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A STUDY ON CLOUD-BASED PROJECT MANAGEMENT SYSTEM MODEL: FOCUS ON NEW-ICT PROJECT

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ABSTRACT

Modern society is undergoing various changes in all industries. Especially, the requirements, scale, and interfaces to carry out SW projects are complex and large, due to development of IT technology. So project management is becoming more important. This requires new structured form of project management system to manage the project. Many SW development companies have difficulties in management since they are dispersed. In this situation, the cloud system is emerging as an alternative. Also, project management is not properly managed because they apply New-ICT to traditional management process. The thesis proposes integrated management system of easy access to anyone that integrates the tasks of various projects by implementing the necessary management models and system to manage New-ICT services in Cloud Computing environment. It is expected that project management will improve management efficiency when it applying to New-ICT service projects because this system is managed information and data from disparate projects into a single to manage them as SaaS Cloud Computing based approach.

Keywords: *Cloud Computing, Project Management, Agile Methods, Scrum, ICT*

1. INTRODUCTION

Modern society has many changes throughout industry. Rapid advances in IT technology mean that requirements, scale and interfaces of the system are complex and large. As a result, management of development projects is becoming more important issue. Under these circumstances, most SW development company are attempting to shift rapidly from revolving around SI(System Integration) and package SW project to revolving The Third Platform Area. Under these circumstances, when carry out a new project there are lags in the development period because of lack of project management services tailored to developers and managers, data dispersion, and difficulty in collaboration. This requires new structured form of project management system to manage the project because of diversification of the company. As a result Cloud computing systems are becoming an alternative The Cloud computing system is a next-generation computing environment that provides wide variety services to enable users and distribute IT resources efficiently. Cloud system enable high capacity processing and rapid processing. If network is connected, you can always access it anywhere. And beyond the limitations of the individual computing environment, there is the advantage of utilizing resources as infinite. For these reasons Cloud system is being spotlighted by SW developers and personal users. In addition, each information is correlated with interconnectivity, but interconnectivity is impossible to interlink when integrate the traditional project information and the current New-ICT project information. Thus, the same tasks are repeated, and overhead occurs for manpower and time. There is currently insufficient system to functionally link these project management functions. And these project management systems have many studies in information technology and finance fields[1],[2],[3],[4]. Thesis proposes SaaS based project management system that aims to identify and develop the system environment and technology capabilities, depending on the performance of the software company and the changing business activities in the rapidly changing environment as a means of linking disparate project management to one another. The proposed system is model for effective use in the SW development project, which combines traditional Methods and agile Methods[5],[6],[7],[8] that make a great

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effectiveness in the field of development projects. The development process and tools were applied to seven projects for the verification of the system. As a result, it gained more than 20 % of the overall through process and productivity.

2. RELATED RESEARCH

2.1 Cloud System

Understanding Cloud computing is essential to knowing Cloud. Cloud have various definitions depending on the views of the researchers, designers, engineers, developers, manager, customers and etc. These can be summarized as keywords for on-demand, utility, virtualization resource pool, web services, and professional vision[9],[10],[11],[12]. The following [Figure 1] is Cloud Service Type.

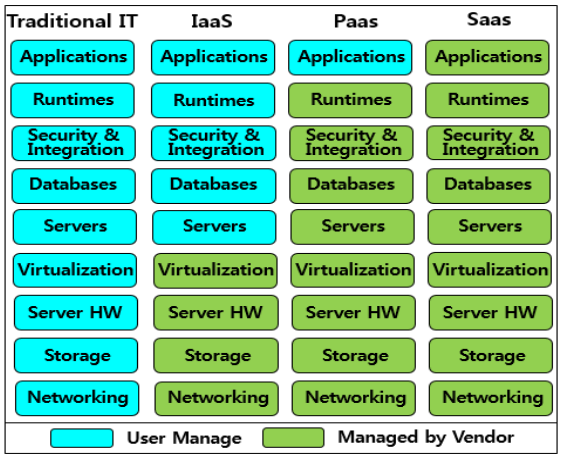

Figure 1: Cloud Services

A Cloud is a system that uses Internet technology to borrow and service IT resources as needed. Cloud systems can be categorized according to service delivery and utilization purposes. Service delivery means the way Cloud provider supports a user. There are Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS). Cloud service types are classified as users and suppliers according to the system configuration[13],[14],[15],[16].

IaaS is service that lets users build high-level structure with providing to user subsequence like virtualization, server, storage, network. Paas is a service that provides the platform for users to develop software through the platform. SaaS provides users with services across all software domains through a single platform, such as application.

The following [Figure 2] is Cloud systems, and classified according to the purpose of use.

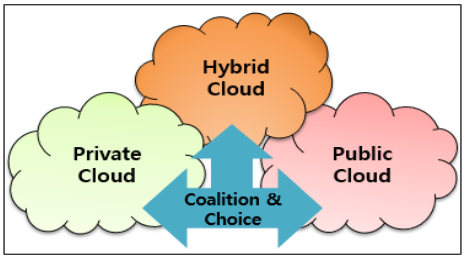

Figure 2: Cloud systems

Depending on the arrangement of the system, the shape is determined such as Private, Public, Hybrid. Hybrid Cloud System is a new system form that combines both characteristics of Private and public cloud with a connection and choice. Private Cloud Systems is a service that enables companies to directly build up cloud systems to share and manage internal data. Public Cloud systems are paid only as much as they used to because IT resources are dependent on external companies that Many users use a system built by a cloud service provider.

2.2 Traditional Project Management Environment and Process

The following [Figure 3] is On-Premise Service Environment.

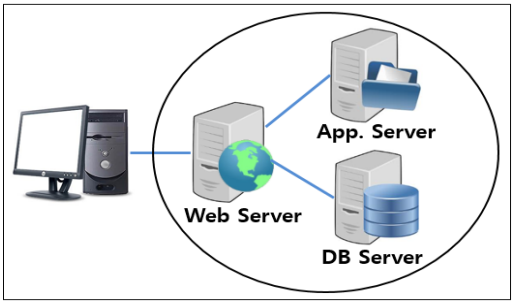

Figure 3: On-premise Service Environment

Traditional development of project were carried out in Traditional (Waterfall) Process in On-Premise environment using an IT infrastructure. The following [Figure 4] is Traditional Management Model.

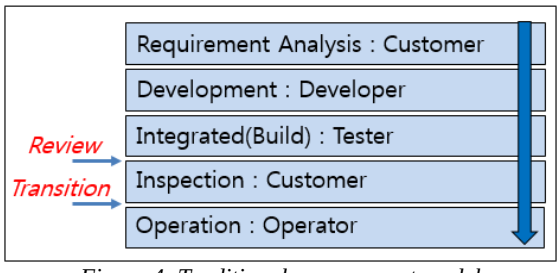

Figure 4: Traditional management model

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There is difficulty in conducting a successful project due to problems with the review and testing, because after all development is completed based on the requirements, the source integrate/ test/ inspection is performed at the end of the project.

2.3 New-ICT Project Management Environment and Process

The following [Figure 5] is Off-premise Service Environment.

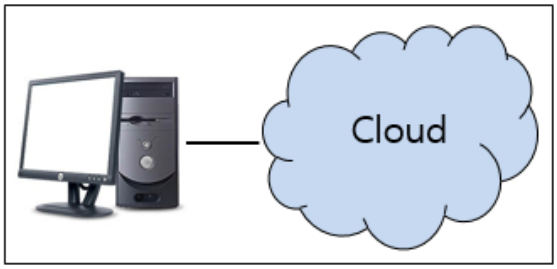

Figure 5: Off-premise Service Environment

Recent IT environments are different from traditional development project management system. Using SaaS or Cloud Computing to connect data-centers, hosting or cloud to the network. The trend is proceeding the Agile Process in the off-premise of running the software remotely.

The following [Figure 6] is New-ICT management model.

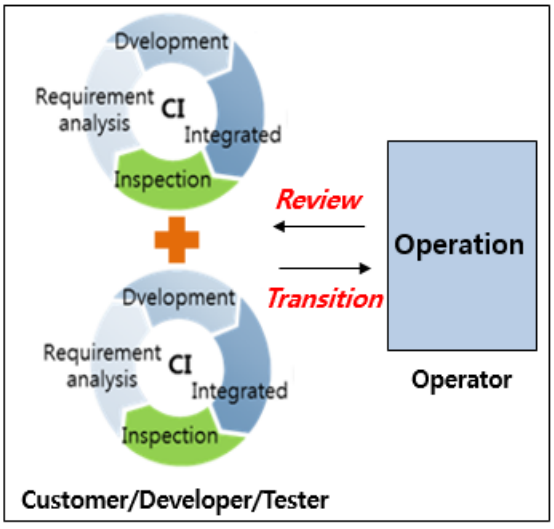

Figure 6: New-ICT management model

Develop and test the project for a short period based on the priority of Task. And periodically, customers, developers, tester, QA work together and share. There is the advantage of minimizing the problems caused by the Waterfall process and saving the project Life Cycle Time.

2.4 Difference between the New-ICT process and the Traditional process

The following [Table 1] is difference between the New-ICT process and the traditional process management model.

Table 1: Difference between the New-ICT process and the traditional process

Division	Traditional process	New-ICT process
Plan	· Fixed range	· Fluid range
Development and Test	· Stepwise execution	· Iteration unit operation
Process	· Defined processes · Standardize, Objectification	· Heuristic process · Flexibility, Simplified, Cyclical
Work flow	· Command and control led by the manager · Work execution with personal responsibility	· Self-organizing Team-management · Work execution with team share responsibility
Organization	· Function oriented · Specialization and Role limitation	· Functional mixing · Multi role
Team management	· Indication, Surveillance, Competition	· Coaching and Facilitation, Cooperation
Evaluation	· Higher administrator assessment · Relative evaluation	· Multiple evaluation · Absolute evaluation
Success measure	· Planning compliance	· Delivering customer value

There are a lot of different ways development goals, methods and team managements. The advantages and disadvantages of traditional processes and agile processes need to be properly utilized when applying a practical project according to In-house or Out Sourcing.

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3. CLOUD BASED NEW-ICT PROJECT MANAGEMENT

3.1 New-ICT Management Triangle

The following [Figure 7] is New-ICT management Triangle. The traditional project management, the left triangle, consists of 'Scope', 'Schedule', and 'Cost'. The left triangle fix 'Scope' and plan 'Cost', 'Schedule'. But if requirements are changed, fix 'Schedule' and readjust priority of 'Scope'.

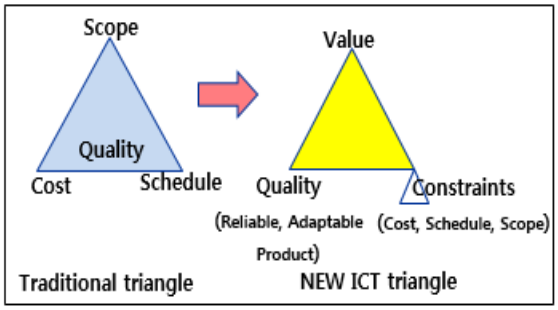

Figure 7: New-ICT Management Triangle

New-ICT Project Management is fixed 'Schedule', and allow changes in 'Scope'. This means Time is fixed constraint. The measured value are Value(to the Customer), Quality(Required to deliver continuous value to the customer), Constraints(Scope, Schedule, and Cost). Although constraints are still important factor in the project, but it is not the goal. Value is goal, and constraints can be adjusted for customer value[17].

The following [Table 2] is New-ICT Triangle

Table 2: New-ICT Triangle

Goal	Descriptions
Value goal	· Build a releasable product
Quality goal	· Build a reliable, adaptable product
Constraint goal	· Achieve value and quality goals within acceptable constraints

3.2 New-ICT Management Life Cycle

The management of New-ICT project proposed by this report aims to select the lifecycle model for the project to facilitate project management. For example, utilizes 'Sprint' as a unit of activity related to task management and 'Milestone' as a unit of constant management. The proposed project management Life Cycle Model consists of Pure Repeat Life Cycle Model which are appropriate for developing a small new solution, Hybrid Repeat Life Cycle Model which are appropriate for developing a medium and Waterfall Repeat Life Cycle Model which are appropriate for developing a Large Next Generation Project. AS a result, Decisions for managing project management are made up of SW Life Cycle, Milestone(Sprint) and Task Management.

3.2.1 Pure Repeat Life Cycle

The following [Figure 8] is a pure repeat life cycle.

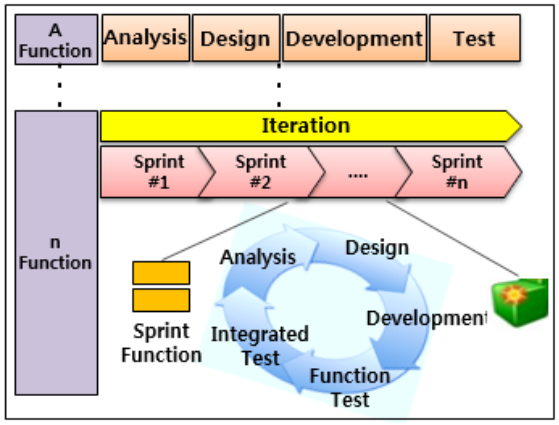

Figure 8: Pure Repeat Life Cycle

Pure Repeat Life Cycle Model is a suitable for developing new solutions that are low safety and highly functional change

3.2.2 Hybrid Repeat Life Cycle

Hybrid Repeat Life Cycle [Figure 9] Model is a suitable for developing of operational systems that are confirmed More than 50 % of the requirements in advance and ordinary functional change

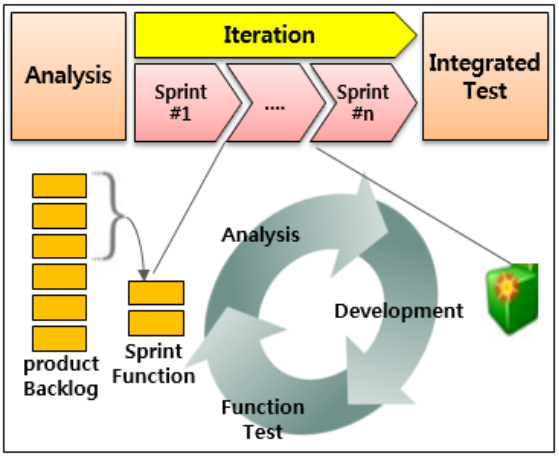

Figure 9: Hybrid Repeat Life Cycle

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3.2.3 Waterfall Repeat Life Cycle

Waterfall Repeat Life Cycle [Figure 10] Model is suitable for developing next-generation systems that require high levels of scale, period, management, and inspection of the outputs.

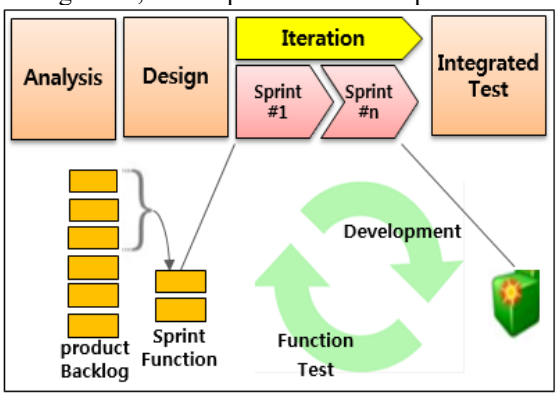

Figure 10: Waterfall Repeat Life Cycle

3.3 New-ICT Management Methodology

It is very difficult to apply agile methodologies, if there is no major reform to prevailing idea in traditional development project[18][19][20]. This Methodology is organized for various factors, such as management, organization maturity, development speed, technical level, management capabilities and services that aims to effectively combine the traditional development process and the agile development Process(Representative XP, Scrum) to better align with New-ICT[21],[22].

3.3.1 Methodology Main Process Map

The following [Figure 11] is Main Process Map of Methodology showing all levels process of New-ICT SW Life Cycle.

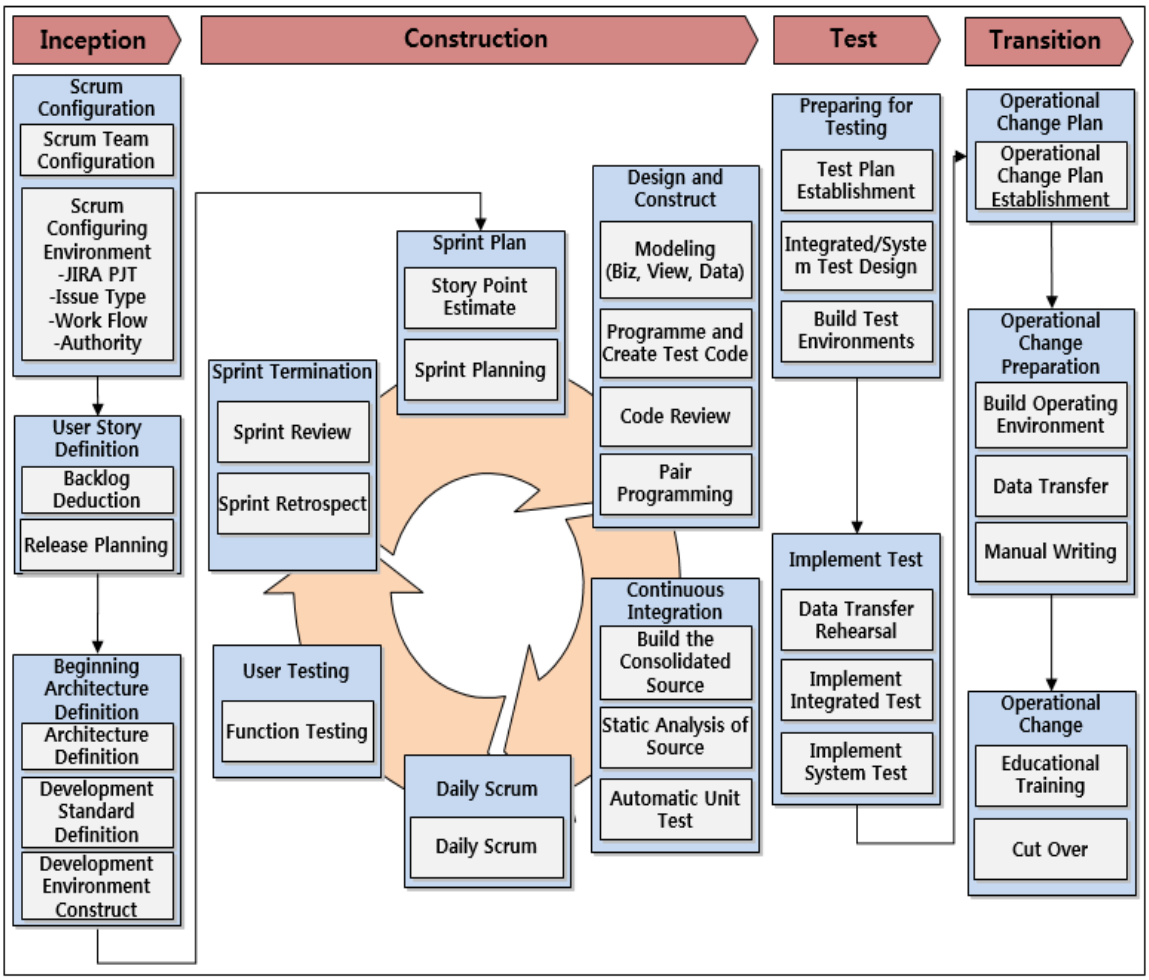

Figure 11: Methodology Main Process Map

The key of methodology proposed by thesis is that the combination of traditional processes and agile practices to fit the New-ICT development environment.

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The traditional development organizational model and Scrum Process reflected Software Development Life Cycle optimized for the New-ICT development environment.

3.3.2 Preparation and Inception Phase

The following [Table 3] lists the start-up 5 steps to perform the project. And it defines Team Members' Briefing Meeting, Determine Application Options, Scrum Configuration, User Story Definition and Beginning Architecture Definition.

Table 3: Inception Phase

Phase	Practices	Descriptions
Team Members' Briefing Meeting	· Team Members' Briefing Meeting	· Explain to The Team Members for Process, in Advance
Determine Application Options	· Determine Application Options	· Life Cycle Model Selection
Scrum Configuration	· Scrum Team Configuration	· Organization Settings (Team composition, Organizational information)
		· Project Manager
	· Configuring Scrum Environment	· Register Project
		· Issue Type Selection
		· Work Flow Setting
		· Authority Setting
User Story Definition	· Backlog Deduction	· Draw Up A Backlog List of Epic and Story
	· Release Planning	· Develop Plans to Release According to The Roadmap of Products
Beginning Architecture Definition	· Architecture Definition	· Architecture Definition
	· Development Standard Definition	· Define The Standards Required for Development
	· Development Environment Construct	· Build Up A Suitable Environment for Development

3.3.3 Construction Phase

The following [Table 4] is Construction Phase. It should establish a sprint schedule and decide work plan in the sprint, in consideration of the product roadmap, priority, personnel and team velocity.

Table 4: Construction Phase

Phase	Practices	Descriptions
Sprint Plan	· Story Point Estimate	· It tells volumes of the Story(Issue, Task), and possible the checking velocity of progress during the sprint
	· Sprint Planning	· Establish project plan within each sprint period by measuring priorities and volumes of backlogs
Design and Construct	· Modeling (Biz, View, Data)	· Modeling data and process about function
	· Programming and Create Test Code	· Implement coding and unit test about function
	· Code Review	· Improve the quality of work with colleague review
	· Pair Program	· Two or more programmers use coding together
Continuous Integration	· Build the Consolidated Source	· Implement tool-setting and automation-work to provide configuration, build, and release management for continuous integration
	· Static Analysis of Source	· Eliminate potential defects and induced to improvement of source quality through automation of unit test and visualization of development quality
	· Automatic Unit Testing	· Implement regression test automatically through the unit test
Daily Scrum	· Daily Scrum	· It is standup meeting to share the progress of the current project and identify the fault elements every day
User Testing	· Function Testing	· It is an activity to test whether or not to complete DoD of story or task within a sprint
Sprint Termination	· Sprint Review	· It is a meeting that verifies the progress and outcome of the sprint goal.
	· Sprint Retrospect	· It is that continues improve processes meeting make sure that there is no problem with the procedure within a sprint

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3.3.4 Test Phase

The following [Table 5] is Test Phase. This Phase is the stage for test preparation and conducting test after the construction phase.

Table 5: Test Phase

Phase	Practices	Descriptions
Preparing for Testing	· Test Plan Establishment	· Establish test plan
	· Integrated/System Test Design	· Definition of integrated test, system test, scenario and case
	· Build Test Environments	· Build up environment for Test
Implement test	· Data Transfer Rehearsal	· Data transfer for Test
	· Implement Integrated Test	· Implement Integrated Test
	· Implement System Test	· Implement System Test

3.3.5 Transition Phase

The following [Table 6] is Transition Phase. As a step toward switching the development system into operation, it is phase to hand over the system, documentation and training to operators.

Table 6: Transition Phase

Phase	Practices	Descriptions
Operational Change Plan	· Operational Change Plan Establishment	· Prepare all details in the form of checklist for operational change
Operational Change Preparation	· Build Operating Environment	· Build operating environment
	· Data Transfer	· Data transfer
	· Manual Writing	· User manual, operator manual, system manual preparation
Operational Change	· Educational Training	· Training for actual users
	· Cut Over	· Close a project

3.4 New-ICT Management Model and SW Development Project

3.4.1 New-ICT Management Model

The following [Figure 12] is New-ICT Management Model. This model is defined as the hybrid form mixed traditional SI development process and agile development process. This is based on contract with client and the way you work depends on the agile process.

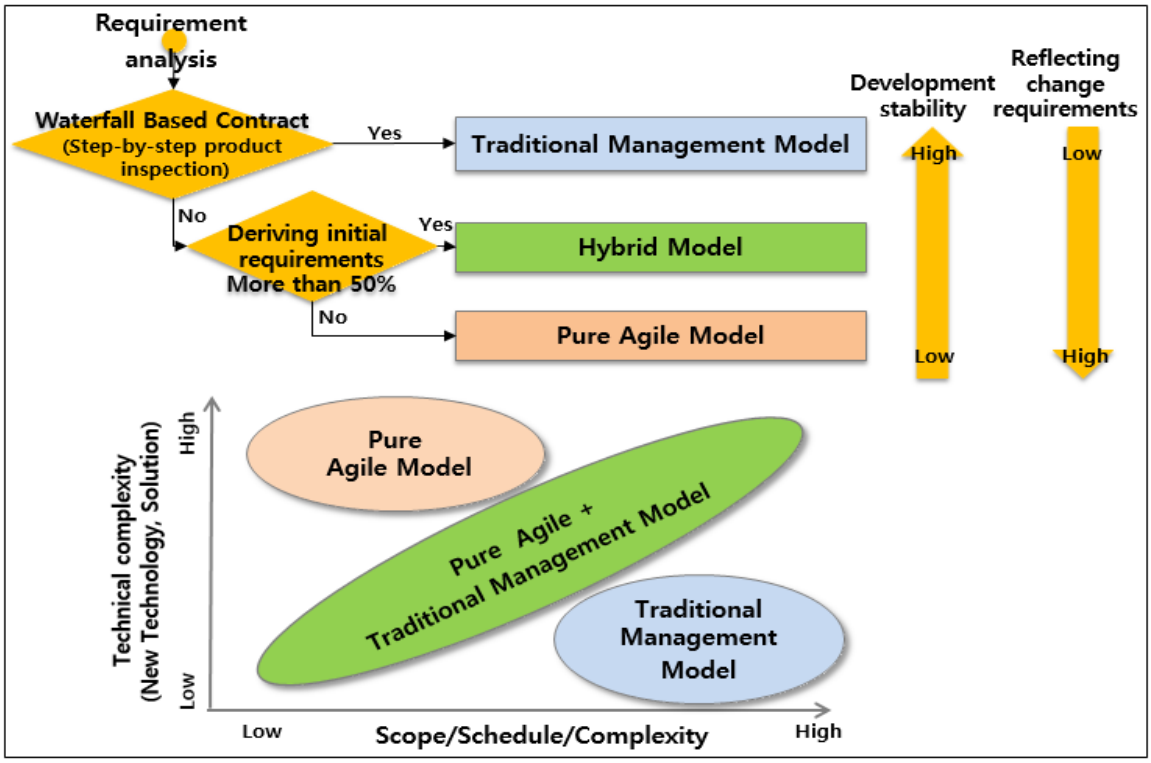

Figure 12: New-ICT Management Model

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3.4.2 The Relation between New-ICT Life Cycle and SW Development Project

Project Management Model proposed by the thesis defines the relationship between program and project through the linking New-ICT methodology and Life Cycle Model. Project refers to management aspects. To create Top Down project through the correlation between project and phase as model for sprint management and task management. And it can generate multiple projects and sprint.

The following[Figure 13] shows relationship between New-Life Cycle and SW development project.

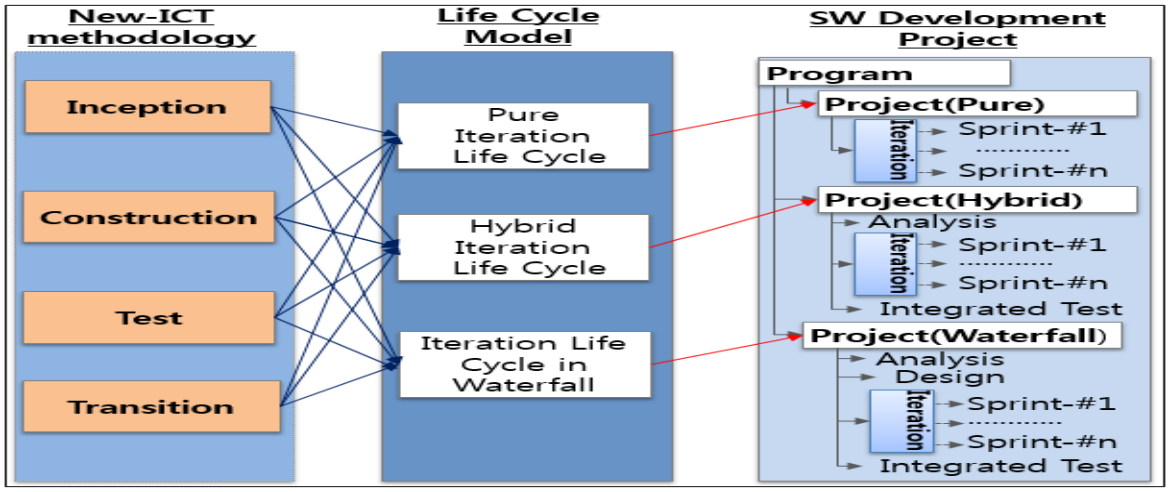

Figure 13: Relationship between New-ICT Life Cycle and SW development project

One program has multiple projects, and one project can generate multiple sprint. One sprint has multiple task, and there are many processes in one task. Users share the progress of the project and quickly register, receive, and resolve problems arising from project implementation. And it support the process and make rapid decisions on changing the variety of requirements.

4. MODEL DESIGN AND DEVELOPMENT

This stage describes implementation of New-ICT methodology, Life Cycle Model and Linked Project Management Model previously defined. This is developed in the Cloud Based Web Environment, which can be used anywhere and anytime, so accommodates PMBOK and basic process of agile development with thorough analysis of new environments and requirements, etc.

4.1 Scope and Process of Design

The following [Table 6] are divided into four sections as the scope of design. This is separated areas that Requirements Management, Schedule Management that integrates task management, DashBoard that manages project status in real time and provide basic information for communication.

Table 6: Basic Functions of Management Tools

Function	Descriptions
Requirements Management	• Easy to change the need for sustained requirements • Manage requirements by task type (Feature, Epic, Task, Bug) • Flexibly respond to requirements
Schedule Management	• WBS management in project development Life cycle units • Progress management by project Phase units, Feature units, Sprint units. • Progress status and delay management by user. • Quick decision management using Burn Down/Up charts.
DashBoard	• Real-time information on processes and risks status • Monitor workload fluctuation • Milestone Performance Management
Quality Control	• Manage productivity based on story point estimation in the Sprint Unit • Estimate the performance of individual units by managing velocity trends and estimates
Link	• Traditional management process with organic connections • Link to portfolio management, link to quality management

The following [Figure 14] is schematic function and structure of a function to implement the basic functions as a management system.

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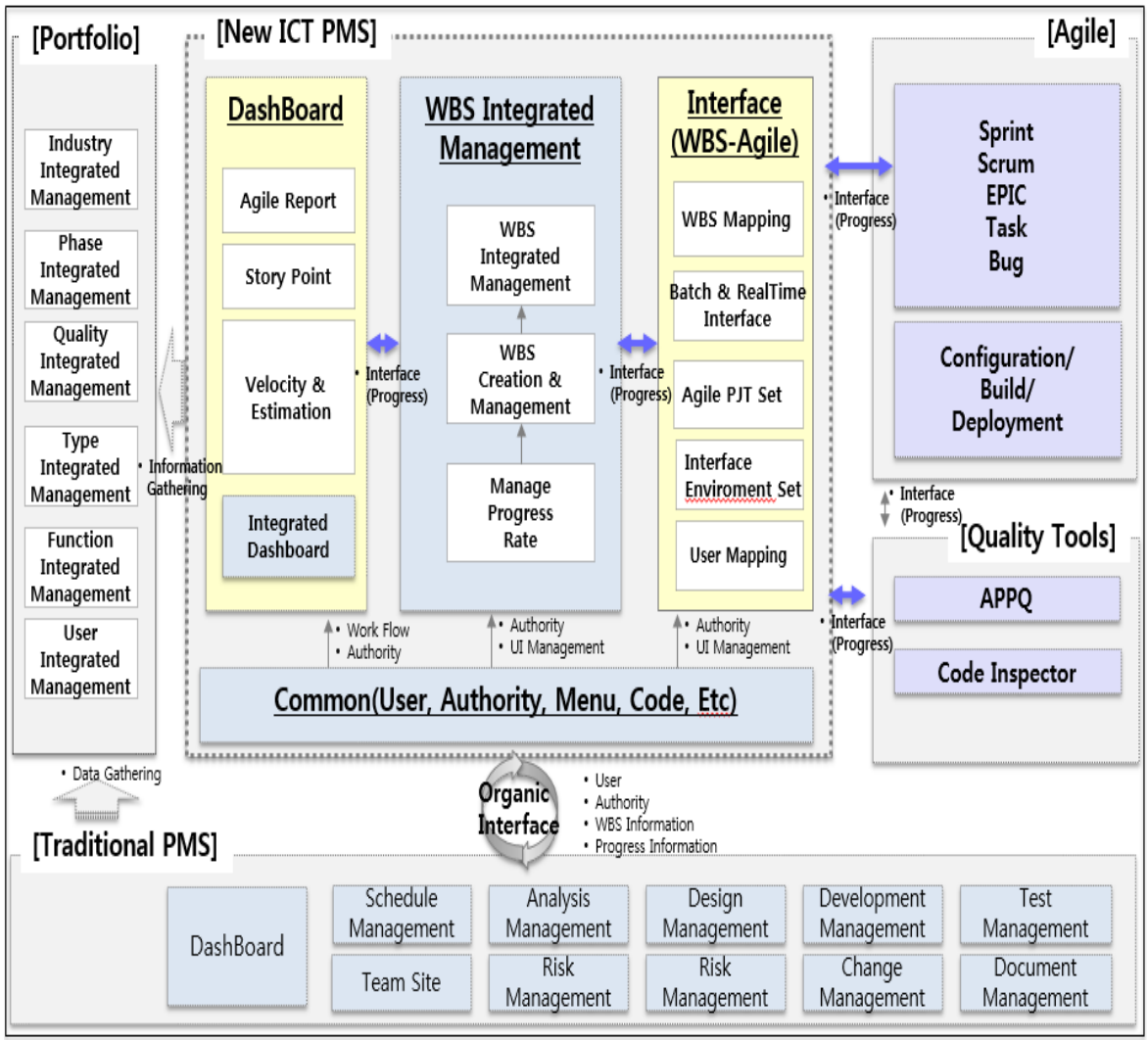

Figure 14: NeW-ICT Function concept diagram

4.2 Describe the Basic Functions of Management

The key function of implementing seamless communication system is in the management of projects integrated into the project. Systematic project management is essential to

This screen collects and summarizes the task to share the effective requirements among project stakeholders. In addition, it can be managed from various perspectives and monitored for registration and progress. Each function has an standardization of data based on the standard process considering the characteristics of the task.

4.2.1 Requirements Management Systems and Functions

The following [Figure 15] is requirements management systems and functions screen. internal process and is systematically managed, including the task registration and output, export, import, delivering templates, and requirement tracking.

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Agile Work List (65)

Sub-System	Agile Link Tarç	Job Name	Agile Wo	Priority	Story Po
Agile Type of Work	To assign a group, drag and drop the column name here.				
Bug					
Pure-Agile Dev.(DevOps Link)		Op. Server Manager Account Escalation a	Closed	Highest	
Story					
Pure-Agile Dev.(DevOps Link)	PMS OP. / Dev.	Agile PMS-Agile Check List Liked to Relea	Closed	High	5
Pure-Agile Dev.(DevOps Link)	PMS OP. / Dev.	Modify the Agile Project Dashboard UI	Closed	Medium	1
Pure-Agile Dev.(DevOps Link)	PMS OP. / Dev.	Agile Configuration Management -Progr	Closed	Medium	1
Pure-Agile Dev.(DevOps Link)	PMS OP. / Dev.	Application of Grid Individual Cache in Ta	Closed	Medium	0
Pure-Agile Dev.(DevOps Link)	PMS OP. / Dev.	Schedule Management(WBS Lookup)-Sta	Closed	Medium	1
Pure-Agile Dev.(DevOps Link)	PMS OP. / Dev.	Manage Agile Settings-Agile Linkage Ma	Closed	Medium	2
Pure-Agile Dev.(DevOps Link)	PMS OP. / Dev.	Schedule Management(WBS Lookup)-Ag	Closed	Medium	1
Pure-Agile Dev.(DevOps Link)	PMS OP. / Dev.	Manage Agile Settings-Improve Collabor	Closed	Medium	3
Pure-Agile Dev.(DevOps Link)	PMS OP. / Dev.	Schedule Management(WBS Lookup)- W	Closed	Medium	3
Pure-Agile Dev.(DevOps Link)	PMS OP. / Dev.	SKT SOC-> mpms Data Migration Develo	Closed	Medium	20
Pure-Agile Dev.(DevOps Link)	PMS OP. / Dev.	Scheduling(Start)-Checking Duplicate Co	Closed	Medium	1

Figure 15: requirement registration and managing

4.2.2 Schedule Management System and Functions

Once the scale estimates and the story point are established, assign and manage the task, considering the priority of the task after setting WBS(Sprint Planning) to link the Release Pan(major milestone) and the Product Back Log(Business classification) with the scope of the Project Life Cycle. The following [Figure 16] is project integration progress management process.

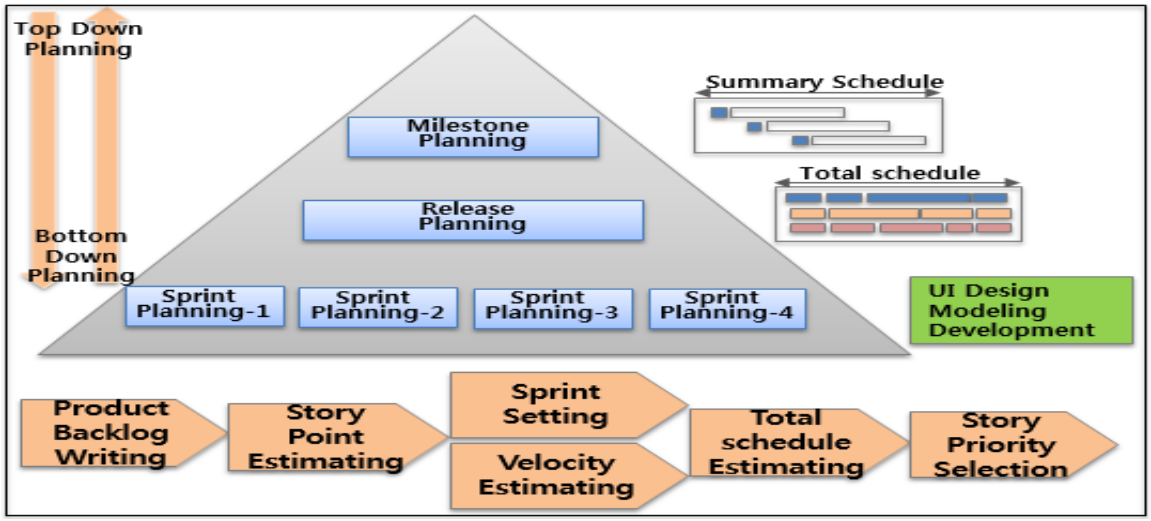

Figure 16: Planning Associations and procedures

The following [Figure 17] is screen that can be scheduled regularly for certain periods of time.

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Progress Rate List

Project/ SubSystem	Manager	Weight	Last Week 17.10.13.(Fri)				Last Week 17.10.13.(Fri)				Next Wee
			Plan	Result	Achieve Rate	Difference	Plan	Result	Achieve Rate	Difference	Plan
AgilePMS Dev/Imp	pms	100.00%	46.16%	36.83%	79.78%	-9.33%	49.61%	36.90%	74.39%	-12.71%	52.94%
Pure-Agile Dev	pms	30.00%	62.22%	64.75%	104.07%	2.53%	65.00%	65.00%	100.00%	0.00%	68.57%
Hybrid-Agile Dev	pms	30.00%	39.25%	23.00%	58.60%	-16.25%	43.31%	23.00%	53.11%	-20.31%	47.38%
Waterfall-Agile Dev	pms	30.00%	44.75%	31.00%	69.27%	-13.75%	48.19%	31.00%	64.33%	-17.19%	51.63%
Project Mgmt.	pms	5.00%	45.95%	24.08%	52.40%	-21.87%	53.24%	24.08%	45.23%	-29.16%	53.24%

Figure 17: Project integration Progress Management

4.2.3 Real Time Integration Management Using DashBoard

The following [Figure 18] is Project integration dashboard. Managing risks and managing progress using DashBoard is a function of providing real-time information and integrated management.

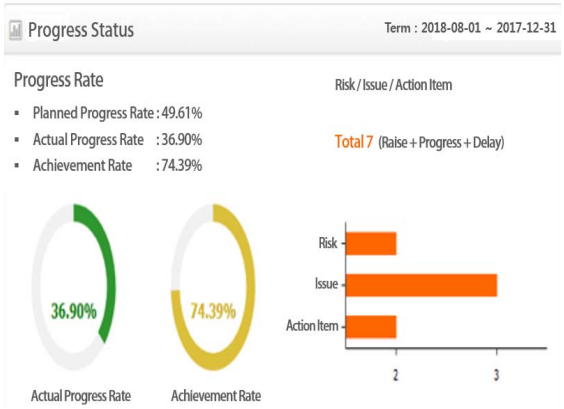

Figure 18: Project integration DashBoard

The following [Figure 19] is Velocity & Estimating DashBoard. Story point is the number used to calculate the magnitude of the requirement (Story) considering complexity, risk, and size.

The sum of the backlog story points performed during the duration of the sprint period means the workload that was treated during the project period.

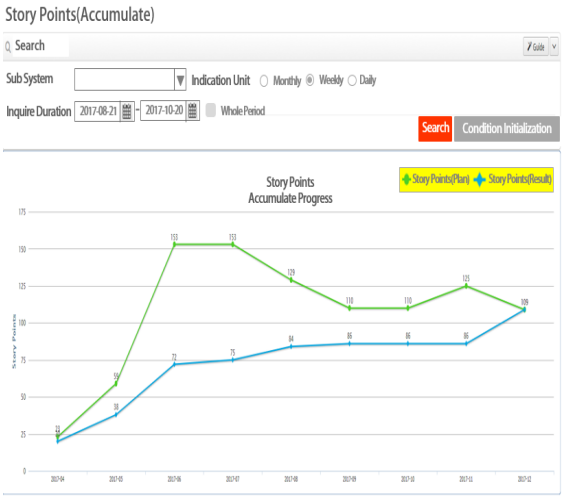

Figure 19: Velocity & Estimating DashBoard

5. NEW-ICT PROJECT MANAGEMENT SYSTEM EVALUATION

Based on the design of the proposed management tools, build up system and apply to a project in progress. Then analyze differences by comparing them with existing management methods. In particular, the validity of management tool is verified through performance of management, identification and measurement of changes in the way.

5.1 Performance of Integrated Management

The following [Table 7] is project management objective. This is project performance by proposed management tool compared to schedule management, collaboration, quality aspects item from project management object of PMBOK[23] and Software Engineering[24].

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Table 7: Project Management Object

Subject	Category	Subject	
		Manager	Developer
All	· Transparency in schedule/ quality management · Communication	↑	↑
Schedule Management Aspect	· Progressive management transparency	↑	↑
	· Project Forecast	↑	↑
	· Project Over Time		↑
Collaboration Aspect	· Communication efficiency	↑	↑
	· Document preparation time		↑
	· Self-level co-operation		↑
Quality Aspect	· Implement Customer Value	↑	↑
	· Early Detection of Defects	↑	↑
	· Defect Processing Rate	↑	↑

The proposed management tools provide a clear view of the progress of the work. The defects in the release phase have decreased by 30 % and the efficiency and productivity of the development process has increased by more than 20 %.

5.2 Change in The Way of Working

The following [Table 8] is a way of thinking of losing. Rather than simply attempts to implement a tool or process, a paradigm shift in people's mindset is needed. Wisdom is needed to choose the right method depending on the nature of the project and the nature of the organization.

Table 8: The way of thinking

Item	Description
Self-directed execution culture	· Team member-led results review and retrospective · Prioritize performance based on repeated cycles.
Communication and Collaboration culture	· Sharing and actively solving problems · Real-time information sharing and tracking management
Efficiency culture	· Progress automation in connected with agile · Minimize reporting by using real-time dashboards
Continuous improvement culture	· Priority-oriented small execution · Systems that continue to grow and improve

6. CONCLUSION AND FUTURE DIRECTIONS

By integrating the advantages of the traditional SW development process and the advantages of the NEW-ICT SW development process, we have implemented the Hybrid SW development process to solve the existing problems. Although the process is important in real application to the project, the development culture must also change before the Hybrid SW development process can be settled.

Currently, the majority of the development projects are managed and operated with traditional service environments and processes. Owing to the unstructured models and tools, interoperability between the systems is degraded within the organization.

Hence, I Offers cloud-based integrated management system to enable heterogeneous data exchange with the management model and processes appropriate for the period of time for the upcoming New-ICT implementation. These proposed models has not only the effect of using many development platforms and external services but also, Testing and Staging Server can be infinitely provided and synchronize development work at the same time. In terms of security and usability, research needs to be continued continuously in the future. The integrated management model is needed that is considered to be operational and developmental without limitation on development projects within the organization.

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