall 2007), characteristic of action research are direct involvement of the researcher in the problem solving and there is willingness for both parties to be involved in change. The last one is there should have a clear conceptual framework or theoretical position driving the research aspects of the intervention. Contrast with these characteristics, indeed the researcher performed a direct involvement, however due to limited time available; there some parts were performed remotely.

Baskerville (1999) mentioned that it is required to establishment the research environment – client-system infrastructure prior the execution of action research cycle. However, the researcher fails to do this because it just learned after the research was carried out – It is too late. Instead, the researcher only conveys the research and its scenario verbally. The consequence is the executions of actions were less intense, which was indicated by low interaction from the participants during the use of the tools.

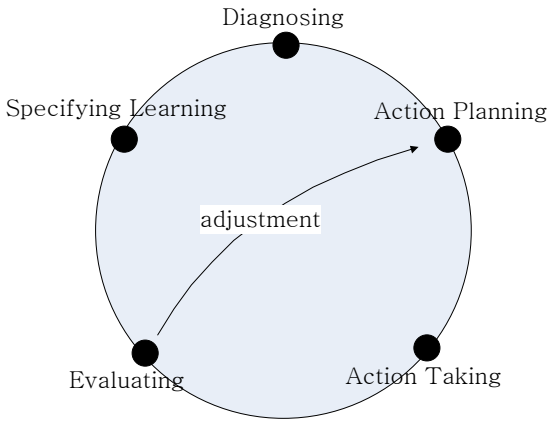

Figure 5.1: Improvement Cycle performed on this research

Concerning about the way action research was performed, this study was performed a bit different with the common way. In addition to follow five-stages action research cycle as described in Section 3.5.1, in this study, the researcher performed an improvisation cycle. The improvisation was to make small adjustment to the research setting during the action taking stage. This improvisation was needed to cope with unspecified/unanticipated situation that occurred during the intervention. This approach accommodate the theories of situated change perspective by Orlikowski (1996). In-

deed, help the researcher to reveal the valuable information regarding the situation and condition of the environment under study. Illustration for the improvisation can be seen in Figure 5.1.

In order to help the implementation process, the researcher also adopt strategy provided by Curry & Katz (2002), "local champion", in such a way that the researcher train the selected programmers to administer the tools prior the execution of action. This approach indeed works in the area of programmers. They become a trainer for other programmers regarding the use of tools.

5.3 Recommendation

According to the action research activity performed during this study, several recommendations are created based on the outcome of the study so far. This recommendation may be worth to consider toward successful of IT implementation process.

As stated earlier (Section 4.6.5), the action research cycle need to be continued to gain the benefits provided by the proposed approach and can reach the research goal appropriately. In order to do so, following are several recommendations in relation with the action research.

1. *Re-establish the research environment*
   The first cycle of this action research failed to perform the establishment of research environment clearly, so that the interaction of participants was less intense toward the use of selected tools, whereas it is very importance in initiating the research. According to (Baskerville 1999), this establishment specifies the infrastructure of the research, which contains agreement that constitutes the research environment. It provides the authority, or sanctions under which the researchers and host practitioners may specify actions. This also includes the research domain, and the entry and exit of the researcher. This is away to ensure that both actors agree to participate in to the actions.
2. *Software Configuration Management Plan- SCMP*
   As has been experienced before, the participants little bit confuse with the concept and terminology used during the execution of actions. Different participant has different perceptions about it. In addition, every programmers use different style in performing their work. The way they used the selected approach tools are varies. Hence, it is necessary to provide a set of convention that can be used to control and ensure the integrity and traceability of the software product, which is known as Software Configuration Management (SCM). The SCM activities include the identification and establishment of baselines; the review, approval, and control of changes; the tracking and reporting of such changes; the audits and reviews of the evolving software product; and control of interface documentation. All of these rules are presented in a document called Software Configuration Management Plan (SCMP). This document can adopt

the standard document IEEE 828-2005 (IEEE Standard for Software Configuration Management Plan).
In normal sequence, this document must be prepared prior the execution of software project (coding) and specific for each project. However, in this context of action research, one document can be used for the entire project as the initial effort of introduction. To do so, it must be ensured that the document is ready prior the next action research cycle.

3. *Providing complete example of system migration*
As described previously, many participants do not have any clear pictures about how the process and the result of the proposed approach will look like. Hence, they do not have any reference for comparison regarding what they are doing. To do so, it is necessary to provide a complete sample of migration processes, i.e. the existing system into the Redmine application, and in such a way that this document can be used as reference for them.
4. *Software Requirement Specification - SRS*
As showed previously, almost all the information systems was developed in an informal approach, which there are no written document regarding the requirement specification and other supporting documents.
In order to improve this issue, it is worth to try to introduce a standard and common procedure in developing software by following recommended approaches for the specification of software requirements. This is provided in IEEE 830-1998 (IEEE Standard for Software Requirements Specification).
5. *Perform sufficient tutorial and workshop session*
As has been experience from the first cycle, the participants still not fully understand regarding concepts and terminology used in the proposed tools. Hence, it needs to provide proper documentation manual about how to use the tools prior the execution of actions and hold several workshop session if necessary, to ensure the participants' understanding.
6. *Pilot Project*
As explained previously, this action research involve all the information system projects that exist in the organization, it means that the participants were all the coordinators and programmers. However, it seems that it will take a long time to obtain a visible result, and it could disrupt the participants' faith regarding the benefit of the proposed approach as time goes by.
Therefore, it is necessary to initiate a pilot project, by choosing the existing one for example, and then perform the same action research cycle as previously and including the new possible adjustments, but only for those selected project. By doing so, it is expected that the outcome will be obtain faster and can be used to convince other software project as soon as possible. This approach was one of the strategies offered by Curry & Katz (2002).

CHAPTER 6

CONCLUSION

Implementation of IT holds significant potential to organizations in developing countries, including the public sector and HEIs. Realizing the potential, however, is not a simple task. Many challenges would be faced during the implementation process. Moreover, in the context of public HEIs in developing countries, it has many limitation and multi dimensions, such as resources, financial, cultural background. If this situation cannot be recognized and handled properly, then this will greatly disrupt the implementation process. It is important to manage the IT implementation process properly. Hence, the purpose of this study is therefore attempt explain and improve the IT implementation process in public sector organization, particularly in higher education institutions (HEIs) in developing countries.

An action research approach in combination with case study method was selected to address the research goal. An action-research cycle was followed as a guideline for the research activity. Empirical data collection was done for twice to support the research investigation. The first one was done for two weeks to perform diagnosing stage in away to understand the contextual situation of the selected institution. The second one was done for one and half month to perform plan and action taking stage. Data gathering was conducted by getting involved into the organization activity by introducing tools that support the software development process. In addition to this, two round pre and follow-up semi-structural interviews was performed as well as direct observation, discussion, meeting, document analysis and previous involvement in the institution. An Online Questionnaire was also performed to obtain the perception of research participants regarding the proposed tools.

After five years of IT implementation processes, many things have been achieved so far, including establishment of several information systems and its infrastructure. However, many problems also arise and inevitable affecting IT implementation pro-

cess, especially in information systems. This study found several factors that possibly hamper the implementation process in the institution, including limited human resources, lack of management commitment, lack of clear job description among staffs, lack of appropriate planning and strategy for systems development and implementation, ineffective communication & coordination, lack of funds, lack of rewards, and government policies. Apparently, these findings were tie in well with the barriers and challenges found in the literatures.

Several strategies are formulated to cope with the existing challenges found in the institution. Introduction of new system development and implementation management into organization can be considered to overcome the communication and coordination problem. Another strategies including involve students in system development and implementation, improvement in development and implementation strategy, arranging standard operating procedure as guidance for the stakeholders, increase effort to looking for grant/donor to deal with the funding issue, and increase number of socialization and training about IT and its benefits.

As a way to objectify the formulated strategies, action of interventions was performed by introducing Şsoftware project managementŤ tools into the organization. Considering that only one cycle of action research was done, it is difficult to say that the proposed approach successfully improve the IT implementation at this time. However, it showed that the proposed approach made the participants very motivated and enthusiasm for the next process cycle, which is a good sign for the success of the implementation process.

In conclusion, this study has attempted to explain and improve the IT implementation in public sector organizations in developing countries, particularly in higher education institution. This study found that they share common challenges in general, among others. Even though the outcome of the proposed approach not clearly visible at this time, yet it give a motivation for the continuity of the implementation of the proposed approach, considering the positive feedback from the participants and the potentials offered from this approach is still believed to be achieved. However, to obtain the potential offered by the IT, it is not sufficient only by improving the software development processes and its organization, as addressed by this study. Beyond that, it is also need to ensure the commitment of the organization top management toward the IT implementation process, awareness of IT literacy among the stakeholders, provision of sufficient funds as well as their awareness of the importance of rewards.

6.1 Limitation

This study has several limitations that need to be considered. Not all stakeholders of the institution are covered in which excluding the students as the "*main clients*" of the institution. The researcher does not have any experience and has not trained as action researcher previously, which affects the research preparation and execution.

Moreover, only one cycle of action research was completed in the study, and it is remain an ongoing process. In addition, the work has a somehow narrow perspective, with only one specific public sector organization in focus, higher education institution, in one institution. Further research is to continue the execution of the next cycle of action research in order to understand its implementation process and obtain its offered benefits. Another possible future research is implementing this research approach into multi case study, multi institution in order to validate the research approach and findings.

6.2 Future Work

Several further studies could be performed according to the investigation result to uphold the previous findings.

Continue the next cycle (2^{nd}) of the Action Research.
As described in Section 5.3, some additional theories and strategies may be used as foundations for the next action research interventions. To expedite getting the real results, a pilot project worth to be considered, in which the intervention is focused on one project, for example the existing project such as payment systems, or new executed project such as finance management systems. Another important preparation is then to provide complete sample of those transition process, which can be used as guidance.

Perform comparative study in other similar type organization to validate the research approach and findings
In order to validate the research approach and findings in this research, it is possible to perform the same approach in other similar type organizations and then conduct a comparative study to gain a better understanding and more general.

REFERENCES

Ajzen, I. (1991), 'The Theory of Planned Behavior', *Organizational Behavior and Human Decision Processes* **211**, 179–211.

Al-busaidy, M. & El-haddadeh, R. (2011), Evaluating e-Government Implementation Using Institusional Perspective: a case study of Oman, *in* 'European Conference on Information Systems (ECIS)'.

Anda, B. C. D., Sjoberg, D. I. K. & Mockus, A. (2009), 'Variability and Reproducibility in Software Engineering: A Study of Four Companies that Developed the Same System'.

Anwar, F. (2011), 'Barriers in Adoption of Health Information Technology in Developing Societies', *International Journal of Advanced Computer Science and Applications* **2**(8), 40–45.

Avison, D., Baskerville, R. & Myers, M. D. (2007), The Structure of Power In Action Research Projects, *in* N. Kock, ed., 'Information Systems Action Research: An Applied View of Emerging Concepts and Methods', p. Chapter 2.

Baskerville, R. L. (1999), 'INVESTIGATING INFORMATION SYSTEMS WITH ACTION RESEARCH', *Communications of the Association for Information Systems* **2**(October).

Baskerville, R. & Myers, M. D. (2004), 'Special Issue on Action Research in Information Systems: Making is Research Relevant to Practice - Foreword', *MIS Quarterly* **28**(3), 329–335.

Bhatnagar, S. (2000), 'Social Implications of Information and Communication Technology in Developing Countries: Lessons from Asian Success Stories', *Electronic Journal on Information Systems in Developing Countries* **1**, 1–9.

Bii, H. & Gichoya, D. M. (2006), 'Challenges of Establishing and Managing an IRM Centre in a Kenyan Public University: a Critical Review of Papers by Moi Univer-

sity's IRM Centre Staff', *Electronic Journal on Information Systems in Developing Countries* **26**, 1–11.

Braa, J. r., Macome, E., Mavimbe, J. a. C., Nhampossa, J. L., da Costa, J. a. L., Manave, A. & Sitói, A. (2001), 'A Study of the Actual and Potential Usage of Information and Communication Technology at District and Provincial Levels in Mozambique with a Focus on the Health Sector', *Electronic Journal on Information Systems in Developing Countries* **5**, 1–29.

Cooper, B. (1994), 'The inertial impact of culture on IT implementation', *Information Management* **27**, 17–31.

Cooper, R. B. & Zmud, R. W. (1990), 'Information Technology Implementation Research: A Technological Diffusion Approach', *Management Science* **36**(2), 123–139.

Curley, K. & Cremillion, L. (1983), 'The role of the Champion in DSS Implementation', *Information Management* **6**(4), 203–209.

Curry, J. R. & Katz, R. N. (2002), 'The Organizational Challenge IT and Revolution in Higher Education', *Workforce* .

Dasgupta, S. & Gupta, B. (2011), Impact of Organizational Culture on Technology Use in a Developing Country, *in* 'Americas Conference on Information Systems (AMCIS)'.

Davis, F. D. (1989), 'Perceived Usefulness , Perceived Ease Of Use , And User Acceptance of Information Technology', *MIS Quarterly* **13**(3), 319–341.

De Bakker, K., Boonstra, A. & Wortmann, H. (2010), 'Does risk management contribute to IT project success? A meta-analysis of empirical evidence', *International Journal of Project Management* **28**(5), 493–503.

De Wit, A. (1988), 'Measurement of project success', *International Journal of Project Management* **6**(3), 164–170.

Ehn, P. (1993), Scandinavian Design: On participation and Skill, *in* 'Participatory design : principles and practices', pp. 41–78.

Emam, K. E. & Koru, A. G. (2008), 'A Replicated Survey of IT Software Project Failures'.

Furuholt, B. r. & Ø rvik, T. U. (2005), 'Implementation of Information Technology in Africa : Understanding and Explaining the Results of Ten Years of Implementation

Effort in a Tanzanian Organization', *Information Technology for Development* **12**(1), 45–62.

Hammer, M. (1990), Reenginerering Work: Don't Automate, Obliterate, *in* 'Harvard Business Review', pp. 104–112.

Heeks, R. (2002), 'Information Systems and Developing Countries: Failure, Success, and Local Improvisations', *The Information Society* **18**(2), 101–112.

Huda, Q. & Hussin, H. (2010), ICT Implementation Barriers and Organizational Is Âη sues in Islamic-based Higher Education Institution : The Case of Syarif Hidayatullah State Islamic University (UIN) Jakarta, *in* 'Information and Communication Technology for the Muslim World (ICT4M)', pp. A18–A25.

Hussein, R., Karim, N. S. A., Mohamed, N. & Ahlan, A. R. (2007), 'The Influence of Organizational Factors on Information Systems Success in E-Government Agencies in Malaysia', *Electronic Journal on Information Systems in Developing Countries* **29**, 1 – 17.

IEEE Standard for Software Configuration Management Plans (2005), *IEEE Std 828-2005 (Revision of IEEE Std 828-1998)* pp. 1–30.

Imran, A. (2006), 'Significant barriers to ICT adoption in the public sector in the Least Developed Countries (LDCs): A case study of Bangladesh', *ACIS 2006 Proceedings* .

Imran, A. & Gregor, S. (2005), Strategies for ICT Use in the Public Sector in the Least Developed Countries : A Cross-Country Analysis, *in* 'Australasian Conference on Information Systems (ACIS)', number about 125, pp. 1–11.

Jalote, P. (2002), *Software Project Management in Practice*, Addison Wesley.

Javier, A. & Alvarez, S. (2004), 'Challenges to Information Systems Implementation and Organisational Change Management : Insights from the Health Sector in Ecuador', *Electronic Journal on Information Systems in Developing Countries* **16**, 1–16.

Kankaanpaa, I. (2002), Implementation of IT Application in Small and Middle Size Enterprises - Controlling the critical success factors, PhD thesis.

Klein, H. K. & Myers, M. D. (1999), 'A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems', *MIS Quarterly* **23**(1), 67–94.

Krisana Kitiyadisai (2000), The Implementation of IT in Reengineering the Thai Revenue Department, *in* 'Information flows, local improvisations and work practices. Proceedings of the IFIPWG9.4 Conference', Cape Town, pp. 2000–2000.

Kwon, T. H. & Zmud, R. W. (1987), Unifying the fragmented models of information systems implementation, *in* R. J. Boland JR & R. A. Hirschheim, eds, 'Critical issues in information systems research', John Wiley Sons, chapter blalba, pp. 227–251.

Lai, V. S. & Mahapatra, R. K. (1997), 'Exploring the research in information technology implementation', *Information Management* **32**, 187–201.

Leonard-barton, D. (1988), 'Implementation as mutual adaptation of technology and organization', *Research Policy* **17**.

Levin, B. D. Z., Cross, R., Abrams, L. C. & Lesser, E. L. (2002), 'Trust and knowledge sharing: A critical combination', *IBM Institute for KnowledgeBased Organizations* **1**, 1–9.

Lewin, K. (1952), Group decision and social change, *in* T. M. Newcomb & E. L. Hartley, eds, 'Readings in social psychology', Vol. 40, Holt, pp. 463–469.

Lucas, H. J. J. (1992), *The analysis, design, and implementation of information systems*, 4th editio edn, McGraw-Hill, New York.

McKay, J. & Marshall, P. (2007), DRIVEN BY TWO MASTERS , SERVING BOTH The Interplay of Problem Solving and Research in Information Systems Action Research Projects, *in* 'Information Systems Action Research: An Applied View of Emerging COncepts and Methods'.

Miller, E. (1993), 'From System Design to Democracy', *Communications of the ACM* **36**(4), 1993–1993.

Munns, A. K. & Bjeirmi, B. F. (1996), 'The role of project management in achieving project success', *International Journal of Project Management* **14**(2), 81–87.

Myers, M. D. (1997), 'Qualitative Research in Information Systems', *MIS Quarterly* **21**(2), pp. 241–242.

Ndou, V. (2004), 'E-Government for Developing Countries: Opportunities and Challenges', *Electronic Journal on Information Systems in Developing Countries* **18**, 1–24.

Oates, B. J. (2005), *Researching Information Systems and Computing*, Sage Publications Ltd.

O'Brien, R. (1998), 'An Overview of the Methodological Approach of Action Research', *Practice* **2006**(2001), 1–22.

Orlikowski, W. J. (1993), 'CASE Tools as Organizational Change', *MIS Quarterly* **17**(3), 93.

Orlikowski, W. J. (1996), 'Improvising Organizational Transformation Over Time : A Situated Change Perspective', *Information systems research* (November).

Quaddus, M. (1995), diffusion of information technology- an exploration of the stage models and facilitating the user's choice by system approach.pdf, *in* 'Proceedings of the 1995 Pan Pacific Conference on INformation Systems', Singapore, pp. 191 – 199.

Rogers, E. M. (1995), *Diffusion of Innovations*, Free Press, New York.

Savolainen, P., Ahonen, J. J. & Richardson, I. (2011), 'Software development project success and failure from the supplier's perspective: A systematic literature review', *International Journal of Project Management* **30**(4), 458–469.

Stellman, A., Greene, J. & Friedman, M. (2006), *Applied Software Project Management*, first edit edn, O'Reilly.

Susman, G. I. (1983), Action Research: A Sociotechnical Systems Perspective, *in* G. Morgan, ed., 'Beyond Method Strategies for Social Science Research', Sage Publications, pp. 95–113.

Tomayko, J. E. & Hallman, H. K. (1989), 'Software Project Management', *Software Engineering Institute Curriculum Module* (July).

Traunmiiller, R. & Linz, J. (1996), New Public Management and Enabling Technologies, *in* 'IFIP World Conference on IT Tools'.

Venkatesh, V., Morris, M. G., Davis, G. B. & Davis, F. D. (2003), 'User Acceptance of Information Technology: Toward a Unified View', *MIS Quarterly* **27**(3), 425–478.

Walsham, G. (1995), 'Interpretive case studies in IS research: nature and method', *European Journal of Information Systems* **4**(2), 74–81.

Weerakkody, V., Dwivedi, Y. K. & Kurunananda, A. (2009), 'Implementing E-Government in Sri Lanka : Lessons from the UK', *Information Technology for Development* **15**(June 2009), 171–192.

Wood-Harper, T. (1985), Research Methods in Information Systems: Using Action Research, *in* 'Research Methods in Information Systems', e. mumford edn, Amsterdam: North-Holland, pp. 169–191.

Appendices

APPENDIX A

BADAN LAYANAN UMUM

As explained in Chapter 4, in 2012, which coincides with its 50^{th} (gold) anniversary, the institution will re-form the organizational into *Badan Layanan Umum* or Public Service Agency, in English. Being a BLU unit, management of the university will have broad autonomy in implementing the principles of effective corporate management and accountable, so that management can develop the university to improve performance and service quality, either to students, staffs and communities. Following are things can be done in a BLU unit:

- Besides from the institution income, the source revenue of the institution can also be obtained from government's subsidy for the costs such as: the cost of the staff salaries. and the cost of investment/capital.
- The institution's management has flexibility in managing its finances and utilization of its income and are not required to deposit their income to the national treasury. This of course will provide positive impact to the institution, since the institution are given the authority to conduct procurement of resources needed from the institution's income.
- The BLU concept also open up the possibility for cooperation with the third parties who are not binding.

The flexibility in finance management will make head of the institution have the right to set up employee's payroll. This is the basic different from the old rules in state-own institutions, in which all employees receive the same salary regardless of their work's performances. With BLU, the management can provide salaries, incentives or bonuses beyond the salary provisions. Management also enable to improve human resources and recruiting employees in accordance with the needs and desired competences. Placement of professionals should not be based on rank, hierarchy and the like, but more focused on the professionalism of human resources. Hence it can guarantee the service quality in accordance with the goals and direction of the BLU.

However, to be a BLU unit, the institution must be able to meet various requirements: substantive, technical and administrative. Hence it requires a serious preparations in order to meet these requirements. The consideration is to look at the performance of the institution as well as the financial performance. It should be based on the principles of good governance which consists of transparent, participative and accountable. These principles are needed to achieve a good public management. It aims to improve the performance of the institution as well as allowing communities to get quality services from professionals. It is possible because the institution no longer managed bureaucratically but governed by entrepreneurs without overlook their main function as a public institution instead of gain profits.

Becoming a BLU institution, as explained above, will accelerate the process toward the institutional goals and IT is seen as an enabler by the institution to become a transparent, effective, efficient and accountable institution.

APPENDIX B

QUESTIONNAIRE

B.1 Questionnaire

User Perception to "Software Project" Management Application

Introduction

Thank you for your participation in this project. After conducted some observation and analysis of the development process, since early of February 2012, we decided to implement a new system to organize in-house software development process in IS Development Unit, Udayana University. Among numbers of project management applications out there, we selected REDMINE, an open source project management application, to be used in this project. This application provide features that we need in order to organized the development processes, such as issue tracking and integrated source code management. In addition, this application offers features that are less complicated compare with others OSS, yet fulfill the need.

Planning

In order to study the implementation process of the new system, I as the researcher want to collect any response/perception from you as participants by providing questionnaires. The questionnaire is divided into two parts, pre-questionnaire and post-questionnaire. Following are the overall planning of the project listed below:

1. Application preparation, REDMINE Installation on server (devserver.unud.ac.id)
2. Application Guide, a customized version according to the needs, through Wiki feature
3. Workshop for participants
4. Pre-questionnaire
5. The use of application, and active guidance from the researcher
6. Post-questionnaire

Pre-questionnaire: a set of questions that aim to reveal the characteristic of the participants in this project.

Post-questionnaire: a set of questions that aim to show the participant's perception regarding the new implemented system.

Please provide your response on the questionnaire as honest as possible. Feel free to show your perception about redmine application as what you feel about it. Your responses will remain completely anonymous.

Once again, thank you for your participation.

I Made Agus Setiawan
Researcher

Pre-Questionnaire

Welcome to this pre-questionnaire session. This questionnaire will consist of set of questions that aim to reveal the characteristic of the participants in this project. Thank you for your participation.

Participant Characteristic

1. You are : - Coordinator - Programmer - Management - Others
2. Sex : - Male - Female
3. How old are you?
4. How long have you been using computer? …. Years.
5. Have you been involving in software development project previously?
6. If Q5 is yes, for how many projects you have been involved?
    a. Less than equal to 2 projects
    b. Between 3 until 5 projects
    c. More than 5 projects
7. If Q5 is yes, is the development process following particular methodology (Waterfall, Agile, Iterative, Scrum, Xtreme Programming, etc)?
    a. Yes, all of them
    b. Yes, some of them
    c. Not at all (as long as it's finished)
8. Mark the number, which you feel most fit, there are 5 choice boxes from left to the right.

	Never heard about it	Read about it	Tried it out	Used it a lot	Expert
Project Management Software *Redmine, Trac, Microsoft Project, Open Project etc*	1	2	3	4	5
Issue Tracking System *Tracker, Ticket, Issue*	1	2	3	4	5
Source Code Management (SCM) *Subversion, Mercurial, GitHub etc*	1	2	3	4	5

Post-Questionnaire

Welcome to this pre-questionnaire session. This questionnaire will consist of set of questions that aim to show the participant's perception regarding the new implemented system, redmine application, in this project. Thank you for your participation.

Participant's Perception

Usefulness

PU6: I would find the system useful in my job
PU5: Using the system would make it easier to do my job
PU4: Using the system would enhance my effectiveness on the job
JF2: Using the system can decrease the time needed for my job

Ease of Use

EOU6: I would find the system easy to use
EU4: Learning to use the system is easy for me
C1: Using the system takes too much time from my normal duties
C2: Working with the system is so complicated

Attitude toward using Technology

A1: Using the system is a good idea
AF1: The system makes work more interesting
AF2: Working with the system is fun
Affect1: I like working with the system

Facilitating Conditions

FC1: Guidance was available to me in the use of the system
FC2: A specific person is available for assistance with the system difficulties
FC3: I have the knowledge necessary to use the system

Self efficacy

SE1: I would do my job using the system if I had a lot of time to do it.
SE2: I would do my job using the system if it is a mandatory
SE3: I would do my job using the system if there is decent appreciation

Intention

BI1: I intend to use the system in the remaining time of the project or for project where I am involved in.
BI2: I will use the system in the remaining time of the project or for project where I am involved in.

B.2 Result

Number of records in this query:	20
Total records in survey:	20
Percentage of total:	100.00%

			Coordinator		Programmer		Management	
Field summary for 0001								
You are :								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
Coordinator (1)	8	40.00%	8	100.00%	0	0.00%	0	0.00%
Programmer (2)	11	55.00%	0	0.00%	11	100.00%	0	0.00%
Management (3)	1	5.00%	0	0.00%	0	0.00%	1	100.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

			Coordinator		Programmer		Management	
Field summary for 0002								
Sex								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
Female (F)	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Male (M)	20	100.00%	8	100.00%	11	100.00%	1	100.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for 0003			
How old are you ?			
Calculation	Result	Result	Result
Count	20	8	11
Sum	558	274	239
Standard deviation	7.62	3.67	1.35
Average	27.9	34.25	21.73
Minimum	20	30	20
1st quartile (Q1)	21.25	30.25	20
2nd quartile (Median)	23.5	33.5	21
3rd quartile (Q3)	33.75	38.75	23
Maximum	45	39	24
Null values are ignored in calculations			
Q1 and Q3 calculated using minitab method			

Field summary for 0004			
How long have you been using computer (in years) ?			
Calculation	Result	Result	Result
Count	20	8	11
Sum	260	144	96
Standard deviation	6.39	5.24	3.65
Average	13	18	8.73
Minimum	4	11	4
1st quartile (Q1)	8	13.25	5
2nd quartile (Median)	12.5	16.5	8
3rd quartile (Q3)	17.5	24	12
Maximum	25	25	16
Null values are ignored in calculations			
Q1 and Q3 calculated using minitab method			

Field summary for 0005			Coordinator		Programmer		Management	
Have you been involving in software development project previously?								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
Yes (Y)	16	80.00%	8	100.00%	7	63.64%	1	100.00%
No (N)	4	20.00%	0	0.00%	4	36.36%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for 0006			Coordinator		Programmer		Management	
For how many projects you have been involved?								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
Less than / equal to 2 projects (A)	7	43.75%	0	0.00%	6	85.71%	1	100.00%
Between 3 until 5 projects (B)	4	25.00%	3	37.50%	1	14.29%	0	0.00%
More than 5 projects (C)	5	31.25%	5	62.50%	0	0.00%	0	0.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for 0007			Coordinator		Programmer		Management	
Is the development process following particular methodology (Waterfall, Agile, Iterative, Scrum, Xtreme Programming, etc)?								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
Yes, all of them (A)	2	12.50%	1	12.50%	1	14.29%	0	0.00%
Yes, some of them (B)	8	50.00%	5	62.50%	3	42.86%	0	0.00%
Not at all (as long as it's finished) (C)	6	37.50%	2	25.00%	3	42.86%	1	100.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for 0008(SQ1)			Coordinator		Programmer		Management	
Following are question about your knowledge for several term and concept. Mark the number, which you feel most fit, there are 5 choice boxes from left to the right. [Project Management Software,Redmine, Trac, Microsoft Project etc.]								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
Never heard about it (1)	5	25.00%	1	12.50%	3	27.27%	1	100.00%
Read about it (2)	7	35.00%	2	25.00%	5	45.45%	0	0.00%
Tried it out (3)	5	25.00%	2	25.00%	3	27.27%	0	0.00%
Used it a lot (4)	3	15.00%	3	37.50%	0	0.00%	0	0.00%
Expert (5)	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for 0008(SQ2)			Coordinator		Programmer		Management	
Following are question about your knowledge for several term and concept. Mark the number, which you feel most fit, there are 5 choice boxes from left to the right. [Project Management Software,Redmine, Trac, Microsoft Project etc.]								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
Never heard about it (1)	2	10.00%	0	0.00%	1	9.09%	1	100.00%
Read about it (2)	8	40.00%	2	25.00%	6	54.55%	0	0.00%
Tried it out (3)	7	35.00%	3	37.50%	4	36.36%	0	0.00%
Used it a lot (4)	3	15.00%	3	37.50%	0	0.00%	0	0.00%
Expert (5)	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for 0008(SQ3)			Coordinator		Programmer		Management	
Following are question about your knowledge for several term and concept. Mark the number, which you feel most fit, there are 5 choice boxes from left to the right. [Project Management Software,Redmine, Trac, Microsoft Project etc.]								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
Never heard about it (1)	7	35.00%	1	12.50%	5	45.45%	1	100.00%
Read about it (2)	2	10.00%	1	12.50%	1	9.09%	0	0.00%
Tried it out (3)	7	35.00%	2	25.00%	5	45.45%	0	0.00%
Used it a lot (4)	4	20.00%	4	50.00%	0	0.00%	0	0.00%
Expert (5)	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for PU4			Coordinator		Programmer		Management	
Using the system would enhance my effectiveness on the job.								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
1 Strongly Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2 Quite Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3 (Slightly Disagree)	1	5.00%	0	0.00%	1	9.09%	0	0.00%
4 (Neutral)	4	20.00%	2	25.00%	2	18.18%	0	0.00%
5 (Slightly Agree)	3	15.00%	2	25.00%	1	9.09%	0	0.00%
6 (Quite Agree)	7	35.00%	2	25.00%	5	45.45%	0	0.00%
7 (Strongly Agree)	5	25.00%	2	25.00%	2	18.18%	1	100.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for PU5			Coordinator		Programmer		Management	
Using the system would make it easier to do my job.								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
1 Strongly Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2 Quite Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3 (Slightly Disagree)	1	5.00%	0	0.00%	1	9.09%	0	0.00%
4 (Neutral)	3	15.00%	2	25.00%	1	9.09%	0	0.00%
5 (Slightly Agree)	5	25.00%	1	12.50%	4	36.36%	0	0.00%
6 (Quite Agree)	8	40.00%	3	37.50%	4	36.36%	1	100.00%
7 (Strongly Agree)	3	15.00%	2	25.00%	1	9.09%	0	0.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for PU6			Coordinator		Programmer		Management	
I would find the system useful in my job.								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
1 Strongly Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2 Quite Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3 (Slightly Disagree)	1	5.00%	0	0.00%	1	9.09%	0	0.00%
4 (Neutral)	3	15.00%	2	25.00%	1	9.09%	0	0.00%
5 (Slightly Agree)	7	35.00%	2	25.00%	5	45.45%	0	0.00%
6 (Quite Agree)	4	20.00%	1	12.50%	3	27.27%	0	0.00%
7 (Strongly Agree)	5	25.00%	3	37.50%	1	9.09%	1	100.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for JF2

Using the system can decrease the time needed for my job.

Answer	Count	Percentage	Coordinator Count	Coordinator Percentage	Programmer Count	Programmer Percentage	Management Count	Management Percentage
1 Strongly Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2 Quite Disagree	2	10.00%	0	0.00%	2	18.18%	0	0.00%
3 (Slightly Disagree)	2	10.00%	0	0.00%	1	9.09%	1	100.00%
4 (Neutral)	6	30.00%	3	37.50%	3	27.27%	0	0.00%
5 (Slightly Agree)	4	20.00%	0	0.00%	4	36.36%	0	0.00%
6 (Quite Agree)	4	20.00%	3	37.50%	1	9.09%	0	0.00%
7 (Strongly Agree)	2	10.00%	2	25.00%	0	0.00%	0	0.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for EOU6

I would find the system easy to use.

Answer	Count	Percentage	Coordinator Count	Coordinator Percentage	Programmer Count	Programmer Percentage	Management Count	Management Percentage
1 Strongly Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2 Quite Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3 (Slightly Disagree)	2	10.00%	0	0.00%	2	18.18%	0	0.00%
4 (Neutral)	4	20.00%	3	37.50%	1	9.09%	0	0.00%
5 (Slightly Agree)	6	30.00%	1	12.50%	4	36.36%	1	100.00%
6 (Quite Agree)	6	30.00%	2	25.00%	4	36.36%	0	0.00%
7 (Strongly Agree)	2	10.00%	2	25.00%	0	0.00%	0	0.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for EU4

Learning to use the system is easy for me.

Answer	Count	Percentage	Coordinator Count	Coordinator Percentage	Programmer Count	Programmer Percentage	Management Count	Management Percentage
1 Strongly Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2 Quite Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3 (Slightly Disagree)	1	5.00%	0	0.00%	1	9.09%	0	0.00%
4 (Neutral)	4	20.00%	2	25.00%	2	18.18%	0	0.00%
5 (Slightly Agree)	7	35.00%	2	25.00%	4	36.36%	1	100.00%
6 (Quite Agree)	6	30.00%	4	50.00%	2	18.18%	0	0.00%
7 (Strongly Agree)	2	10.00%	0	0.00%	2	18.18%	0	0.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for C1

Using the system takes too much time from my normal duties.

Answer	Count	Percentage	Coordinator Count	Coordinator Percentage	Programmer Count	Programmer Percentage	Management Count	Management Percentage
1 Strongly Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2 Quite Disagree	1	5.00%	0	0.00%	1	9.09%	0	0.00%
3 (Slightly Disagree)	7	35.00%	2	25.00%	4	36.36%	1	100.00%
4 (Neutral)	5	25.00%	3	37.50%	2	18.18%	0	0.00%
5 (Slightly Agree)	4	20.00%	2	25.00%	2	18.18%	0	0.00%
6 (Quite Agree)	3	15.00%	1	12.50%	2	18.18%	0	0.00%
7 (Strongly Agree)	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for C2			Coordinator		Programmer		Management	
Working with the system is so complicated.								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
1 Strongly Disagree	1	5.00%	0	0.00%	1	9.09%	0	0.00%
2 Quite Disagree	2	10.00%	1	12.50%	0	0.00%	1	100.00%
3 (Slightly Disagree)	6	30.00%	3	37.50%	3	27.27%	0	0.00%
4 (Neutral)	8	40.00%	2	25.00%	6	54.55%	0	0.00%
5 (Slightly Agree)	2	10.00%	1	12.50%	1	9.09%	0	0.00%
6 (Quite Agree)	1	5.00%	1	12.50%	0	0.00%	0	0.00%
7 (Strongly Agree)	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for A1			Coordinator		Programmer		Management	
Using the system is a good idea.								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
1 Strongly Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2 Quite Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3 (Slightly Disagree)	1	5.00%	1	12.50%	0	0.00%	0	0.00%
4 (Neutral)	3	15.00%	2	25.00%	1	9.09%	0	0.00%
5 (Slightly Agree)	7	35.00%	0	0.00%	7	63.64%	0	0.00%
6 (Quite Agree)	6	30.00%	3	37.50%	3	27.27%	0	0.00%
7 (Strongly Agree)	3	15.00%	2	25.00%	0	0.00%	1	100.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for AF1			Coordinator		Programmer		Management	
The system makes work more interesting.								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
1 Strongly Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2 Quite Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3 (Slightly Disagree)	0	0.00%	0	0.00%	0	0.00%	0	0.00%
4 (Neutral)	4	20.00%	3	37.50%	1	9.09%	0	0.00%
5 (Slightly Agree)	6	30.00%	1	12.50%	5	45.45%	0	0.00%
6 (Quite Agree)	8	40.00%	3	37.50%	4	36.36%	1	100.00%
7 (Strongly Agree)	2	10.00%	1	12.50%	1	9.09%	0	0.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for AF2			Coordinator		Programmer		Management	
Working with the system is fun.								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
1 Strongly Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2 Quite Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3 (Slightly Disagree)	1	5.00%	0	0.00%	1	9.09%	0	0.00%
4 (Neutral)	5	25.00%	4	50.00%	1	9.09%	0	0.00%
5 (Slightly Agree)	7	35.00%	1	12.50%	5	45.45%	1	100.00%
6 (Quite Agree)	7	35.00%	3	37.50%	4	36.36%	0	0.00%
7 (Strongly Agree)	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for Affect1			Coordinator		Programmer		Management	
I like working with the system								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
1 Strongly Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2 Quite Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3 (Slightly Disagree)	1	5.00%	0	0.00%	1	9.09%	0	0.00%
4 (Neutral)	6	30.00%	3	37.50%	3	27.27%	0	0.00%
5 (Slightly Agree)	5	25.00%	1	12.50%	4	36.36%	0	0.00%
6 (Quite Agree)	8	40.00%	4	50.00%	3	27.27%	1	100.00%
7 (Strongly Agree)	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for FC1			Coordinator		Programmer		Management	
Guidance was available to me in the use of the system.								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
1 Strongly Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2 Quite Disagree	1	5.00%	0	0.00%	1	9.09%	0	0.00%
3 (Slightly Disagree)	1	5.00%	0	0.00%	0	0.00%	1	100.00%
4 (Neutral)	3	15.00%	1	12.50%	2	18.18%	0	0.00%
5 (Slightly Agree)	5	25.00%	2	25.00%	3	27.27%	0	0.00%
6 (Quite Agree)	8	40.00%	4	50.00%	4	36.36%	0	0.00%
7 (Strongly Agree)	2	10.00%	1	12.50%	1	9.09%	0	0.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for FC2			Coordinator		Programmer		Management	
A specific person is available for assistance with the system difficulties.								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
1 Strongly Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2 Quite Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3 (Slightly Disagree)	0	0.00%	0	0.00%	0	0.00%	0	0.00%
4 (Neutral)	3	15.00%	1	12.50%	2	18.18%	0	0.00%
5 (Slightly Agree)	7	35.00%	2	25.00%	5	45.45%	0	0.00%
6 (Quite Agree)	9	45.00%	4	50.00%	4	36.36%	1	100.00%
7 (Strongly Agree)	1	5.00%	1	12.50%	0	0.00%	0	0.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for FC3			Coordinator		Programmer		Management	
I have the knowledge necessary to use the system.								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
1 Strongly Disagree	1	5.00%	0	0.00%	1	9.09%	0	0.00%
2 Quite Disagree	1	5.00%	0	0.00%	1	9.09%	0	0.00%
3 (Slightly Disagree)	0	0.00%	0	0.00%	0	0.00%	0	0.00%
4 (Neutral)	3	15.00%	1	12.50%	2	18.18%	0	0.00%
5 (Slightly Agree)	7	35.00%	2	25.00%	5	45.45%	0	0.00%
6 (Quite Agree)	7	35.00%	4	50.00%	2	18.18%	1	100.00%
7 (Strongly Agree)	1	5.00%	1	12.50%	0	0.00%	0	0.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for SE1			Coordinator		Programmer		Management	
I would do my job using the system if I had a lot of time to do it.								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
1 Strongly Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2 (Quite Disagree)	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3 (Slightly Disagree)	4	20.00%	1	12.50%	3	27.27%	0	0.00%
4 (Neutral)	9	45.00%	2	25.00%	6	54.55%	1	100.00%
5 (Slightly Agree)	1	5.00%	1	12.50%	0	0.00%	0	0.00%
6 (Quite Agree)	5	25.00%	4	50.00%	1	9.09%	0	0.00%
7 (Strongly Agree)	1	5.00%	0	0.00%	1	9.09%	0	0.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for SE2			Coordinator		Programmer		Management	
I would do my job using the system if it is a mandatory.								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
1 Strongly Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2 (Quite Disagree)	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3 (Slightly Disagree)	2	10.00%	1	12.50%	1	9.09%	0	0.00%
4 (Neutral)	4	20.00%	1	12.50%	3	27.27%	0	0.00%
5 (Slightly Agree)	6	30.00%	1	12.50%	4	36.36%	1	100.00%
6 (Quite Agree)	5	25.00%	3	37.50%	2	18.18%	0	0.00%
7 (Strongly Agree)	3	15.00%	2	25.00%	1	9.09%	0	0.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for SE3			Coordinator		Programmer		Management	
I would do my job using the system if there is decent appreciation.								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
1 Strongly Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2 (Quite Disagree)	1	5.00%	1	12.50%	0	0.00%	0	0.00%
3 (Slightly Disagree)	2	10.00%	1	12.50%	1	9.09%	0	0.00%
4 (Neutral)	7	35.00%	2	25.00%	4	36.36%	1	100.00%
5 (Slightly Agree)	3	15.00%	0	0.00%	3	27.27%	0	0.00%
6 (Quite Agree)	5	25.00%	2	25.00%	3	27.27%	0	0.00%
7 (Strongly Agree)	2	10.00%	2	25.00%	0	0.00%	0	0.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for BI1			Coordinator		Programmer		Management	
I intend to use the system in the remaining time of the project or for project where I am involved in.								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
1 Strongly Disagree	1	5.00%	1	12.50%	0	0.00%	0	0.00%
2 (Quite Disagree)	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3 (Slightly Disagree)	0	0.00%	0	0.00%	0	0.00%	0	0.00%
4 (Neutral)	4	20.00%	1	12.50%	3	27.27%	0	0.00%
5 (Slightly Agree)	10	50.00%	2	25.00%	8	72.73%	0	0.00%
6 (Quite Agree)	4	20.00%	3	37.50%	0	0.00%	1	100.00%
7 (Strongly Agree)	1	5.00%	1	12.50%	0	0.00%	0	0.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

Field summary for BI2			Coordinator		Programmer		Management	
I will use the system in the remaining time of the project or for project where I am involved in.								
Answer	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
1 Strongly Disagree	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2 (Quite Disagree)	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3 (Slightly Disagree)	1	5.00%	1	12.50%	0	0.00%	0	0.00%
4 (Neutral)	4	20.00%	1	12.50%	3	27.27%	0	0.00%
5 (Slightly Agree)	7	35.00%	2	25.00%	5	45.45%	0	0.00%
6 (Quite Agree)	6	30.00%	3	37.50%	2	18.18%	1	100.00%
7 (Strongly Agree)	2	10.00%	1	12.50%	1	9.09%	0	0.00%
Other	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No answer	0	0.00%	0	0.00%	0	0.00%	0	0.00%

APPENDIX C

COMMUNICATION MATERIAL

This appendix consist of several email conversations, which are originally in Bahasa Indonesia and translated into English.

C.1 First Adjustment

C.1.1 First Email

Made Agus <madeagus@ >

Redmine application

12 messages

Made Agus <madeagus@gmail.com> **Tue, Mar 27, 2012 at 12:12 PM**

To: linawati@ , sukadarmika <sukadarmika@ >, made sukarsa <e_arsa@ >, Ngurah Agus Sanjaya ER <ghozan@ >, ghozan <ghozan@ >, muliantara <muliantara@ >, agung cahyawan <agung.cahyawan@ >, agung cahyawan <agung.cahyawan@ >, okasaputra <okasaputra@ >, madewidiartha@gmail.com, putri ardyanti <putri.ardyanti@ >, fatih sugiharno <fatih_unud@ >, aryasasmita <aryasasmita@ >, arya <arya@ >, "N. Putra Sastra" <putra.sastra@ >

Dear all,

Associated with implementing the use redmine application as monitoring developments in the internal application development UNUD, after I look at devserver1.unud.ac.id , not all projects listed in the server and actively use.

1. Active (Academic IS, Planning &Budgeting and DWConnector)
2. The newly created project, developers have been determined but there is no Coordinator(Student Selection and Student IS)
3. The newly created project with Coordinator(Finance MS)

Perhaps this is because some of this things

1. The bustle of all the coordinators
2. Difficulties in using the redmine application
3. The project currently in design stage, and have not implemented yet
4. System improvement project, softwate code already exists, but can not upload it to redmine
5. Do not know the account in redmine application

Related to the problems mentioned above, perhaps I can give some input according to each point above:

1. busy? Its also rather difficult to find a solution. may be the task can be done gradually,
   - Start by creating project workspace in redmine
   - Upload an existing source code to the svn repository, or if not at the programming stage, you can upload the required documents [design stage]
   - Start adding the most basic issue(features) (either a feature or task for the design) so that developers can deliver a recorded report.
2. I've provided a project howto -> wiki which contains guidelines for the use of the application. More complete version. if any parts are needed and not in the wiki, please drop me an email or ym etc. http://devserver1.unud.ac.id/redmine/projects/how-to-project/wiki
3. There are several new projects in the design stage, can actually be put into redmine. design documents can be included in the "Document" and the issue (fiture) can be entered in accordance with the programmer needs to be done, so the development of the project can be recorded.
   NOTE: Any issue creation, will notify the related coordinator/programmer to the issue / project is via email
4. If got confusion on the way to upload the existing code, you could ask me, or someone else that already done with it (Planning & Budgeting and Academic IS)
5. If you do not know what his or her account, you can ask me, or also Lanang / Wira (Planning & Budgeting programmer) I gave them the right to administer the server.

Keep me informed as well, a month ago I gave a workshop to the programmer so basically they are familiar with this application, it's just still waiting for the coordinator to decide **issues** that have to do, wait for their project listed in redmine. so it depends on you as coordinator.

C.1.2 Second Email

Made Agus <madeagus@gmail.com> Fri, Mar 30, 2012 at 9:45 AM
To: linawati@ , sukadarmika <sukadarmika@ >, made sukarsa <e_arsa@ >, Ngurah Agus Sanjaya ER <ghozan@ >, ghozan <ghozan@ >, muliantara <muliantara@ >, agung cahyawan <agung.cahyawan@ >, agung cahyawan <agung.cahyawan@ >, okasaputra <okasaputra@ >, madewidiartha@gmail.com, putri ardyanti <putri.ardyanti@ >, fatih sugiharno <fatih_unud@ >, aryasasmita <aryasasmita@ >, arya <arya@ >, "N. Putra Sastra" <putra.sastra@ >

Dear all,

How To Project Wiki is now equipped with:
1. step by step creation of new project
2. step by step to upload the code the first time
3. Import list of issues from CSV files, as a batch processing. It could very helpful for all the coordinators to register a lot of features which are possessed by the system, especially for those systems that have been developed

Please have a look on Redmine Wiki

Hopefully it can help you all

best regards,
madeagus

C.2 Second Adjustment

Gmail by Google **Made Agus <madeagus@ >**

Migration project to Redmine
1 message

Made Agus <madeagus@gmail.com> Mon, April 16, 2012 at 3:53 PM
To: arya@ , agung.cahyawan @ , ghozan@ , linawati@ , muliantara@ , putra.sastra @ , okasaputra@ , sukadarmika@ , e_arsa@ , wbhuana@ , madewidiartha@ , Nyoman Putra Sastra < putra.sastra @ >, Putu Wira Bhuana <wbhuana@ >

Dear Coordinators,

To speed up the migration process to the Redmine project,
I have an idea that we can ask the programmers to register all the features owned by each system, because the programmer is also more up to date on features they do.

Therefore, as an early example, I provide one task in the SIMASET system (previously I apologize for SIMASET coordinator) and I assigned one of its programmers (Wayan Shandyasa) on the issue.

http://devserver1.unud.ac.id/ redmine/issues/46

Please coordinate it accordingly with each programmer. the sooner the better, before the system getting bigger and complex:)

Any suggestions are welcome.

madeagus