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**Doctoral Thesis**

**Effects of Quality Management Measures Based on the Use of Project Management  
Information System for Project Management Success of ERP Implementation**

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Division of Systems Science and Informatics  
Graduate School of Information Science and Technology  
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Doctor of Philosophy

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# **Effects of Quality Management Measures Based on the Use of Project Management Information System for Project Management Success of ERP Implementation\***

Atsushi Taniguchi

## **Abstract**

Recent research has provided an application with the use of Project Management Information Systems (PMIS) for such implementations in improvement of Quality Management Systems (QMS) requirements.

Due to the findings of an extensive literature review, the case study method was used for evaluation of the effects of the three quality management (QM) measures selected for this research for continuous improvement of quality in project management based on the use of PMIS, “the effects of quality improvement of PMIS output information”, “the effective use of PMIS to initiate the project quality gate process”, as well as “the effective reuse of lessons learned to conduct the quality audit”.

For the QM measure to improve quality of PMIS output information, this article is to discuss how the continuous quality improvement based on the plan-do-check-act cycle was conducted on the reporting quality of the project status report from project management information system generated by the project managers, for achieving project management success in ERP (Enterprise Resource Planning) projects implemented by a solution provider for their customers in the various industries in Japan. The results of the study, based on the scorecard data taken from the nine target projects which went live during the period of nine months from

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January 2017 to September 2017, indicate that the continuous improvement on the reporting quality of PMIS was found to be effective in achieving quality of PMIS output information to help managers in decision making, planning, organizing and controlling the project. It was also found to be effective in positively influencing achievement of project management success in terms of respecting the time, cost and quality.

For the QM measure to initiate the quality gate process, this article describes how PMIS was used to implement the project quality gate process for ERP implementation projects conducted by the solution provider for their customers in the various industries in Japan. The results of the study, based on the quality gate control list data maintained in PMIS for the four projects which were due for the project quality gate reviews to be conducted during the month of April 2017, indicate that PMIS was found to be effective in identifying, notifying and influencing the project managers to timely initiate the quality gate process based on the schedule fixed for each quality gate review as all the four quality gate reviews were accepted and completed in time.

For the QM measure to have lessons learned collected for the reuse, this article describes the systematic approach to initiate the project review on the specific project identified for requiring the formal quality audit based on the use of PMIS for having the execution date fixed by the independent quality reviewer with the project manager. Then, the project review process is started by retrieving the lessons learned data from the lessons learned repository, which were collected from the previous project reviews for the relevant ERP implementation projects, for the preparation of conducting the project document review and project stakeholder interviews. A case study methodology was applied to the historical lessons learned data of the ERP implementation projects conducted by the solution provider for their customers in the various

industries in Japan, which were retrieved for the period of four years from 2014 to 2017 to analyze how the lessons learned collected from the project reviews of the earlier projects were reused in those of the succeeding projects conducted during the period. Use of lessons learned based on the past project review results was found to be effective in focusing on the specific areas projected for improvement during the processes of conducting the project document review and project stakeholder interviews, as well as putting together the practical recommendations for the findings to finalize the results of the project review, which were to be formally presented and submitted to the customer as the results of the quality audit.

In conclusion, for all the three QM measures, PMIS was found to be effective to improve QMS requirements and positively influence project management success in terms of time, cost and quality.

Keywords: Project Management Information System, Quality Management System, Quality Management Measures, Continuous Improvement, PDCA Cycle, KPIs, Scorecard, Project Quality Gates, Project Management Success, ERP, Independent Quality Reviewer, Solution Provider, Lessons Learned, Project Reviews, Quality Audit.



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## List of Publications

1. Atsushi Taniguchi, Masahiko Onosato, "Use of Project Management Information System to Initiate the Quality Gate Process for ERP Implementation," *International Journal of Information Technology and Computer Science (IJITCS)*, 2017, Vol. 9, No. 12, 1-10. DOI: 10.5815/ijitcs.2017.12.01
2. Atsushi Taniguchi, Masahiko Onosato, "Effect of Continuous Improvement on the Reporting Quality of Project Management Information System for Project Management Success," *International Journal of Information Technology and Computer Science (IJITCS)*, 2018, Vol. 10, No. 1, 1-15. DOI: 10.5815/ijitcs.2018.01.01
3. Atsushi Taniguchi, Masahiko Onosato, "Effective Use of Lessons Learned to Conduct the Project Review for ERP Implementation," *International Journal of Information Technology and Computer Science (IJITCS)*, 2018, Vol. 10, No. 5, 1-15. DOI: 10.5815/ijitcs.2018.05.01



## **Chapter 1. Introduction**

This opening chapter provides the background and motivation for conducting the research based on the literature review, the stakeholders involved in this research, the research methods and objectives along with the glossary of industry-specific terminology used in the case studies and introduces the organization of this thesis.

### **1.1 Background and Motivation**

Non-conformance to quality in a project often can lead to a major reason for project failure resulted in not meeting the triple constraints of project management, scope, time and cost. To prevent it from occurring, a quality check against the standard for quality needs to be conducted without fail at the critical stages of ERP (Enterprise Resource Planning) implementation project. However, getting the schedule of each required quality check timely fixed by the independent quality reviewer with the project manager of a newly started project can often be problematic without having a systematic approach implemented.

### **1.2 Literature Review and Purpose of Research**

Project management success is defined that it focuses upon the project process and, in particular, the successful accomplishment of cost, time, and quality objectives. It also considers the manner in which the project management process was conducted [1]. The recent study result has indicated that the quality of PMIS (Project Management Information Systems) output information is positively and significantly related to PMIS application and project management

factors as it helps managers in decision making, planning, organizing and controlling the project [2]. PMIS were also found to have direct impacts on project success, as they contribute to improving budget control and meeting project deadlines as well as fulfilling the technical specifications [3].

Recent research has provided an application with the use of Project Management Information Systems (PMIS) for such implementations in improvement of Quality Management Systems (QMS) requirements [4]. Synergies between the PMIS (or IS) and the QMS according to ISO 9001 standard [5], [6], allows the association between these two systems, so that the PMIS can support and influence the processes related to the QMS, not only limited to the collection and documentation management [7].

To date, much of the research and industry focus has been on capturing lessons learned from the projects. However, even if lessons learned are successfully captured, there are still numerous problems to address in terms of their dissemination [8].

Due to the findings of an extensive literature review, effects of the three quality management (QM) measures [9] for continuous improvement of quality in project management based on the use of PMIS for project management success below were selected for the target of this research.

- *QM measure 1*: “Effects of Continuous Improvement of Reporting Quality based on the Monthly PDCA Cycle on PMIS for Project Management Success” [10] which is the QM measure conducted based on the PMIS output information review.
- *QM measure 2*: “Effective Use of PMIS to Initiate the Project Quality Gate Process for Continuous Improvement” [11] which is the QM measure conducted based on the project management document review triggered by the use of PMIS.

- *QM measure 3*: “Effective Reuse of Lessons Learned to Conduct the Quality Audit based on the Use of PMIS for Continuous Improvement” [12] which is the QM measure conducted based on the project management document review as well as project stakeholder interviews triggered by the use of PMIS.

### 1.3 Stakeholders Involved in this Research

Table 1.1 shows all the stakeholders involved in the respective QM measures of this research.

Table 1.1. Stakeholders Involved by QM Measure

Stakeholders Involved		QM Measure 1	QM Measure 2	QM Measure 3
Independent Quality Reviewer	Solution Provider	X	X	X
Project Manager	Solution Provider	X	X	X
Delivery Manager	Solution Provider	X	X	X
Head of Delivery Organization	Solution Provider	X	X	X
Key Project Stakeholders	Solution Provider	-	-	X
Project Manager	Customer	-	-	X
Project Sponsor	Customer	X	-	X
Key Project Stakeholders	Customer	-	-	X

### 1.4 Research Methods and Objectives

The case study method was used for evaluation of the effects of the three QM measures selected for this research for continuous improvement of quality in project management based on the use of PMIS, “the effects of quality improvement of PMIS output information”, “the effective use of PMIS to initiate the project quality gate process”, as well as “the effective reuse of lessons learned to conduct the quality audit”.

Project management information systems (PMIS) have their proven position as an effective tool for achieving project management success in terms of the successful realization of the project regarding time, cost and quality. Recent research results have indicated that quality of

project management information system output information is positively and significantly related to project management information system application and project management factors and revealed the empirical support [2]. However, getting the reporting quality of the project status report, monthly generated from the project management information system based on the information timely maintained by the project managers, responsible for ERP implementation up to the satisfactory level at any time, can be problematic without having a systematic approach implemented. For the QM measure to improve quality of PMIS output information, this article is to discuss how the continuous quality improvement based on the plan-do-check-act cycle [13-14] was conducted on the reporting quality of the project status report from project management information system generated by the project managers, for achieving project management success in ERP projects implemented by a solution provider for their customers in the various industries in Japan. The results of the study, based on the scorecard data taken from the nine target projects which went live during the period of nine months from January 2017 to September 2017, indicate that the continuous improvement on the reporting quality of project management information system was found to be effective in achieving quality of project management information system output information to help managers in decision making, planning, organizing and controlling the project [2]. It was also found to be effective in positively influencing achievement of project management success in terms of respecting the time, cost and quality [15].

Proactive quality management by the quality gate process is embedded in the implementation methodology to help secure quality outcomes for the customers. However, getting the schedule of each quality gate timely fixed by the independent quality reviewer with the project manager of a newly started project can often be problematic without having a

systematic approach implemented. For the QM measure to initiate the quality gate process, this article describes how the project management information system (PMIS) was used to implement the project quality gate process for ERP implementation projects conducted by the solution provider for their customers in the various industries in Japan. The results of the study, based on the quality gate control list data maintained in PMIS for the four projects which were due for the project quality gate reviews during the month of April 2017, indicate that PMIS was found to be effective in identifying, notifying and influencing the project managers to timely initiate the quality gate process based on the schedule fixed for each quality gate review.

According to a recent study [16], it has been said that “lessons learned” is one of the most important and “value added” aspects of the project management lifecycle. However, it has been reported that it is often the most ignored part of finishing a project. Various reasons have been offered for this phenomenon. For the QM measure to have lessons learned collected for the reuse, this article describes the systematic approach to initiate the project review on the specific project identified for requiring the formal quality audit based on the use of project management information system for having the execution date fixed by the independent quality reviewer with the project manager. Then, the project review process is started by retrieving the lessons learned data from the lessons learned repository, which were collected from the previous project reviews for the relevant ERP implementation projects, for the preparation of conducting the project document review and project stakeholder interviews. A case study methodology was applied to the historical lessons learned data of the ERP implementation projects conducted by the solution provider for their customers in the various industries in Japan, which were retrieved for the period of four years from 2014 to 2017 to analyze how the lessons learned collected from the project reviews of the earlier projects were reused in those of the succeeding projects conducted

during the period. Use of lessons learned based on the past project review results was found to be effective in focusing on the specific areas projected for improvement during the processes of conducting the project document review and project stakeholder interviews, as well as putting together the practical recommendations for the findings to finalize the results of the project review, which were to be formally presented and submitted to the customer as the results of the quality audit.

### **1.5 Glossary of the Industry-Specific Terminology Used in the Case Studies**

This section comprises the industry-specific terminology used in the case studies. The following are the relevant key terms:

***Project Management Information System:*** Project management information system (PMIS), which is part of enterprise environmental factors, provides access to information technology (IT) software tools, such as scheduling, cost, and resourcing software tools, work authorization systems, configuration management systems, information collection and distribution systems, as well as interfaces to other online automated systems such as corporate knowledge base repositories. Automated gathering and reporting on key performance indicators (KPIs) can be part of this system [17].

***Quality Management System:*** A quality management system (QMS) is a formalized system that documents processes, procedures, and responsibilities for achieving quality policies and objectives. A QMS helps coordinate and direct an organization's activities to meet customer and regulatory requirements and improve its effectiveness and efficiency on a continuous basis. ISO 9001:2015 is by far the most recognized and implemented quality management system standard in the world. ISO 9001:2015 specifies the requirements for a QMS that organizations can use to develop their own programs [18].

**Quality Management Measures:** Quality management ensures that an organization, product or service is consistent. It has four main components: quality planning, quality assurance, quality control and quality improvement [19]. Quality management measures are the measures to improve quality of the processes in project management.

**Continuous Improvement:** Continuous improvement involves at least three specific actions, communication, corrective action, identifying and acting on opportunities [19]. Communication is essential and it is the means of identifying problems and opportunities, resolving problems, and exploiting opportunities. The plan-do-check-act cycle provides a disciplined approach for continuous improvement based on either identified problems or opportunities.

**PDCA Cycle:** The plan-do-check-act (PDCA) cycle is a disciplined approach for providing continuous improvement based on either identified problems or opportunities [19].

**KPIs:** A key performance indicator (KPI) is an index used in measuring an individual's, organization's or institution's performance [20]. Key performance indicators (KPIs) are essential for monitoring and controlling the project performance in the industries.

**Reporting Quality KPI Scorecard:** A reporting quality KPI scorecard is a card for recording the scores of the relevant project managers as the results of reporting quality audit based on the KPIs on their respective project status reports generated from PMIS.

**Project Quality Gates:** Project quality gates described in this article are the quality management gates [21], [22] where targets, timeframes and deadlines are fixed for the project at the management level. Quality management gates are established for the decision-making process which will predict and control the outcome of the project with the desired quality [22].

***Project Management Success:*** Project management success is defined that it focuses upon the project process and, in particular, the successful accomplishment of cost, time, and quality objectives. It also considers the manner in which the project management process was conducted [1].

***ERP:*** Enterprise resource planning (ERP) is the glue [23] that binds together the different computer systems for a large organization. Typically, each department would have its own system optimized for that division's particular tasks. With ERP, each department still has its own system, but it can communicate and share information easier with the rest of the company [24].

***Independent Quality Reviewer:*** Independent Quality Reviewer is the quality reviewer who does not belong to the organization unit responsible for the project delivery of the solution provider.

***Solution Provider:*** Solution Provider is a service provider to provide their customers in the various industries in Japan with the project managers and project teams to conduct the ERP implementation projects on a contract basis.

***Lessons Learned:*** The latest PMBOK 6<sup>th</sup> Edition defines it in more detail as “the knowledge gained during a project which shows how project events were addressed or should be addressed in the future for the purpose of improving future performance [17].” Commonly used synonyms for lessons learned include project assessments, project reviews, project completion audits, postmortems, reviews, appraisals, after-action reviews, debriefings and post-implementation evaluations [25, 26].

***Project Reviews:*** Project Reviews are one of the commonly used synonyms for lessons learned [25, 26].

**Quality Audit:** An audit is structured, independent process used to determine if project activities comply with organizational and project policies, processes, and procedures [17]. A quality audit is usually conducted by a team external to the project, such as the organization's internal audit department, PMO (Project Management Office), or by an auditor external to the organization.

## 1.6 Structure of the Thesis

This thesis has been organized into six chapters and the coverage of chapters is described as follows:

- Chapter 1 “Introduction” presents the background and motivation for the research in Section 1.1, the purpose of research based on the literature review in Section 1.2, the stakeholders involved in this research in Section 1.3, the research methods and objectives in Section 1.4, the glossary of industry-specific terminology used in the case studies in Section 1.5, and the organization of this thesis in Section 1.6.
- Chapter 2 “Literature Review of PMIS and its Production Configuration” covers the literature review of PMIS on the core areas related to the research in Section 2.1, the production configuration of PMIS used in the respective case studies in Section 2.2, and all the users of PMIS concerned with the respective QM measures in Section 2.3.
- Chapter 3 “Effects of Continuous Improvement of Reporting Quality based on the Monthly PDCA Cycle on PMIS for Project Management Success” describes the overview (background, motivation and objective) of the research in Section 3.1, Section 3.2 reviews the works that are related to PDCA cycle, continuous quality improvement, KPIs, scorecards and their adoption. PDCA cycle based process of continuous improvement on the reporting quality of PMIS for ERP implementation

projects conducted by the solution provider is presented in Section 3.3. Results of continuous improvement on the reporting quality of PMIS are summarized in Section 3.4.

- Chapter 4 “Effective Use of PMIS to Initiate the Project Quality Gate Process for Continuous Improvement” describes the overview (background, motivation and objective) of the research in Section 4.1, Section 4.2 is related to the literature review of quality gates and its adoption. Use of PMIS to initiate the process of project quality gate reviews for the solution provider led ERP implementation projects by the independent quality reviewer is presented in Section 4.3. Summary of the case study is described in Section 4.4.
- Chapter 5 “Effective Reuse of Lessons Learned to Conduct the Quality Audit based on the Use of PMIS for Continuous Improvement” describes the overview (background, motivation and objective) of the research in Section 5.1, Section 5.2 reviews the works that relate to lessons learned definitions, lessons learned processes, a lessons learned session, commonly used synonyms for lessons learned and their adoption. Use of lessons learned effectively to conduct the project review for the ERP project carried out by the solution provider is presented in Section 5.3. Results based on the use of lessons learned from the past project reviews are summarized in Section 5.4.
- Chapter 6 “Conclusions and Future Work” presents the conclusions in Section 6.1 and the potential future work in Section 6.2.

## **Chapter 2. Literature Review of PMIS and its Production Configuration**

This chapter covers the literature review of project management information systems (PMIS) on the core areas related to the research, the production configuration of PMIS used in the respective case studies [10-12] conducted in 2017, and all the users of PMIS concerned with the respective QM measures.

### **2.1 Literature Review of PMIS**

PMIS, which is part of enterprise environmental factors, provides access to information technology (IT) software tools, such as scheduling, cost, and resourcing software tools, work authorization systems, configuration management systems, information collection and distribution systems, as well as interfaces to other online automated systems such as corporate knowledge base repositories. Automated gathering and reporting on key performance indicators (KPIs) can be part of this system [17]. PMIS provides a wide range of functions directly supporting a complex of a process involving various projects related activities: planning, monitoring, control and others [27]. In the IT industry, Gartner Research estimates that 75% of large IT projects managed with the support of a PMIS will succeed, while 75% of projects without such support will fail [28]. Using PMIS to manage projects, while not sufficient to ensure project success, has thus become a necessity [3]. The most appropriate PMIS configuration defined depends on the project situation [29]. Project situation requirements for PMIS have been identified accordingly to project classification [30] based on the project type, product, size, organization, management, planning approaches and related guidance, as well as

project environments and specific requirements, enterprise environment factors and organizational process assets [17]. Definition of the PMIS configuration requirements must include the following information [29] such as data entities or work items used in the project, attributes or data fields of each data entity and processes or workflows related to the data.

## 2.2 Production Configuration of PMIS Used in this Research

The configuration use case elements supported by the PMIS implemented for the use by the solution provider are shown in Table 2.1. It aims to provide the KPIs, risk registers and reports such as project financials in terms of earned value management (EVM) [17].

Table 2.1. PMIS Production Configuration Use Case Elements

Use Case	Elements	
Project Management	Project Identification	Key Project Information
	Project Classification	Contract Type (i.e. T&M, FFP), Quality Requirements, Governance
	Project Scope Description	Project Scope
	Management Summary	Status Reporting
	Status Indicators	Overall, Margin, Cost, Accounts Receivable, Schedule, Risks, Issues, Resources, Quality, Scope, Customer Satisfaction, Governance, Value Management
	Key Issues	Top Issues Reporting
	Key Risks	Top Risks Reporting
	Project Financials	Expenses (Bid Baseline / PM Baseline), Revenue (Bid Baseline / PM Baseline), Earned Value Management (EVM)
	Project Milestones	Performance Reporting
	Change Request	Change Request Management
	Issue List	Issue Management
	Risk Register	Risk Management
	Financial Contract	Plan (Man Days)
	WBS	Phases, Schedule, Milestones
	Roles w/ Assigned Tasks	Man Days by Resource
	Resources (Plan vs. Actual)	Budget Monitoring
	Contact List	Project Manager, Quality Manager, Sales
Authorization	Access Authorization Level	
Accounting	Plan, Actual, Revenue, Expenses, Billing, Backlog	
Portfolio Management	Reports	Online Portfolio Report, Change Request Report, Issue and Risk Report, Action Item Report, Financial Contract Report, Consolidated Financial Report, Portfolio Revenue Forecast Report, Solution Scope Report

It covers four types of delivery services provided by the solution provider based on the two contract types, time and material contracts (T&M) and firm fixed price contracts (FFP) [17], related to the ERP implementation projects and operations support to their customer in four major industry sectors in Japan. It also captures 100% of the contracts closed for the four

delivery services so that the performance of each project can be closely monitored for early detection of issues and risks and the project outcomes can be controlled at an early stage based on the appropriate corrective actions [17], [6] implemented ahead of time.

### 2.3 Users of PMIS Concerned with the Respective QM Measures

Lastly, all the users of PMIS concerned with the respective QM measures of this research are shown in Table 2.2.

Table 2.2. Users of PMIS Concerned with the Respective QM Measures

Users of PMIS		QM Measure 1	QM Measure 2	QM Measure 3
Independent Quality Reviewer	Solution Provider	X	X	X
Project Manager	Solution Provider	X	X	X
Delivery Manager	Solution Provider	X	X	X
Head of Delivery Organization	Solution Provider	X	X	X
Delivery Operations	Solution Provider	X	X	-
Financial Controlling	Solution Provider	X	-	-



## **Chapter 3. Effects of Continuous Improvement of Reporting Quality based on the Monthly PDCA Cycle on PMIS for Project Management Success**

This chapter describes the overview of the research and reviews the works that are related to PDCA cycle, continuous quality improvement, KPIs, scorecards and their adoption. PDCA cycle based process of continuous improvement on the reporting quality of PMIS for ERP implementation projects conducted by the solution provider is presented and the results of continuous improvement on the reporting quality of PMIS are summarized [10].

### **3.1 Overview**

Information is one of the most important capitals in the organizations, because all physical facilities and environmental decision making are affected by information [2]. In cases when product or service realization has been organized in the projects, one of the main information systems (IS) in the organization is a project management information system (PMIS) [4]. Similar to other IS, a successful PMIS should have individual impacts in terms of satisfied users and effective use [3]. However, a successful PMIS should also have organizational impacts [31], that is, impacts on project management success in terms of respecting the time, cost and quality. Project management success is defined that it focuses upon the project process and, in particular, the successful accomplishment of cost, time, and quality objectives. It also considers the manner in which the project management process was conducted [1].

The recent study result has indicated that the quality of PMIS output information is positively and significantly related to PMIS application and project management factors as it

helps managers in decision making, planning, organizing and controlling the project [2]. PMIS were also found to have direct impacts on project success, as they contribute to improving budget control and meeting project deadlines as well as fulfilling the technical specifications [3].

This article describes the case study on how an iterative process of continuous quality improvement [32], [33] based on the plan-do-check-act (PDCA) cycle [13], [14] was applied for getting the reporting quality of the project status report from PMIS generated by the project managers up to the satisfactory level using the key performance indicators (KPIs) [34] for evaluation measurement. The study was conducted for the set of ERP implementation [35], [36] projects carried out by a solution provider for their customers in the various industries in Japan. The set of projects was determined based on the following criteria that the solution provider is:

- To provide a project manager and project team
- To be responsible for providing particular results based on contractual agreements
- To provide advisory services that are mainly relevant to meet customers' project goals
- To provide project work with the budget of the contract that is greater than the threshold value

The results of the study indicate that the continuous improvement on the reporting quality of PMIS was found to be effective in achieving quality of PMIS output information to help managers in decision making, planning, organizing and controlling the project [2]. It was also effective in positively influencing project management success in terms of the following three project management dimensions [15]:

- Doing the project at the acceptable time
- Observing the budget (cost)
- Meeting the quality specifications of the project

### 3.2 Related Works

The PDCA cycle is a renowned continuous quality improvement approach and has been widely used by many successful companies as a strategic weapon for enhancing organizational performance [13]. Deming's PDCA cycle of continuous quality improvement provides a systematic method to incrementally progress toward the goal [14]. According to this framework, quality improvement will be effective if improvements start with a good plan (P), activities necessary to achieve the plan are implemented (i.e., done, D), results are checked (C) to understand the causes of the results, and actions (A) are taken to improve the processes [37], [38]. Continuous quality improvement is an iterative process of: planning to improve a product or process, plan implementation, analyzing, and comparing results against those expected, and corrective action on the differences between actual and expected results [33].

A KPI is an index used in measuring an individual's, organization's or institution's performance [20]. KPIs are essential for monitoring and controlling the project performance in the industries. An organization contains various types of processes and equipment that have to be controlled and maintained to achieve highest project performance and profit for the plants. KPIs are crucial in measuring the organizational performance and its progress [39]. KPIs help organizations understand how well they are performing in relation to their strategic goals and objectives. In the broadest sense, a KPI provides the most important performance information that enables organizations or their stakeholders to understand whether the organization is on track or not. KPIs serve to reduce the complex nature of organizational performance to a small number of key indicators in order to make it more digestible [40].

In order to be evaluated, KPIs are linked to target values, so that the value of the measure can be assessed as meeting expectations or not. The explored way in this work for improving this

process is based on scorecard approach. KPIs accommodated in scorecards is a usual tool within the strategic management, but it is rarely used effectively in the field of software projects [20].

The iterative process of continuous quality improvement based on the PDCA cycle adopted by the solution provider is as follows:

- Plan:
  - Establish the set of KPIs based on the guideline for evaluation of the reporting quality of PMIS linked to the target values in the scorecard used for the criteria of continuous quality improvement.
- Do:
  - Provide the training on the KPIs based on the reporting quality guideline referring an actual project status report along with the scorecard for the newly assigned project managers and/or whomever required.
- Check:
  - Evaluate the reporting quality of the project status report from PMIS monthly generated by the responsible project manager against the reporting quality guideline for all the ongoing projects falling under the criteria.
- Act:
  - Provide the corrective actions to the project managers in need of reporting quality improvement and did not clear the passing score of the KPIs set in the scorecard.
  - Provide the results of reporting quality evaluation of PMIS to the head of project delivery organization and the delivery managers in charge of the portfolio categories where the projects belong to.

The set of KPIs for evaluation of the reporting quality of PMIS is:

- Timeliness
- Scope
- Summary
- Risks/Issues
- Financials
- Milestones
- Client Expectation Management
- Use of PMIS

Table 3.1 shows the guideline of reporting quality KPIs based on a 16-point scale which covers the KPIs, a metric of performance measurement, in terms of use case, elements, evaluation criteria and score linked to eight areas of the project status report from PMIS. There are two terminologies, ETC and EAC used in Metric 5 (Financials) of Table 3.1. ETC (Estimate to Complete) is the expected cost to finish all the remaining project work. EAC (Estimate at Completion) is the expected total cost of completing all work expressed as the sum of the actual cost to date and the estimate to complete [17].

Table 3.1. Reporting Quality Guideline

Reporting Quality Audits are regularly performed on reporting and quality is scored on a 16 point scale;

Use Case	Elements (KPIs)	Evaluation Criteria	Score
Project Management	Metric 1: Timeliness	Score of 1 - Updated on time, or Score of 0 - Late, or Not updated.	1
	Metric 2: Scope	Score of 2 - Gives a good overview (good to take from scope of contract), a paragraph or two giving a concise overview of the engagement which in addition provides information on customer anticipated benefits.	2
	Metric 3: Summary	Score of 2 - Provides summary of recent progress and upcoming focus areas, may also summarize some key risks or issues, or Score of 1 - If covers only past, future, or is written in such a way that any leader could not understand progress (e.g. Client specific acronyms are used).	2
	Metric 4: Risks/Issues	Score of 1 - Risks well articulated, each has 4 components (description, impact, action plan, status), dates and owners assigned, or Score of 0 - If nothing is entered and maintained.	1
		Score of 1 - Issues well articulated, each has 4 components (description, impact, action plan, status), dates and owners assigned, or Score of 0 - If nothing is entered and maintained.	1
	Metric 5: Financials	Score of 2 - Accurately updated and tracking to plan. Reconcilable to the billing system (automatically interfaced with PMIS), ETC (Estimate to Complete) completed includes all days forecast to contract total (even if in future years). Baselines effectively managed, or Score of 1 - EAC (Estimate at Completion) cost is increased $\geq$ 1.0% from the agreed baseline. Also, requested to enter the reason.	2
	Metric 6: Milestones	Score of 1 - Sufficient granularity and all key deliverables/phases listed as milestones, and add Score of 1 - Uses effective action verbs i.e. completed, signed off is in Milestone description, and add Score of 2 - Achieving to plan and tracking to agreed baseline. Dates exist for milestones in next couple of months.	4
	Metric 7: Client Expectation Management (CEM)	Score of 2 - Step 1. Project Manager to ask the Project Sponsor the question verbally based on the Client Expectation Management template separately attached and listen to his response. Step 2. Read back by sending him/her the minutes to confirm what was discussed. The minutes is to be stored in the designated folder in PMIS.	2
Metric 8: Use of PMIS	Score of 1 - Integrity of the Project Status Report template regarding use of PMIS retained on the reporting quality guideline, or Score of 0 - If template has been changed or status is over-written from those automatically calculated.	1	

Total Score: 16

Table 3.2 shows the reporting quality KPI scorecard template with three sample entries, a full score of data maturity index based on a 5-point scale that is converted from the total score of quality KPIs based on a 16-point scale, a passing score threshold of 4 and a failing score of 3 requiring the corrective actions. The passing score threshold of 3.75 (or 4 after rounding) is calculated by the total KPI score of 12 / the perfect KPI score of 16 x 5. The scorecard is used to assist in monitoring the reporting quality of the project status report and identifying areas in need

of improvement by providing a maturity index. Data maturity is measured across eight areas and a maturity index is calculated (1-5). Reviewer feedback is provided.

Table 3.2. Reporting Quality KPI Scorecard Template

Project Manager	Project Name	Metric 1: Timeliness (1)	Metric 2: Scope (2)	Metric 3: Summary (2)	Metric 4: Risks/Issues (2)	Metric 5: Financials (2)	Metric 6: Milestones (4)	Metric 7: CEM (2)	Metric 8: Use of PMIS (1)	Total Score (16)	Data Maturity Index (DMI) (5 point scale)	Review Comments and Corrective Actions
Project Manager 1	Project A	1	2	2	2	2	4	2	1	16	5	Full Score Example
Project Manager 2	Project B	1	2	2	2	2	2	0	1	12	4	Passing Score Threshold
Project Manager 3	Project C	1	2	2	1	2	2	0	1	11	3	If DMI < 4 (or Total Score < 12), then the Corrective Actions to be notified.

Fig. 3.1 shows the client expectation management template that is described in Metric 7 of Table 3.1. It is an example in the mail format of how the response from the project sponsor on the performance question asked by the project manager should be fed back.

Example – Client response to “Are you satisfied with the service that our company is providing?”

Dear #,

Thank you for your feedback about the services that our company is delivering at #Company Name#.

I am summarizing below the key points of our discussion:

Overall Rating:	R/A/G (Ensure that the R/A/G status is discussed and agreed with the client)  (Optional – Summary Statement Text)
Positive Feedback:	List here the bullet points of positive feedback (if any):  <ul style="list-style-type: none"> <li>#Item1</li> <li>#Item2</li> </ul>
Improvement Opportunities:	List here the bullet points of negative feedback (if any):  <ul style="list-style-type: none"> <li>#Item1</li> <li>#Item2</li> </ul>
Actions:	Extract agreed action items (in standard Action Tracker format). Note only include actions that will be delivered – do not commit to anything that you cannot confidently deliver.  <ul style="list-style-type: none"> <li>Create Date, ID, Action Item, Owner, Original Target Date, Current Target/Actual Date, Status, Update</li> </ul>

Regards

Project Manager

Fig. 3.1. Client Expectation Management Template

The project status report template that is described in Metric 8 of Table 3.1 is shown in Table 3.3. Project financials automatically calculated by PMIS is based on the earned value management (EVM) [17].

Table 3.3. Project Status Report Template

Use Case	Elements	
Project Management	Project Identification	Key Project Information (i.e. Customer Name, Start Date, Finish Date, Current Phase, etc.)
	Project Scope Description	Project Scope
	Management Summary	Status Reporting
	Status Indicators (Automatically Calculated)	Overall, Margin, Cost, Accounts Receivable, Schedule, Risks, Issues, Resources, Quality, Scope, Customer Satisfaction, Governance, Value Management
	Key Issues	Top Issues Reporting
	Key Risks	Top Risks Reporting
	Project Financials (Automatically Calculated)	Expenses (Bid Baseline / PM Baseline), Revenue (Bid Baseline / PM Baseline), Earned Value Management (EVM)
	Project Milestones	Performance Reporting

### 3.3 Continuous Quality Improvement Process to achieve Reporting Quality of PMIS

Continuous Quality Improvement process on the reporting quality of the project status report from PMIS consists of two major processes. One is PMIS Reporting Quality KPI Training process that is conducted at the beginning of each project when the project manager assigned is either newly hired or taking on the role for the first time. The other is an iterative process of Continuous Quality Improvement on Reporting Quality of Project Status Report that is conducted once the financial month end closing of PMIS is completed in the project lifecycle for the set of projects described in Section I. PMIS used to trigger the initiation of the PMIS reporting quality KPI training as well as the succeeding iterative continuous quality improvement process on the reporting quality of PMIS systematically throughout the project duration is discussed below.

### ***3.3.1 Conduct Continuous Quality Improvement Process on Project Status Report from PMIS in Project Lifecycle***

Systematic overview of the continuous quality improvement process to achieve the reporting quality of PMIS that is triggered by the appropriate project initiation information from PMIS can be expressed in IDEF0 (Integration DEFinition level 0) [42], [43] as shown in Fig. 3.2. This is the top-level context diagram A-0.

It is decomposed to the next level diagram with a systematic framework that consists of two nodes, A1 and A2 as shown in Fig. 3.3. Node A1 is PMIS reporting quality KPI training process that is triggered by the relevant project initiation information from PMIS to be conducted at the beginning of each project. It is specifically positioned to influence the phase and project results positively, as well as coach and educate project manager on upcoming project status reporting with the methodology, tools, quality and standards based on the reporting quality guideline along with the reporting quality KPI scorecard template and the project status report template. Node A2 is an iterative process of continuous quality improvement on the project status report from PMIS to be conducted monthly throughout the project duration. It is positioned to check that reporting quality of the project status report generated upon completion of the financial month end closing of PMIS is aligned with the reporting quality guideline and up to the satisfactory level at the reporting quality KPI scorecard. It is to make sure that the quality of PMIS output information can help managers in decision making, planning, organizing and controlling the project.

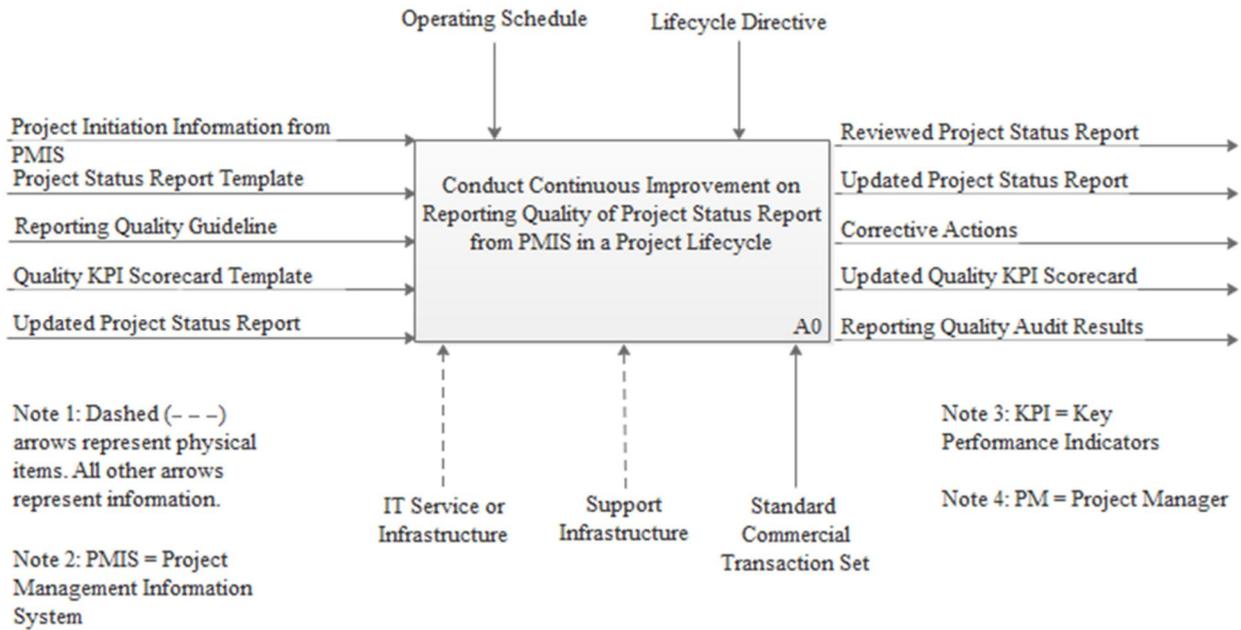


Fig. 3.2. Conduct Continuous Quality Improvement Process on the Project Status Report from PMIS in the Project Lifecycle

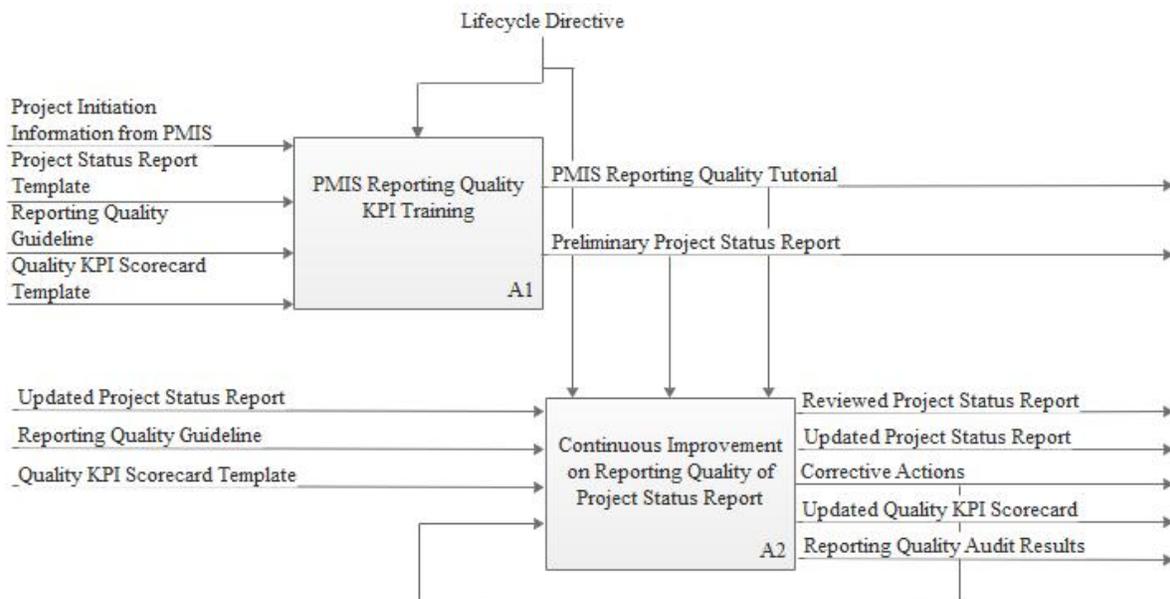


Fig. 3.3. Conduct PMIS Reporting Quality KPI Training and Continuous Quality Improvement on the Project Status Report from PMIS

### 3.3.2 Classify Project Having Newly Assigned Project Manager and Conduct Reporting Quality KPI Training

The decomposition of node A1 to 3 activities is shown in Fig. 3.4. PMIS strategically implemented is effectively used by the independent quality reviewer who does not belong to the organization unit responsible for the project delivery, in searching for the newly registered projects classified for the need of continuous quality improvement on the reporting quality of PMIS, having newly hired project managers assigned. This process for conducting the reporting quality KPI training by the independent quality reviewer plays the most important role to properly kick off the continuous quality improvement process on the reporting quality of PMIS that is to be carried out monthly in the project lifecycle.

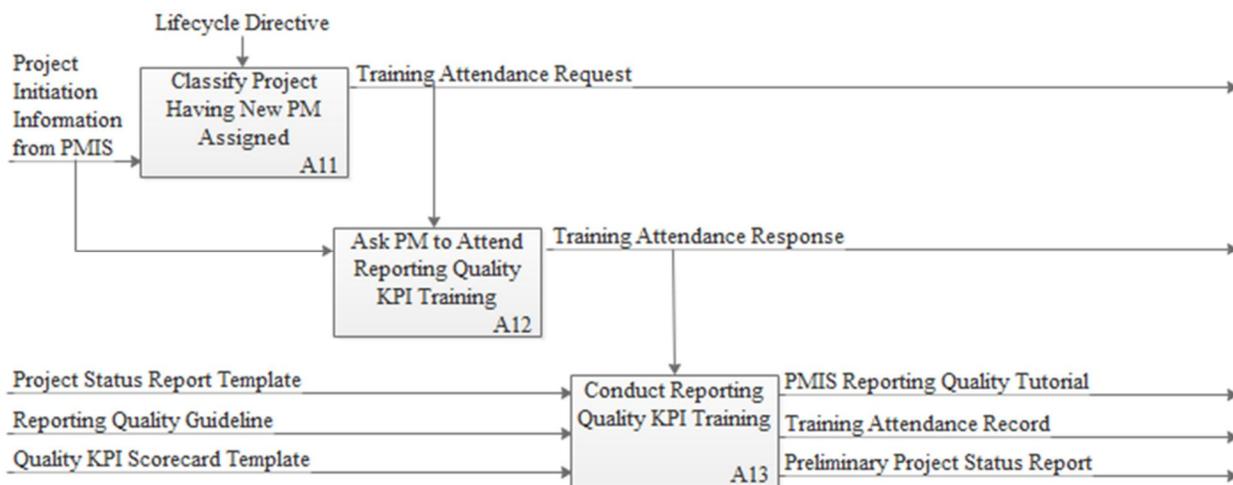


Fig. 3.4. Classify the Project Having the Newly Assigned Project Manager and Conduct the Reporting Quality KPI Training

Below are the major activities required to plan and conduct Reporting Quality KPI Training.

- **Node A11; Classify Project Having New Project Manager Assigned:** The independent quality reviewer is to check (during the 1<sup>st</sup> two weeks of the month) if

there is any newly started project in PMIS which is having a newly hired project manager assigned and relevant for triggering the initiation of the continuous quality improvement process on the reporting quality of PMIS based on the following criteria that the Solution Provider is:

- To provide a project manager and project team
- To be responsible for providing particular results based on contractual agreements
- To provide advisory services that are mainly relevant to meet customers' project goals
- To provide project work with the budget of the contract that is greater than the threshold value

Table 3.4 shows a snapshot of the project initiation information from PMIS taken in January 2017 for classifying the project having a newly hired project manager assigned. Project J1 is identified as the classified project having the newly hired project manager, Project Manager 4 assigned.

Table 3.4 Project Initiation Information from PMIS Classifying the Project Having the Newly Hired Project Manager Assigned

Project ID	Industry Sector	Project Manager	Project Name	Period	Contract Type	Project Type	Planned Start	Planned Finish
PS-11170	Consumer / Trading	Project Manager 4	Project J1	2017 M 01	T&M	Consulting Project	2017/1/5	2017/5/31
PS-11211	High Tech	Project Manager 8	Project T	2017 M 01	T&M	Consulting Project	2017/1/16	2017/9/29

- ***Node A12; Ask Project Manager to Attend Reporting Quality KPI Training:*** Once a relevant project is found:
  - The independent quality reviewer is to send an email to the project manager responsible for the execution of the project, which is also copied to the

delivery manager in charge of the portfolio category, based on the explanation for the need of getting Reporting Quality KPI Training conducted before a proposed due date for completion stated on the email.

- The project manager is to send back an hour meeting request with a date specified for having the Reporting Quality KPI Training conducted.
- The independent quality reviewer is to respond to the meeting invite to have the training date finally fixed.

· ***Node A13; Conduct Reporting Quality KPI Training:*** The independent quality reviewer is:

- To educate the project manager responsible for the project on the PDCA cycle of continuous quality improvement process, based on the quality audit monthly conducted on the project status report generated from PMIS against the reporting quality guideline, to keep the quality of the PMIS output information above the passing score threshold defined in the reporting quality KPI scorecard as evaluation criteria.
- To request the project manager to create the preliminary project status report based on the project status report template as an exercise so that it can be used as a basis for quality evaluation and corrective actions for quality improvement if necessary.
- To maintain a record for the training attendance and provide the project manager with the PMIS reporting quality tutorial, the reporting quality guideline as well as the reporting quality KPI scorecard template upon completion of the training session.

### 3.3.3 Conduct Iterative Process of Continuous Quality Improvement on Project Status Report

The decomposition of node A2 to 6 activities is shown in Fig. 3.5. In an iterative process based on the PDCA cycle, the periodic quality audit by the independent quality reviewer is conducted on the relevant project status reports generated based on the information maintained by the responsible project managers upon completion of the financial month end closing of PMIS. Analysis of the audit results compiled is reported to the managers of the project delivery organization for their governance. Corrective actions for quality improvement required accordingly to the reporting quality guideline are communicated to the project managers who have not cleared the passing score threshold in the reporting quality KPI scorecard.

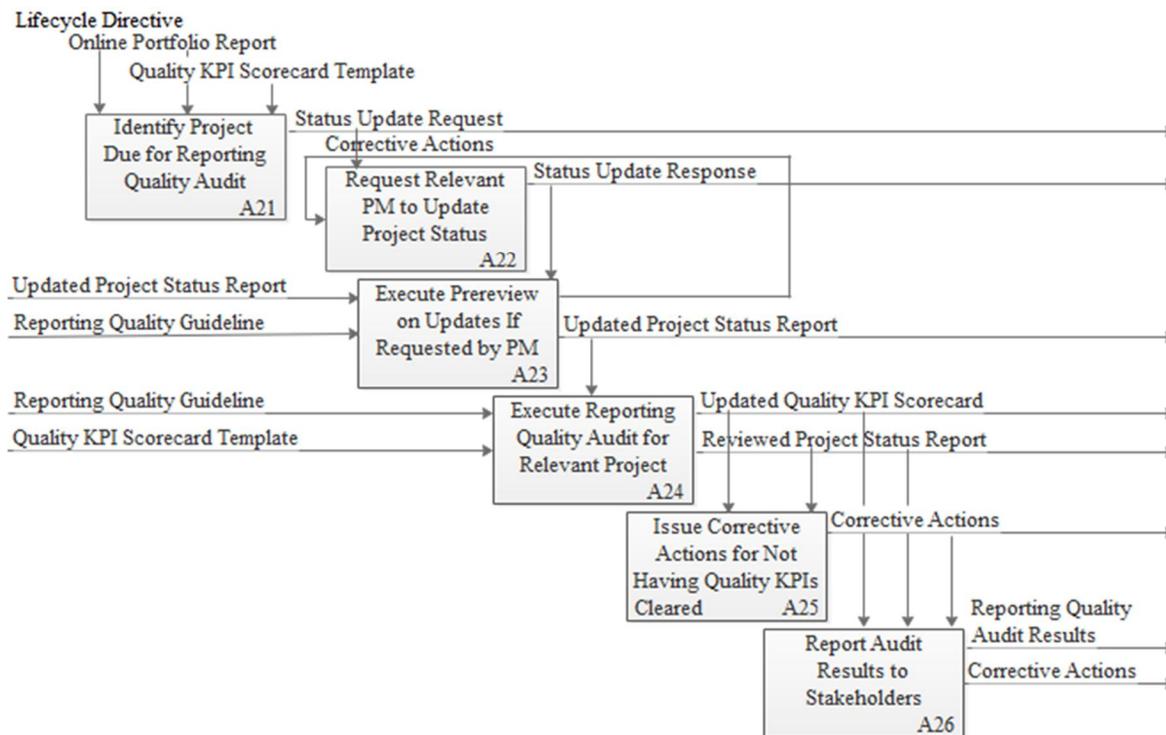


Fig. 3.5. Conduct the Iterative Process of Continuous Quality Improvement on the Project Status Report from PMIS

Below are the steps of major activities required for conducting Continuous Quality Improvement.

- **Node A21; Identify Project Due for Reporting Quality Audit:** By leveraging the Online Portfolio Report that is available in PMIS, the independent quality reviewer is to check the set of relevant projects (based on the criteria set by the Solution Provider) for triggering the iterative process of continuous quality improvement on the reporting quality of PMIS on the 25<sup>th</sup> of every month. Table 3.5 shows the set of selected projects classified for continuous quality improvement on the project status report from PMIS due for the monthly reporting quality audit.

Table 3.5. Online Portfolio Report for the Project with the Reporting Quality Audit Requirement

Project ID	Industry Sector	Project Manager	Project Name	Period	Contract Type	Project Type	Planned Finish
PS-10445	Consumer / Trading	Project Manager 1	Project A	2017 M 01	T&M	Consulting Project	2017/7/31
PS-10940	High Tech	Project Manager 2	Project Y	2017 M 01	T&M	Consulting Project	2017/3/31
PS-10300	Consumer / Trading	Project Manager 3	Project D	2017 M 01	T&M	Consulting Project	2018/12/31
PS-11170	Consumer / Trading	Project Manager 4	Project J1	2017 M 01	T&M	Consulting Project	2017/5/31
PS-11014	Consumer / Trading	Project Manager 5	Project J2	2017 M 01	T&M	Consulting Project	2017/12/29
PS-10782	Utilities	Project Manager 6	Project K	2017 M 01	T&M	Consulting Project	2020/3/31
PS-09236	High Tech	Project Manager 7	Project M	2017 M 01	T&M	Consulting Project	2017/5/31
PS-10717	High Tech	Project Manager 8	Project S	2017 M 01	T&M	Consulting Project	2017/3/31
PS-10275	Utilities	Project Manager 9	Project T1	2017 M 01	T&M	Consulting Project	2017/9/29
PS-09889	Utilities	Project Manager 10	Project T2	2017 M 01	T&M	Consulting Project	2018/1/31
PS-09250	Utilities	Project Manager 11	Project T3	2017 M 01	T&M	Consulting Project	2018/1/31
PS-10781	Utilities	Project Manager 11	Project T4	2017 M 01	T&M	Consulting Project	2017/1/31
PS-09796	High Tech	Project Manager 12	Project G	2017 M 01	T&M	Consulting Project	2019/1/31
PS-09862	Process / Auto	Project Manager 13	Project O	2017 M 01	T&M	Consulting Project	2017/5/31
PS-11211	High Tech	Project Manager 8	Project T	2017 M 01	T&M	Consulting Project	2017/9/29

- **Node A22; Request Relevant Project Managers to Update Project Status:** For covering each project relevant for continuous quality improvement on the project status report due for the reporting quality audit, the independent quality reviewer is:
  - To send an email request to the project manager responsible for execution of the project, which is also copied to the delivery manager in charge of the

- portfolio category, for getting the project status report updated by the due date specified upon completion of the financial month end closing of PMIS.
- To request the project manager to ask any questions on how to enter the contents of project status report and the prereview on the update if required.
- ***Node A23; Execute Prereview on Updates If Requested by Project Manager:*** The following major activities are conducted:
    - The project manager is to send the updated project status report for review by email to the independent quality reviewer at the earliest timing possible prior to the deadline specified.
    - The independent quality reviewer is to provide the project manager with the review results on the updated project status report submitted for prereview by return.
  - ***Node A24; Execute Reporting Quality Audit for Relevant Project:*** The following major activities are conducted:
    - The independent quality reviewer is to audit the reporting quality on the latest project status report from PMIS, updated right after the previous month end closing, against the reporting quality guideline along with the reporting quality KPI scorecard template based on the following criteria:
      - **Good Standing:** Indicates that the reporting quality audit is passed with the passing score of 4 or above earned in the data maturity index of the quality reporting KPI scorecard. No further action is required except for what is stated as comments for improvement.
      - **Improvement Required:** Indicates that the reporting quality audit has not

cleared the passing score threshold of 4 in the data maturity index of the quality reporting KPI scorecard. The further corrective actions for reporting quality improvement entered in the reporting quality KPI scorecard are to be applied and completed by the next reporting cycle.

- **Node A25; Issue Corrective Actions for Not Having Quality KPIs Cleared:** The independent quality reviewer is to communicate by email to the project manager and the delivery manager in charge:
  - The results of the evaluation on each review item of the project status report against the respective target metric of reporting quality guideline along with the corrective actions (if required), which are entered in the reporting quality KPI scorecard.

Table 3.6 shows the list of projects not having the quality KPIs cleared with the corrective actions issued in the reporting quality KPI scorecard.

Table 3.6. Projects with Unsatisfactory Audit Results Recorded in the Reporting Quality KPI Scorecard with Corrective Actions

Project Manager	Project Name	Period	Metric 1: Timeliness (1)	Metric 2: Scope (2)	Metric 3: Summary (2)	Metric 4: Risks/Issues (2)	Metric 5: Financials (2)	Metric 6: Milestones (4)	Metric 7: CEM (2)	Metric 8: Use of PMIS (1)	Total Score (16)	Data Maturity Index (DMI) (5 point scale)	Review Comments and Corrective Actions
Project Manager 1	Project A	2017 M 01	1	2	2	2	2	1	0	1	11	3	<b>M/s:</b> Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. Also, it needs to start with an effective "Action Verb". <b>CEM:</b> No evidence stored in PMIS.
Project Manager 4	Project JI	2017 M 01	1	2	2	2	1	1	0	1	10	3	<b>Financials:</b> Why the cost at EAC increased by 1.1% was not explained. Please also provide the corrective action to get it back. <b>M/s:</b> Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. Also, it needs to start with an effective "Action Verb". <b>CEM:</b> No evidence stored in PMIS.
Project Manager 6	Project K	2017 M 01	1	2	2	2	2	0	0	1	10	3	<b>M/s:</b> Planned action items for the month of January not entered at all. Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. Also, it needs to start with an effective "Action Verb". <b>CEM:</b> No evidence stored in PMIS.

- ***Node A26; Report Audit Results to Stakeholders:*** The independent quality reviewer is to report by email the final quality audit results to the head of project delivery organization and the delivery managers for their governance on the corrective actions issued for quality improvement. Table 3.7 shows the quality audit results of the project status report generated from PMIS on all the project managers assigned consulting projects classified for the iterative process of continuous quality improvement upon completion of the financial month end closing of January 2017.

Table 3.7. Quality Audit Results of the Reporting Quality KPIs on the Project Status Report from PMIS for January 2017

Project Manager	Project Name	Period	Metric 1: Timeliness (1)	Metric 2: Scope (2)	Metric 3: Summary (2)	Metric 4: Risks/Issues (2)	Metric 5: Financials (2)	Metric 6: Milestones (4)	Metric 7: CEM (2)	Metric 8: Use of PMIS (1)	Total Score (16)	Data Maturity Index (DMI) (5 point scale)	Review Comments and Corrective Actions
Project Manager 1	Project A	2017 M 01	1	2	2	2	2	1	0	1	11	3	M/s: Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. Also, it needs to start with an effective "Action Verb". CEM: No evidence stored in PMIS.
Project Manager 2	Project Y	2017 M 01	1	2	2	2	2	2	0	1	12	4	M/s: Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. CEM: No evidence stored in PMIS.
Project Manager 3	Project D	2017 M 01	1	2	2	2	2	2	0	1	12	4	M/s: Express the action items bi-weekly planned in specificity and granularity. Also, it needs to start with an effective "Action Verb" as it is not done that way. CEM: No evidence stored in PMIS.
Project Manager 4	Project J1	2017 M 01	1	2	2	2	1	1	0	1	10	3	Financials: Why the cost at EAC increased by 1.1% was not explained. Please also provide the corrective action to get it back. M/s: Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. Also, it needs to start with an effective "Action Verb". CEM: No evidence stored in PMIS.
Project Manager 5	Project J2	2017 M 01	1	2	2	2	2	2	0	1	12	4	M/s: Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. CEM: No evidence stored in PMIS.
Project Manager 6	Project K	2017 M 01	1	2	2	2	2	0	0	1	10	3	M/s: Planned action items for the month of January not entered at all. Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. Also, it needs to start with an effective "Action Verb". CEM: No evidence stored in PMIS.
Project Manager 7	Project M	2017 M 01	1	2	2	2	2	4	0	1	14	4	CEM: No evidence stored in PMIS.
Project Manager 8	Project S	2017 M 01	1	2	2	2	2	4	0	1	14	4	CEM: No evidence stored in PMIS.
Project Manager 9	Project T1	2017 M 01	1	2	2	2	2	2	0	1	12	4	M/s: Express the action items bi-weekly planned in specificity and granularity. Also, it needs to start with an effective "Action Verb" as it is not done that way. CEM: No evidence stored in PMIS.
Project Manager 10	Project T2	2017 M 01	1	2	2	2	2	2	0	1	12	4	M/s: Express the action items bi-weekly planned in specificity and granularity. Also, it needs to start with an effective "Action Verb" as it is not done that way. CEM: No evidence stored in PMIS.
Project Manager 11	Project T3	2017 M 01	1	2	2	2	2	2	0	1	12	4	CEM: No evidence stored in PMIS.
Project Manager 11	Project T4	2017 M 01	1	2	2	2	2	2	0	1	12	4	M/s: Express the action items bi-weekly planned in specificity and granularity. Also, it needs to start with an effective "Action Verb" as it is not done that way. CEM: No evidence stored in PMIS.
Project Manager 12	Project G	2017 M 01	1	2	2	2	2	2	0	1	12	4	M/s: Express the action items bi-weekly planned in specificity and granularity. Also, it needs to start with an effective "Action Verb" as it is not done that way. CEM: No evidence stored in PMIS.
Project Manager 13	Project O	2017 M 01	1	2	2	2	2	4	0	1	14	4	CEM: No evidence stored in PMIS.
Project Manager 8	Project T	2017 M 01	1	2	2	2	2	4	0	1	14	4	CEM: No evidence stored in PMIS.

### 3.4 Results

Table 3.8 indicates the summary results of quality audits on the reporting quality KPIs on the project status reports from PMIS for the nine projects completed in total during the case study period of nine months from January 2017 to September 2017. In conclusion, seven out of the nine projects constantly managed to make the passing score of 12 or above based on a 16-point scale on the reporting quality KPIs at the monthly quality audit, although two projects, Project J1 and Project A failed twice each in short of 1-2 points at the earlier stage of the quality audit in the monthly reporting cycle during the project period. In terms of project management, all the nine projects were completed successfully respecting the time, cost and quality.

Table 3.8. Summary Audit Results of the Reporting Quality KPIs on the Project Status Reports from PMIS by Monthly Reporting Cycle

Project Manager	Project Name	Planned Finish	2017/01	2017/02	2017/03	2017/04	2017/05	2017/06	2017/07	2017/08	2017/09
Project Manager 11	Project T4	2017/1/31	12								
Project Manager 2	Project Y	2017/3/31	12	12	12						
Project Manager 8	Project S	2017/3/31	14	14	14						
Project Manager 4	Project J1	2017/5/31	10	11	12	12	12				
Project Manager 7	Project M	2017/5/31	14	14	14	14	14				
Project Manager 13	Project O	2017/5/31	14	14	14	14	14				
Project Manager 1	Project A	2017/7/31	11	12	11	12	12	12	12		
Project Manager 9	Project T1	2017/9/29	12	12	12	12	12	12	12	12	12
Project Manager 8	Project T	2017/9/29	14	14	14	14	14	14	14	14	14

The quality audit results for the duration of the project for Project J1 and Project T, the two projects identified in Table 3.4 are shown in Table 3.9 and Table 3.10 respectively. Project J1 was conducted by the newly hired project manager, Project Manager 4 and Project T was conducted by the experienced senior project manager who is used to the reporting quality requirements of PMIS. Project Manager 4 could not clear the passing score for the first two months of the project duration. However, he finally managed to clear the passing score at the quality audit for the reporting cycle of the third month based on the effects of the PDCA cycle. At any rate, both the projects have cleared the passing score for the data maturity index of the

reporting quality KPI scorecards in the iterative process of continuous quality improvement. They were also completed successfully in terms of project management, respecting the time, cost and quality.

Table 3.9. Quality Audit Results of Project J1 by Reporting Cycle

Project Manager	Project Name	Period	Metric 1: Timeliness (1)	Metric 2: Scope (2)	Metric 3: Summary (2)	Metric 4: Risks/Issues (2)	Metric 5: Financials (2)	Metric 6: Milestones (4)	Metric 7: CEM (2)	Metric 8: Use of PMIS (1)	Total Score (16)	Data Maturity Index (DMI) (5 point scale)	Review Comments and Corrective Actions
Project Manager 4	Project J1	2017 M 01	1	2	2	2	1	1	0	1	10	3	<b>Financials:</b> Why the cost at EAC increased by 1.1% was not explained. Please also provide the corrective action to get it back. <b>M/s:</b> Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. Also, it needs to start with an effective "Action Verb". <b>CEM:</b> No evidence stored in PMIS.
Project Manager 4	Project J1	2017 M 02	1	2	2	2	2	1	0	1	11	3	<b>M/s:</b> Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. Also, it needs to start with an effective "Action Verb". <b>CEM:</b> No evidence stored in PMIS.
Project Manager 4	Project J1	2017 M 03	1	2	2	2	2	2	0	1	12	4	<b>M/s:</b> Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. <b>CEM:</b> No evidence stored in PMIS.
Project Manager 4	Project J1	2017 M 04	1	2	2	2	2	2	0	1	12	4	<b>M/s:</b> Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. <b>CEM:</b> No evidence stored in PMIS.
Project Manager 4	Project J1	2017 M 05	1	2	2	2	2	2	0	1	12	4	<b>M/s:</b> Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. <b>CEM:</b> No evidence stored in PMIS.

Table 3.10. Quality Audit Results of Project T by Reporting Cycle

Project Manager	Project Name	Period	Metric 1: Timeliness (1)	Metric 2: Scope (2)	Metric 3: Summary (2)	Metric 4: Risks/Issues (2)	Metric 5: Financials (2)	Metric 6: Milestones (4)	Metric 7: CEM (2)	Metric 8: Use of PMIS (1)	Total Score (16)	Data Maturity Index (DMI) (5 point scale)	Review Comments and Corrective Actions
Project Manager 8	Project T	2017 M 01	1	2	2	2	2	4	0	1	14	4	<b>CEM:</b> No evidence stored in PMIS.
Project Manager 8	Project T	2017 M 02	1	2	2	2	2	4	0	1	14	4	<b>CEM:</b> No evidence stored in PMIS.
Project Manager 8	Project T	2017 M 03	1	2	2	2	2	4	0	1	14	4	<b>CEM:</b> No evidence stored in PMIS.
Project Manager 8	Project T	2017 M 04	1	2	2	2	2	4	0	1	14	4	<b>CEM:</b> No evidence stored in PMIS.
Project Manager 8	Project T	2017 M 05	1	2	2	2	2	4	0	1	14	4	<b>CEM:</b> No evidence stored in PMIS.
Project Manager 8	Project T	2017 M 06	1	2	2	2	2	4	0	1	14	4	<b>CEM:</b> No evidence stored in PMIS.
Project Manager 8	Project T	2017 M 07	1	2	2	2	2	4	0	1	14	4	<b>CEM:</b> No evidence stored in PMIS.
Project Manager 8	Project T	2017 M 08	1	2	2	2	2	4	0	1	14	4	<b>CEM:</b> No evidence stored in PMIS.
Project Manager 8	Project T	2017 M 09	1	2	2	2	2	4	0	1	14	4	<b>CEM:</b> No evidence stored in PMIS.

Likewise, there were six other projects, Project S, Project Y, Project M, Project O, Project A, and Project T1 described in Table 3.5, having been carried out since 2016 based on the application of PDCA cycle on continuous quality improvement of the PMIS output information that were completed successfully till the end of September 2017 for the period of this study, achieving the reporting quality KPIs of PMIS at the satisfactory level as shown in Table 3.11, Table 3.12, Table 3.13, Table 3.14, Table 3.15 (although Project Manager 1 for project A could not clear the passing score twice), and Table 3.16 respectively, and respecting the time, cost and quality in terms of project management.

Table 3.11. Quality Audit Results of Project S by Reporting Cycle

Project Manager	Project Name	Period	Metric 1: Timeliness (1)	Metric 2: Scope (2)	Metric 3: Summary (2)	Metric 4: Risks/Issues (2)	Metric 5: Financials (2)	Metric 6: Milestones (4)	Metric 7: CEM (2)	Metric 8: Use of PMIS (1)	Total Score (16)	Data Maturity Index (DMI) (5 point scale)	Review Comments and Corrective Actions
Project Manager 8	Project S	2017 M 01	1	2	2	2	2	4	0	1	14	4	CEM: No evidence stored in PMIS.
Project Manager 8	Project S	2017 M 02	1	2	2	2	2	4	0	1	14	4	CEM: No evidence stored in PMIS.
Project Manager 8	Project S	2017 M 03	1	2	2	2	2	4	0	1	14	4	CEM: No evidence stored in PMIS.

Table 3.12. Quality Audit Results of Project Y by Reporting Cycle

Project Manager	Project Name	Period	Metric 1: Timeliness (1)	Metric 2: Scope (2)	Metric 3: Summary (2)	Metric 4: Risks/Issues (2)	Metric 5: Financials (2)	Metric 6: Milestones (4)	Metric 7: CEM (2)	Metric 8: Use of PMIS (1)	Total Score (16)	Data Maturity Index (DMI) (5 point scale)	Review Comments and Corrective Actions
Project Manager 2	Project Y	2017 M 01	1	2	2	2	2	2	0	1	12	4	M/s: Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. CEM: No evidence stored in PMIS.
Project Manager 2	Project Y	2017 M 02	1	2	2	2	2	2	0	1	12	4	M/s: Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. CEM: No evidence stored in PMIS.
Project Manager 2	Project Y	2017 M 03	1	2	2	2	2	2	0	1	12	4	M/s: Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. CEM: No evidence stored in PMIS.

Table 3.13. Quality Audit Results of Project M by Reporting Cycle

Project Manager	Project Name	Period	Metric 1: Timeliness (1)	Metric 2: Scope (2)	Metric 3: Summary (2)	Metric 4: Risks/Issues (2)	Metric 5: Financials (2)	Metric 6: Milestones (4)	Metric 7: CEM (2)	Metric 8: Use of PMIS (1)	Total Score (16)	Data Maturity Index (DMI) (5 point scale)	Review Comments and Corrective Actions
Project Manager 7	Project M	2017 M 01	1	2	2	2	2	4	0	1	14	4	CEM: No evidence stored in PMIS.
Project Manager 7	Project M	2017 M 02	1	2	2	2	2	4	0	1	14	4	CEM: No evidence stored in PMIS.
Project Manager 7	Project M	2017 M 03	1	2	2	2	2	4	0	1	14	4	CEM: No evidence stored in PMIS.
Project Manager 7	Project M	2017 M 04	1	2	2	2	2	4	0	1	14	4	CEM: No evidence stored in PMIS.
Project Manager 7	Project M	2017 M 05	1	2	2	2	2	4	0	1	14	4	CEM: No evidence stored in PMIS.

Table 3.14. Quality Audit Results of Project O by Reporting Cycle

Project Manager	Project Name	Period	Metric 1: Timeliness (1)	Metric 2: Scope (2)	Metric 3: Summary (2)	Metric 4: Risks/Issues (2)	Metric 5: Financials (2)	Metric 6: Milestones (4)	Metric 7: CEM (2)	Metric 8: Use of PMIS (1)	Total Score (16)	Data Maturity Index (DMI) (5 point scale)	Review Comments and Corrective Actions
Project Manager 13	Project O	2017 M 01	1	2	2	2	2	4	0	1	14	4	CEM: No evidence stored in PMIS.
Project Manager 13	Project O	2017 M 02	1	2	2	2	2	4	0	1	14	4	CEM: No evidence stored in PMIS.
Project Manager 13	Project O	2017 M 03	1	2	2	2	2	4	0	1	14	4	CEM: No evidence stored in PMIS.
Project Manager 13	Project O	2017 M 04	1	2	2	2	2	4	0	1	14	4	CEM: No evidence stored in PMIS.
Project Manager 13	Project O	2017 M 05	1	2	2	2	2	4	0	1	14	4	CEM: No evidence stored in PMIS.

Table 3.15. Quality Audit Results of Project A by Reporting Cycle

Project Manager	Project Name	Period	Metric 1: Timeliness (1)	Metric 2: Scope (2)	Metric 3: Summary (2)	Metric 4: Risks/Issues (2)	Metric 5: Financials (2)	Metric 6: Milestones (4)	Metric 7: CEM (2)	Metric 8: Use of PMIS (1)	Total Score (16)	Data Maturity Index (DMI) (5 point scale)	Review Comments and Corrective Actions
Project Manager 1	Project A	2017 M 01	1	2	2	2	2	1	0	1	11	3	M/s: Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. Also, it needs to start with an effective "Action Verb". CEM: No evidence stored in PMIS
Project Manager 1	Project A	2017 M 02	1	2	2	2	2	2	0	1	12	4	M/s: Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. CEM: No evidence stored in PMIS.
Project Manager 1	Project A	2017 M 03	1	2	2	2	2	1	0	1	11	3	M/s: No updates properly made on the activities planned for the month of March. Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. CEM: No evidence stored in PMIS.
Project Manager 1	Project A	2017 M 04	1	2	2	2	2	2	0	1	12	4	M/s: Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. CEM: No evidence stored in PMIS.
Project Manager 1	Project A	2017 M 05	1	2	2	2	2	2	0	1	12	4	M/s: Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. CEM: No evidence stored in PMIS.
Project Manager 1	Project A	2017 M 06	1	2	2	2	2	2	0	1	12	4	M/s: Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. CEM: No evidence stored in PMIS.
Project Manager 1	Project A	2017 M 07	1	2	2	2	2	2	0	1	12	4	M/s: Bi-weekly based planned action item is to be entered and clearly express the target planned in specificity and granularity. CEM: No evidence stored in PMIS.

Table 3.16. Quality Audit Results of Project T1 by Reporting Cycle

Project Manager	Project Name	Period	Metric 1: Timeliness (1)	Metric 2: Scope (2)	Metric 3: Summary (2)	Metric 4: Risks/Issues (2)	Metric 5: Financials (2)	Metric 6: Milestones (4)	Metric 7: CEM (2)	Metric 8: Use of PMIS (1)	Total Score (16)	Data Maturity Index (DMI) (5 point scale)	Review Comments and Corrective Actions
Project Manager 9	Project T1	2017 M 01	1	2	2	2	2	2	0	1	12	4	M/s: Express the action items bi-weekly planned in specificity and granularity. Also, it needs to start with an effective "Action Verb" as it is not done that way. CEM: No evidence stored in PMIS.
Project Manager 9	Project T1	2017 M 02	1	2	2	2	2	2	0	1	12	4	M/s: Express the action items bi-weekly planned in specificity and granularity. Also, it needs to start with an effective "Action Verb" as it is not done that way. CEM: No evidence stored in PMIS.
Project Manager 9	Project T1	2017 M 03	1	2	2	2	2	2	0	1	12	4	M/s: Express the action items bi-weekly planned in specificity and granularity. Also, it needs to start with an effective "Action Verb" as it is not done that way. CEM: No evidence stored in PMIS.
Project Manager 9	Project T1	2017 M 04	1	2	2	2	2	2	0	1	12	4	M/s: Express the action items bi-weekly planned in specificity and granularity. Also, it needs to start with an effective "Action Verb" as it is not done that way. CEM: No evidence stored in PMIS.
Project Manager 9	Project T1	2017 M 05	1	2	2	2	2	2	0	1	12	4	M/s: Express the action items bi-weekly planned in specificity and granularity. Also, it needs to start with an effective "Action Verb" as it is not done that way. CEM: No evidence stored in PMIS.
Project Manager 9	Project T1	2017 M 06	1	2	2	2	2	2	0	1	12	4	M/s: Express the action items bi-weekly planned in specificity and granularity. Also, it needs to start with an effective "Action Verb" as it is not done that way. CEM: No evidence stored in PMIS.
Project Manager 9	Project T1	2017 M 07	1	2	2	2	2	2	0	1	12	4	M/s: Express the action items bi-weekly planned in specificity and granularity. Also, it needs to start with an effective "Action Verb" as it is not done that way. CEM: No evidence stored in PMIS.
Project Manager 9	Project T1	2017 M 08	1	2	2	2	2	2	0	1	12	4	M/s: Express the action items bi-weekly planned in specificity and granularity. Also, it needs to start with an effective "Action Verb" as it is not done that way. CEM: No evidence stored in PMIS.
Project Manager 9	Project T1	2017 M 09	1	2	2	2	2	2	0	1	12	4	M/s: Express the action items bi-weekly planned in specificity and granularity. Also, it needs to start with an effective "Action Verb" as it is not done that way. CEM: No evidence stored in PMIS.

Lastly, there was one project, Project T4 described in Table 3.5 based on the final quality audit results in January 2017, shown in Table 3.7 with the passing score of 4 was also completed achieving project management success in terms of respecting the time, cost and quality.

## **Chapter 4. Effective Use of PMIS to Initiate the Project Quality Gate Process for Continuous Improvement**

This chapter describes the overview of the research and the related literature review of quality gates and its adoption, as well as presents the process lifecycle for the use of PMIS to initiate the process of project quality gate reviews for the solution provider led ERP implementation projects conducted by the independent quality reviewer along with the summary of the case study [11].

### **4.1 Overview**

Project quality gates are described as part of the internal quality assurance activities in the quality management plan which is included in the project management plan as a subsidiary plan [44] for the ERP implementation projects conducted by the solution provider. However, there have been some projects which happened to end up with the schedule delays and cost overruns where the project quality gates did not get properly conducted at the right timing of the project phase. Therefore, the project outcome could not be clearly predicted to implement the corrective actions.

This non-conformity could be very often identified when the procedure for initiation of the project quality gate process is not defined in the quality management plan to get the quality gate review schedule properly fixed. There is a quality gate reference process [45] defined in terms of how the quality gate review is conducted. However, the mandatory project quality gate review activities were flexibly left to be merely conducted and concluded by the resources

assigned to and/or directly concerned with the projects, and thus non-conformance governance was virtually nonexistent.

Recent research has provided an application with the use of PMIS, which is part of information systems (IS), for such implementations in improvement of quality management systems (QMS) requirements [4]. Synergies between the PMIS (or IS) and the QMS according to ISO 9001 standard [5], [6], allows the association between these two systems, so that the PMIS can support and influence the processes related to the QMS, not only limited to the collection and documentation management [7]. On the one hand, the PMIS (or IS) represents a critical component of the backbone of organizations and on the other hand the quality management of products, services and business processes is a key issue for the success of most organizations when they operate in global contexts [46].

This article describes the case study on how PMIS was applied to implement the process of project quality gate reviews for the ERP implementation projects conducted by the solution provider for their customers in the various industries in Japan. PMIS was found to be effective in searching for the newly registered projects classified for the project quality gate requirements by the independent quality reviewer who does not belong to the organization unit responsible for the project delivery. It was effective in identifying the project managers in charge of the classified projects to conduct the previews of the project quality gate reviews and setting the soft-booked dates for the project quality gate reviews prior to the previews. It was also effective in notifying and influencing the project managers to timely initiate the quality gate process based on the schedule fixed for each project quality gate review.

## 4.2 Related Works

The concept of quality gates is based on the stage-gate system initially presented in 1986 and later refined by other researchers (e.g., [47]), [48]. It consists on breaking down a project (or process) into several distinct phases. Then, quality checkpoints (or gates) are placed between phases to check the degree of fulfillment of a project or the quality of “in-progress” artifact that is being manufactured (product) [49]. In general, a quality gate marks the formal end to a particular process within a project, a “gate” through which the project proceeds from one phase to another [48].

Project quality gates described in this article are the quality management gates [21], [22] where targets, timeframes and deadlines are fixed for the project at the management level. A quality management gate is positioned at each major deadline or target. Specific products or results are generated within each defined timeframe. Requirements are defined for these specified outputs but not defined for the specific products as in the case of quality control gates. Quality management gates are established for the decision-making process which will predict and control the outcome of the project with the desired quality [22]. Project quality gates are used for the strategy [45] as a quality guideline where the same set of quality gates (and criteria) is applied to all projects resulting in a comparable and at least an equal minimum quality level in all these projects. Although requirements for additional outputs specific to each project can be included to meet the project’s needs in the criteria, project quality gates are not used as a flexible quality strategy where a suitable quality gate process is applied to each project to exactly meet the project’s needs.

Generally, a quality gate is a checkpoint consisting of a set of predefined quality criteria that a project must meet to proceed from stage of its lifecycle to the next [50].

The ERP implementation methodology used by the solution provider has a total of 4 project quality gates embedded based on the traditional waterfall model [45] to assure project quality by formally conducting a quality check against the quality gate checklist [51], [48] before the end of each phase [36] throughout the project life cycle. Furthermore, there is also the mandatory preview of the project quality gate review positioned at an early stage of Phase 1 of the project as shown in Fig. 4.1.

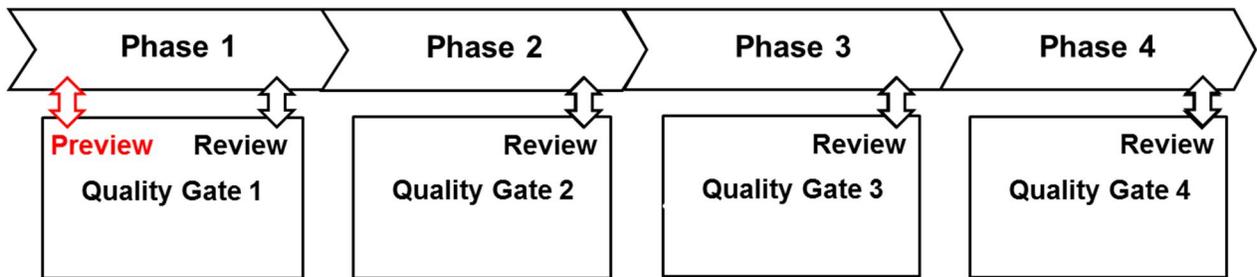


Fig. 4.1. Project Quality Gate Reviews in a Project Lifecycle

The major objectives of the project quality gate reviews are:

- To assure that all key deliverables and actions of the gate have been completed in compliance with recommended practices and to the customer's satisfactions
- To reduce the risks of the project by making sure that standard methods and tools are used to the best effect
- To enable the project manager to continuously communicate the process and build quality directly into the project [51]

Table 4.1 shows the description of the generic project quality gate checklist, which covers the checklist items (use cases and elements) for all phases of the project. The checklist consists of three major methodologies, internal governance, project management knowledge areas [44] and ERP (i.e. processes, products and services [6]) implementation methodology since ERP implementation faces many difficulties that cause its failure [35], [52].

Table 4.1. Generic Project Quality Gate Checklist

Methodology	Workstream	Use Case (Checklist Item)	Elements (Template Recommended)	Quality Gate 1	Quality Gate 2	Quality Gate 3	Quality Gate 4
Internal Governance	Initiation	Handover Meeting - Sales and Delivery	Handover Checklist	X	-	-	-
		Customer Readiness	Project Organization Chart, Role Description	X	-	-	-
		Project KPI Agreement	Internal KPI Document	X	-	-	-
Project Management Knowledge Areas	Project Management	Roles and Responsibilities	RACI Matrix, Role Description	X	X	X	X
		Steering Committee	Role Description, Org Chart with SC	X	X	X	X
		Customer Duties to Collaborate	Deliverables Matrix / RACI Matrix	X	X	X	X
		Project Manager Skills	PMP Credential, Project Management Experience	X	-	-	-
		Project Team	Contact List	X	X	X	X
		Work Breakdown Structure including Schedule	WBS & Schedule	X	X	X	X
		Project Delivery Approach	Project Description	X	X	X	X
		Kickoff Meeting	Kickoff Presentation	X	-	-	-
		Budget Monitoring	Project Planning and Controlling Monitor	X	X	X	X
		Project Progress Reporting	Project Schedule (tracking mode), Project Report	X	X	X	X
		Project Scope / Change Request Handling	Kickoff Presentation, Scope Document, Change Request	X	X	X	X
		Risk Management	Risk Register	X	X	X	X
		Issue Management	Issue List	X	X	X	X
		Approval and Sign-off	Acceptance Protocol	X	X	X	X
		Project Setup Tools	Project Guideline	X	-	-	-
		Project Management Procedures / Plans	Project Management Plan	X	X	X	-
Customer Satisfaction Survey	Tool & Template	X	X	X	X		
Lessons Learned	Lessons Learned Register	X	X	X	X		
ERP (Processes, Products and Services) Implementation Methodology	- Solution Design - Configuration - Walkthrough - Customer Extension Management	Configuration Standards	Guidelines	X	X	X	-
		Solution Design and Documentation	No Specific Template	X	X	X	X
		Security, Authorizations and Roles	Authorization Concept	X	X	X	X
	Solution Testing	Testing Plan and Environment	Test Concept, Test Catalogue, Test Case Description	X	X	X	-
		Testing Execution	No Specific Template		X	X	X
	Data Management Data Migration	Data Management, Migration, Archiving	No Specific Template	X	X	X	X
	- Customer Team Enablement / Training - Solution Adoption	Project Team Training Plan & Schedule	No Specific Template	X	X	X	-
		End User Training	No Specific Template	X	X	X	X
	- System Management - Integration Preparation - Integration Setup	Technical Solution Management	No Specific Template	-	X	X	X
		System Administration and Control	No Specific Template	-	X	X	X
	Cutover Management	Cutover Management	No Specific Template	-	-	X	X
	Support Readiness	Post Implementation Service and Support	No Specific Template	-	-	X	X
Production Support		No Specific Template	-	-	X	X	
	New Topic / Deliverable / Work Stream (to be added as necessary)			X	X	X	X

### **4.3 Use of PMIS to Initiate Quality Gate Process**

Project Q-Gate Review process consists of the two major processes. One is Project Q-Gate Preview process that is conducted at the beginning of each project. The other is an iterative process of Project Q-Gate Review that is conducted at each phase in the project lifecycle. PMIS applied to trigger the initiation of the project quality gate preview as well as the succeeding iterative project quality gate reviews systematically throughout the project phases is discussed in detail below.

#### ***4.3.1 Provide Project Quality Gate (Q-Gate) Reviews in a Project Lifecycle***

Systematic overview of the project quality gate review process that is triggered by the appropriate project initiation information from PMIS can be expressed in IDEF0 (Integration DEFinition level 0) [42], [43] as shown in Fig. 4.2. This is the top-level context diagram A-0.

It is decomposed to the next level diagram with a systematic framework that consists of two nodes, A1 and A2 as shown in Fig. 4.3. Node A1 is project quality gate preview process that is triggered by the relevant project initiation information from PMIS to be conducted at the beginning of each project. It is specifically positioned to influence the phase and project results positively, as well as coach and advise the project manager on upcoming project phase with the methodology, tools, project documents, quality and standards, deliverables, customer duties and so on. Node A2 is an iterative process of project quality gate review to be conducted at each phase in the project lifecycle. It is positioned to check that necessary standards and project approach have been established along with response plans for the identified risks.

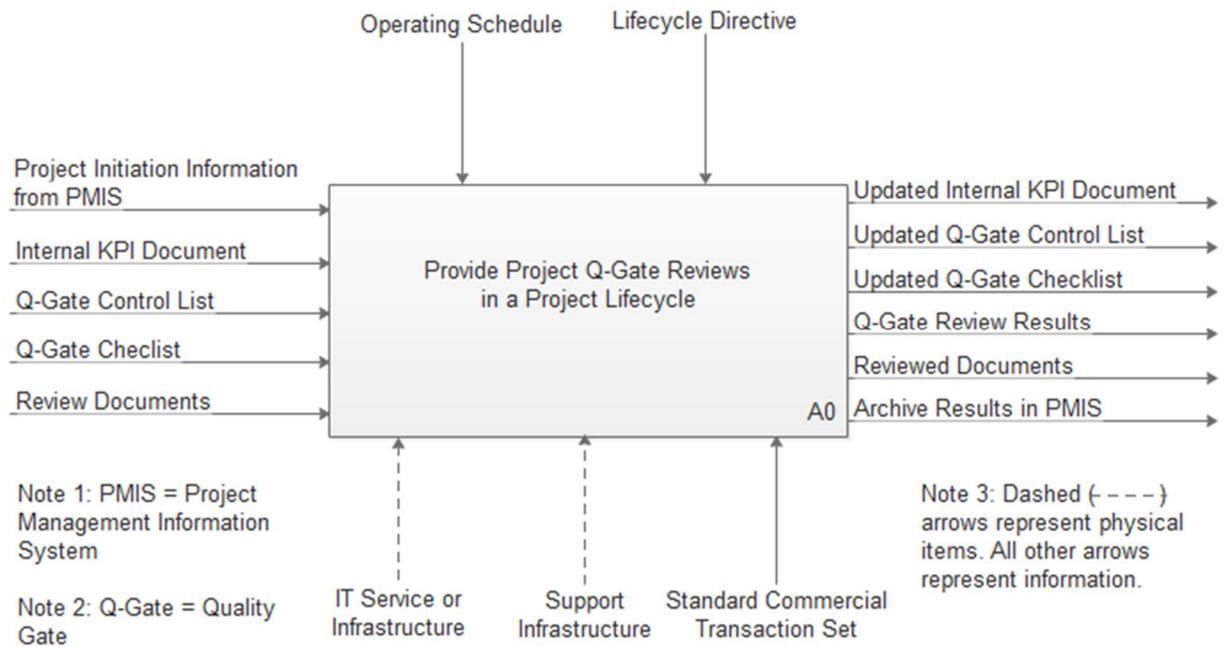


Fig. 4.2. Provide Project Q-Gate Reviews in a Project Lifecycle

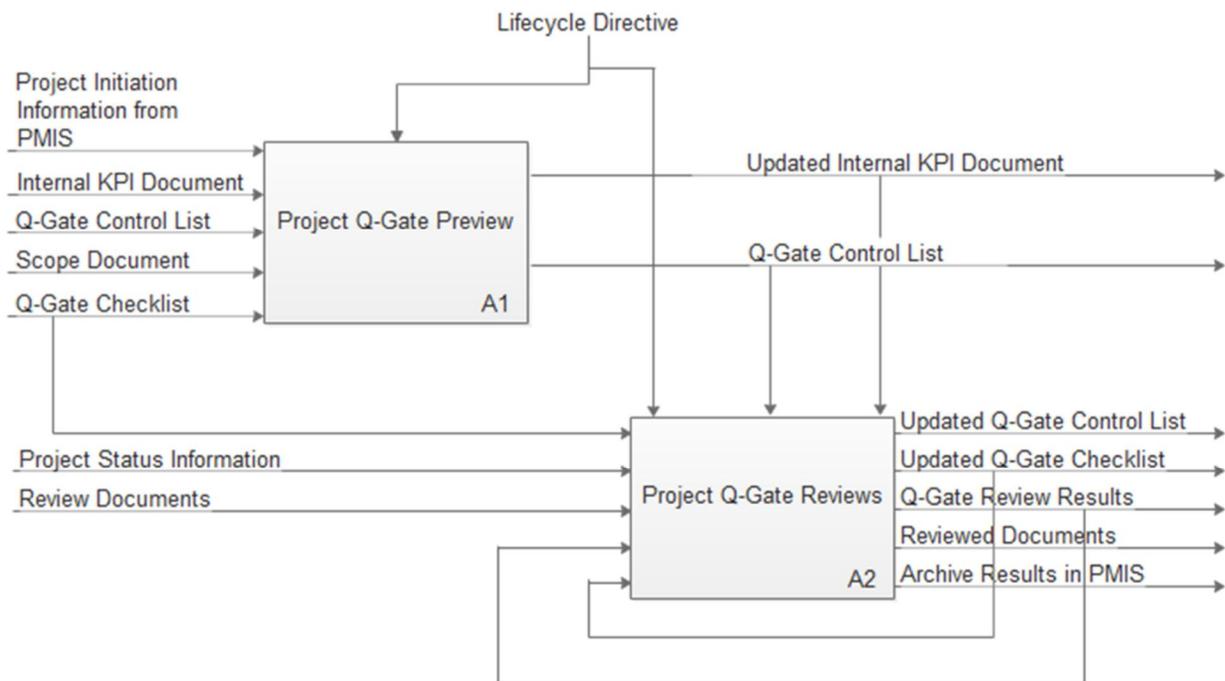


Fig. 4.3. Conduct Project Q-Gate Preview and Project Q-Gate Reviews

### 4.3.2 Conduct Project Q-Gate Preview and Get Agreement on Project Q-Gate Review Schedule

The decomposition of node A1 to 5 activities is shown in Fig. 4.4. This process for conducting Quality Gate 1 Preview by the independent quality reviewer plays the most important role to properly kick off the project quality gate review process that is to be carried out at each phase in the project lifecycle.

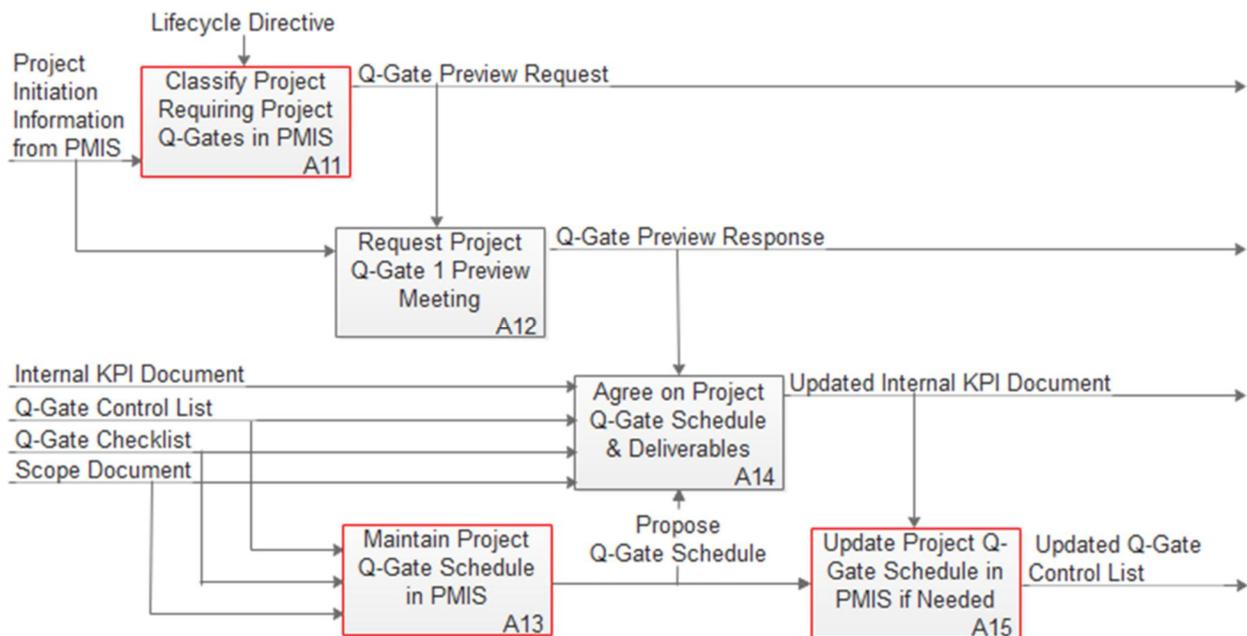


Fig. 4.4. Conduct Project Q-Gate Preview and Get Agreement on Project Q-Gate Review Schedule

Below are the major activities required to plan and conduct Quality Gate 1 Preview.

- Node A11; Classify Project requiring Q-Gates in PMIS:** The independent quality reviewer is to check (during the 1<sup>st</sup> two weeks of the month) if there is any newly started project in PMIS relevant for triggering the initiation of the project quality gate process based on the following criteria that the Solution Provider is:

- To provide a project manager and project team
- To be responsible for providing particular results based on contractual agreements
- To provide advisory services that are mainly relevant to meet customers' project goals
- To provide project work with the budget of the contract that is greater than the threshold value
- **Node A12; Request Q-Gate 1 Preview Meeting:** Once a relevant project is found:
  - The independent quality reviewer is to send an email to the project manager responsible for the execution of the project, which is also copied to the delivery manager in charge of the portfolio category, based on the explanation for the need of getting Q-Gate 1 Preview conducted before a proposed due date for completion stated on the email.
  - The independent quality reviewer is also to have the generic project quality gate checklist template and the internal KPI document template attached to the email.
  - The project manager is to send back an hour meeting request with a date proposed for having Q-Gate 1 Preview conducted.
  - The independent quality reviewer is to respond to the meeting invite to have the preview date finally fixed.
- **Node A13; Maintain Q-Gate Schedule in Control List:** Once the scope document attached to the contract of the classified project is made available, the independent quality reviewer is to maintain the soft-booked dates of the project quality gates for

the project in the Q-Gate Control List in PMIS prior to conducting Q-Gate 1 Preview based on the process that is expressed in UML (Unified Modelling Language) class diagram [53-55] shown in Fig. 4.5. Table 4.2 shows a snapshot of Q-Gate Control List maintained in PMIS prior to conducting the Project Q-Gate 1 Preview based on the soft-booked quality gate schedule.

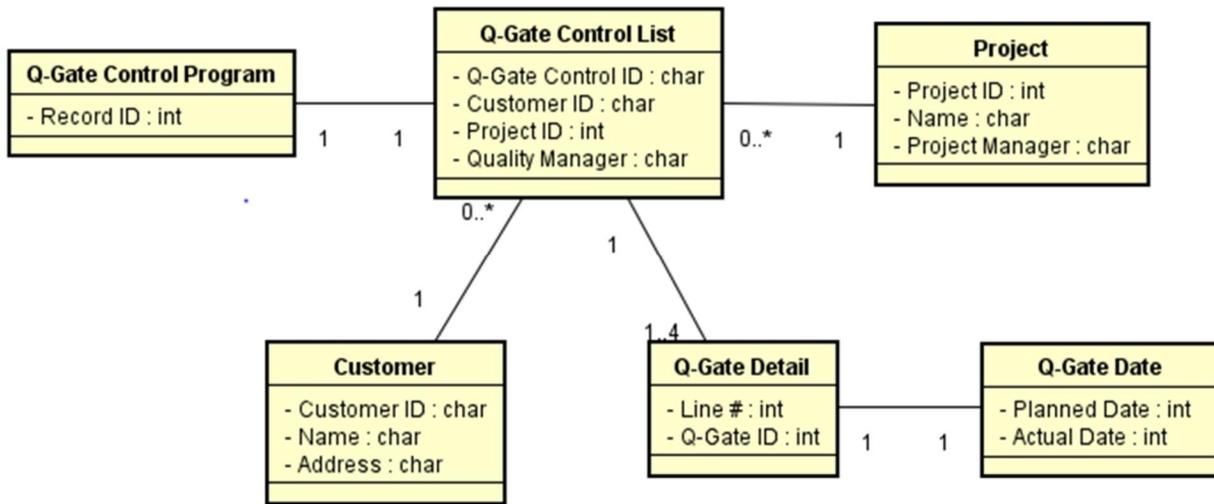


Fig. 4.5. Maintain Q-Gate Schedule in Q-Gate Control List

Table 4.2. Q-Gate Control List Maintained Prior to Conducting Project Q-Gate 1 Preview

Industry Sector Name	Project Name	Q-Gate Name	Q-Gate Severity	Status (Q-Gate)	Compliance	Review Date	Forecast Finish date	Late Gates
Consumer / Trading	Project K	Quality Gate 1	⚠	In Progress	🔴	2017/4/3	2017/4/3	🟢
Consumer / Trading	Project K	Quality Gate 2	⚠	In Progress	🔴	2017/11/27	2017/11/27	🟢
Consumer / Trading	Project K	Quality Gate 3	⚠	In Progress	🔴	2018/11/26	2018/11/26	🟢
Consumer / Trading	Project K	Quality Gate 4	⚠	In Progress	🔴	2019/11/25	2019/11/25	🟢

- **Node A14; Agree on Q-Gate Schedule and Deliverables:** In Quality Gate 1 Preview, there are two major tasks to be conducted as follows:
  - Agree on Quality Gate Schedule: Scheduling of the date for each project quality gate to be conducted needs to be fixed based on the proposed soft-booked dates maintained in PMIS. The tool used to capture the dates fixed for

the project quality gates is the internal KPI document shown in Table 4.3 that is a mandatory item in the generic project Q-Gate 1 checklist.

Table 4.3. Get Internal KPI Document Filled Out and Signed Off

1	Project Revenue Target
2	Project Cost Target
3	Value Target
4	Time KPI
5	Scope KPI
6	Quality KPI: - Quality Gate 1: Date & Phase - Quality Gate 2: Date & Phase - Quality Gate 3: Date & Phase - Quality Gate 4: Date & Phase
7	Communications Management
8	Human Resource Management
9	Signatures: - Signature Delivery Manager, Date - Signature Project Manager, Date

It is developed to contain the objectives for the project manager that are aligned with company business objectives and customer project goals. KPIs listed are to be agreed upon by the project manager responsible for execution of the project and the delivery manager in charge of the portfolio category where the project relevant for project quality gates belongs to.

- Agree on Deliverables: Walk-through of the project quality gate checklist is to be conducted. All key deliverables listed in the project quality gate checklist for each phase are to be looked at and agreed with the project manager, to build quality into the project to comply with recommended practices.

- **Node A15; Update Q-Gate Schedule in Control List if Needed:** If there were some adjustments in the soft-booked dates for quality gate reviews required as the results

of the meeting with the project manager, update them if needed in the Q-Gate Control List in PMIS.

### 4.3.3 Conduct Project Q-Gate Review in Iterative Process

The decomposition of node A2 to 6 activities is shown in Fig. 4.6. Once the dates fixed for the planned project quality gates are maintained in the Q-Gate Control List in PMIS, the iterative process for conducting a quality check at each phase is to be started accordingly to the schedule.

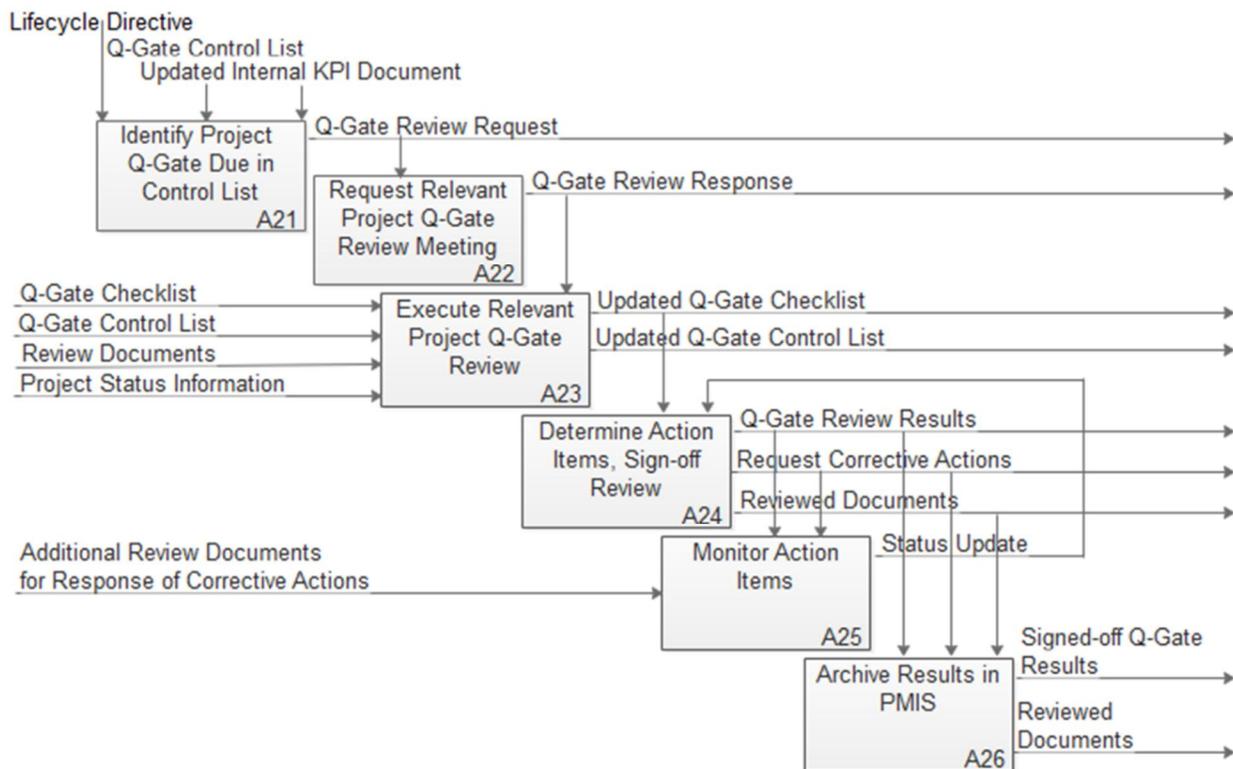


Fig. 4.6. Conduct Project Q-Gate Review in Iterative Process

Below are the steps of major activities required for conducting Quality Gate Review.

- **Node A21; Identify Q-Gate Review due in Control List:** By leveraging the Q-Gate Control List that is maintained in PMIS, the independent quality reviewer is to check

in PMIS the projects having respective project quality gate reviews due in the coming month on the 25th of every month. Table 4.4 shows a sample output of all the project quality gates due in April 2017.

Table 4.4. Q-Gate Control List with Project Q-Gate Reviews Due Next Month

Industry Sector Name	Project Name	Q-Gate Name	Q-Gate Severity	Status (Q-Gate)	Compliance	Review Date	Forecast Finish date	Late Gates
Consumer / Trading	Project K	Quality Gate 1	⚠	In Progress	🔴	2017/4/3	2017/4/3	🟢
High Tech	Project T	Quality Gate 3	⚠	In Progress	🔴	2017/4/3	2017/4/3	🟢
High Tech	Project M	Quality Gate 4	⚠	In Progress	🔴	2017/4/10	2017/4/10	🟢
Consumer / Trading	Project J	Quality Gate 3	⚠	In Progress	🔴	2017/4/14	2017/4/14	🟢

- **Node A22; Request Relevant Q-Gate Review Meeting:** For each project with relevant project quality gate review due in the coming month, the independent quality reviewer is:
  - To send an email to the project manager responsible for the execution of the project, which is also copied to the delivery manager in charge of the portfolio category, for preparation of getting the relevant quality gate review conducted on the planned date captured in the internal KPI document.
  - To request the project manager to submit all the key deliverables mandatory in the generic quality gate checklist at least one week in advance of the date of the quality gate review.
  - To request the project manager to respond by sending back an hour meeting request on the date fixed for having the quality gate review conducted.
- **Node A23; Execute Relevant Q-Gate Review:** The following major activities are conducted:
  - The project manager is to send all key deliverables available for review by mail to the independent quality reviewer at the earliest timing possible prior

to the relevant quality gate review meeting.

- The independent quality reviewer is to review the deliverables submitted by the project manager prior to the meeting for the quality gate review.
- At the meeting for the relevant quality gate review, the project manager is to facilitate the review by presenting the overall project status with the major issues logged and response plans for the risks identified, and briefing the contents of key deliverables mandatory in the relevant quality gate checklist.
- The independent quality reviewer is to determine the overall status as the results of the Q-Gate Review based on the following criteria:
  - Accepted: Indicates that there were no non-conformances identified and thus the project quality gate is passed.
  - Conditionally Accepted: Indicates that action items need to be completed or certain deliverables need to be fixed for improvement, as well as the corrective actions need to be implemented [5, 6] to get “Accepted”. No direct risk for project success is given.
  - Not Accepted: Indicates that the project quality gate is not passed as there are serious action items. Direct risk for project success is given.
- Once the review is over, the independent quality reviewer is to update the Q-Gate Control List in PMIS. Table 4.5 shows a snapshot of Q-Gate Control List updated in PMIS as the results of the Project Q-Gate 1 Review.

Table 4.5. Q-Gate Control List Updated as the Results of Project Q-Gate 1 Review

Industry Sector Name	Project Name	Q-Gate Name	Q-Gate Severity	Status (Q-Gate)	Compliance	Review Date	Forecast Finish date	Late Gates
Consumer / Trading	Project K	Quality Gate 1	✓	Accepted	■	2017/4/3	2017/4/3	■
Consumer / Trading	Project K	Quality Gate 2	⌚	In Progress	●	2017/11/27	2017/11/27	■
Consumer / Trading	Project K	Quality Gate 3	⌚	In Progress	●	2018/11/26	2018/11/26	■
Consumer / Trading	Project K	Quality Gate 4	⌚	In Progress	●	2019/11/25	2019/11/25	■

- **Node A24; Determine Action Items, Sign-off Review:** The independent quality reviewer is to communicate by email to the project manager and the delivery manager:
  - The evaluation on each deliverable against the project quality gate checklist items and provide the management summary as the overall status of the project quality gate review
  - The corrective actions with a deadline if it requires the re-evaluation
  - The reminder of the next project quality gate review date unless it is the final project quality gate planned for the project
- **Node A26; Archive Results in PMIS:** The independent quality reviewer is to upload to PMIS the review results based on the management summary input in the header of the relevant project quality gate checklist along with the actual deliverables reviewed
- **Node A25; Monitor Action Items:** If there are any corrective actions outstanding from the project quality gate review:
  - The independent quality reviewer is to send an email to request them with a deadline set for the re-evaluation of the project quality gate review.
  - The project manager is to send back the updated deliverables due by the deadline.
  - The independent quality reviewer is to provide the results of re-evaluation by
  - email to the project manager and the delivery manager, along with the reminder of the next quality gate review date unless it is the final quality gate.
- **Node A26; Archive Results in PMIS:** The independent quality reviewer is:
  - To upload to PMIS the updated relevant project quality gate checklist as the

results of re-evaluation of the deliverables or the corrective actions implemented

- To update the Q-Gate Control List if needed.

#### 4.4 Summary

As the results of the case study conducted in 2017 for the ERP projects implemented by the solution provider in Japan based on the quality gate process lifecycle described in Section 4.3, PMIS was found to be effective in searching for the newly registered projects relevant for the project quality gate requirements as well as identifying, notifying and influencing the project managers to timely initiate the quality gate process based on the schedule fixed for each quality gate review.

Table 4.6 below shows the results of all the four project quality gates that were due to be conducted in April 2017 described in Table 4.4 based on the Control List maintained in PMIS. In conclusion, it clearly indicates the positive effects of PMIS to properly initiate the project quality gate process for continuous improvement of project management processes, as two out of the four quality gate reviews in total, Quality Gate 3 of Project T and Quality Gate 4 of Project M were even conducted a few days earlier than the original planned review dates of 2017/4/3 and 2017/4/10 respectively and also the review results were all accepted (or passed).

Table 4.6. Q-Gate Control List Updated as the Results of All the Conducted Q-Gate Reviews Due in April 2017

Industry Sector Name	Project Name	Q-Gate Name	Q-Gate Severity	Status (Q-Gate)	Compliance	Review Date	Forecast Finish date	Late Gates
Consumer / Trading	Project K	Quality Gate 1	✓	Accepted	■	2017/4/3	2017/4/3	■
High Tech	Project T	Quality Gate 3	✓	Accepted	■	2017/4/3	2017/3/31	■
High Tech	Project M	Quality Gate 4	✓	Accepted	■	2017/4/10	2017/4/6	■
Consumer / Trading	Project J	Quality Gate 3	✓	Accepted	■	2017/4/14	2017/4/14	■

## **Chapter 5. Effective Reuse of Lessons Learned to Conduct the Quality Audit based on the Use of PMIS for Continuous Improvement**

This chapter describes the overview of the research and reviews the works that relate to lessons learned definitions, lessons learned processes, a lessons learned session, commonly used synonyms for lessons learned and their adoption. Use of lessons learned effectively to conduct the project review for the ERP project carried out by the solution provider is presented and the results based on the use of lessons learned from the past project reviews are summarized [12].

### **5.1 Overview**

In any organization, dealing with lessons learned is a complex issue that involves people, processes and technologies [56]. One of the main challenges that organizations face, specifically project-oriented organizations, is the lack of structure and incentives for organization-wide learning [56, 57]. Since lessons learned are elements of both organizational learning and knowledge management [58, 59], creating, managing, sharing and utilizing knowledge effectively is vital for organizations to take full advantage of the value of knowledge [60].

According to a recent study [16], it has been said that “lessons learned” is one of the most important and “value added” aspects of the project management lifecycle. However, it has been reported that it is often the most ignored part of finishing a project. Various reasons have been offered for this phenomenon. Some actions to prevent the loss of knowledge and experiences are known from the literature. However, only a few firms manage systematically to identify and transfer valuable knowledge from projects to following projects [25]. To date, much of the

research and industry focus has been on capturing lessons learned from the projects. However, even if lessons learned are successfully captured, there are still numerous problems to address in terms of their dissemination [8].

This article describes the systematic approach to initiate the project review on the specific project identified for requiring the formal quality audit based on the use of project management information system (PMIS) [11, 61] for having the execution date fixed by the independent quality reviewer with the project manager [62, 63]. Then, the project review process is started by retrieving the lessons learned data from the lessons learned repository [64-67], which were collected from the previous project reviews for the relevant ERP implementation projects, for the preparation of conducting the project document review and stakeholder interviews.

A case study methodology was applied to the historical lessons learned data of the ERP implementation projects [35, 36], [68-73] conducted by a solution provider for their customers in the various industries in Japan, which were retrieved for the period of four years from 2014 to 2017 to analyze how the lessons learned collected from the project reviews of the earlier projects were reused in those of the succeeding projects conducted during the period. The set of projects was determined based on the following criteria that the solution provider is [10]:

- To provide a project manager and project team;
- To be responsible for providing particular results based on contractual agreements;
- To provide advisory services that are mainly relevant to meet customers' project goals;
- To provide project work with the budget of the contract that is greater than the threshold value; and

- To have an agreement with the customer for conducting the project reviews (or quality audits) at the selected phases or project post mortem for continuous improvement.

Use of lessons learned based on the past project review results was found to be effective in focusing on the specific areas projected for improvement during the processes of conducting the project document review and key stakeholder interviews, as well as putting together the practical recommendations for the findings to finalize the results of the project review, which were to be formally presented and submitted to the customer as the results of the quality audit.

## **5.2 Related Works**

The Project Management Institute defines the term lessons learned as “the learning gained from the process of performing the project” in the 3<sup>rd</sup> Edition of PMBOK [74], such as the activities of the project that went well or could be improved [75]. Another definition used by the American, European and Japanese Space Agencies is: “A lesson learned is knowledge or understanding gained by experience.” The experience may be positive, as in the successful test or mission, or negative, as in a mishap or failure [76, 77]. The latest PMBOK 6<sup>th</sup> Edition defines it in more detail as “the knowledge gained during a project which shows how project events were addressed or should be addressed in the future for the purpose of improving future performance [17].”

The literature on learning organization has described a set of lessons learned processes named as follows: collect, capture, gather, verify, store, share, distribute, disseminate, reuse, and apply [78]. Lessons learned processes have been deployed in commercial, government, and military organizations since the late 1980s to capture, store, disseminate, and share experiential working knowledge [77]. PMBOK 3<sup>rd</sup> Edition defines a process as a set of interrelated actions

and activities performed to achieve a specified set of products, results, or services [74]. The purpose of a lessons learned process is to define the activities required to successfully capture and use lessons learned. The lessons learned process includes five steps: identify, document, analyze, store and retrieve. The following are the details of the five steps [64-67]:

- Step 1: Identify Lessons Learned is to identify comments and recommendations that could be valuable for future projects
- Step 2: Document Lessons Learned is to document and share the findings in the following manner:
  - Detailed Report – The detailed lessons learned report consists of the data captured during the lessons learned session
  - Summary – This is a one-page brief for leadership summarizing the findings and providing recommendations for correcting the findings
  - Executive Report – This report should present an overview of the lessons learned process and a summary of project strength
  - Findings – A summary of the issues found during the review process
  - Recommendations – Recommendation are actions to be taken to correct findings
- Step 3: Analyze lessons Learned is to analyze and organize the lessons learned for application of results
- Step 4: Store Lessons Learned is to store in a repository
- Step 5: Retrieve Lessons Learned is to retrieve for use on current projects

A lessons learned session focuses on identifying project successes and project failures, and includes recommendations to improve future performance on projects [74]. During the

project lifecycle, the project team and key stakeholders identify lessons learned concerning the technical, managerial, and process aspects of the project. The lessons learned are compiled, formalized, and stored through the project's duration [74].

Commonly used synonyms for lessons learned include project assessments, project reviews, project completion audits, postmortems, reviews, appraisals, after-action reviews, debriefings and post-implementation evaluations [25, 26]. The project management literature describes lessons learned as practices that [26]:

- Are quality improvement oriented and help correct process efficiency and effectiveness problems in a timely manner [79]
- Help deliver more successful projects, improve customer satisfaction [79] and help participants learn about successful and unsuccessful practices [80]
- Involve dissemination and sharing functions [80]
- Involve both inter-and intra-project learnings [79] because they assist with externalizing implicit knowledge [25]

By a postmortem, it is meant to be a collective learning activity which can be organized for projects either when they end a phase or are terminated [81]. The main motivation is to reflect on what happened in the project in order to improve future practice – for the individuals that have participated in the project and for the organization as a whole [81].

An audit is structured, independent process used to determine if project activities comply with organizational and project policies, processes, and procedures [17]. A quality audit is usually conducted by a team external to the project, such as the organization's internal audit department, PMO (Project Management Office), or by an auditor external to the organization. Quality audit objectives may include, but are not limited to [17]:

- Identifying all good and best practices being implemented;
- Identifying all nonconformity, gaps, and shortcomings;
- Sharing good practices introduced or implemented in similar projects in the organization and/or industry;
- Proactively offering assistance in a positive manner to improve the implementation of processes to help raise team productivity; and
- Highlighting the contributions of each audit in the lessons learned repository of the organization.

The ERP implementation methodology [36] used by the solution provider is based on the traditional waterfall model consisting of the four phases. A project review (or quality audit) is conducted by the independent quality reviewer who is external to the project on the project documents against the project review checklist relevant for the target phase or project post mortem along with the interviews of key project stakeholders as shown in Fig. 5.1.

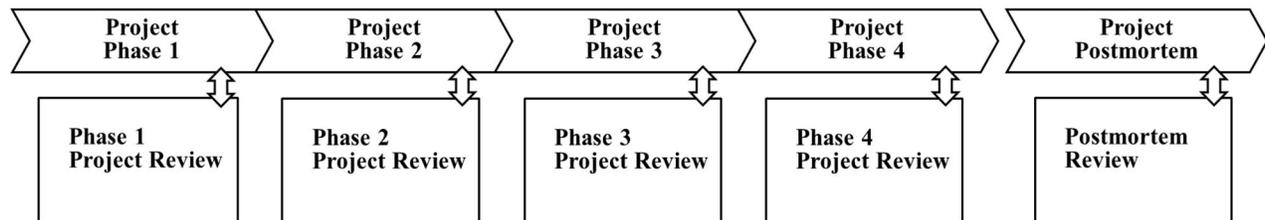


Fig. 5.1. Project Review by Phase and Postmortem Review

The major objectives of the project reviews (or quality audits) are as follows:

- Focus on project management, but also assess organizational and technical readiness
- Conduct on-site interviews with key project stakeholders
- Evaluate project documents
- Uncover project risks and issues that are documented in a set of review reports, providing actionable recommendations for improvement of project management

Delivery roadmap for a typical project review is as follows:

- Initiate:
  - Contact project manager
  - Gather and review project information
- Plan:
  - Conduct review planning meeting
  - Fix project review schedule in PMIS
  - Maintain project review checklist
  - Retrieve relevant lessons learned data
- Execute:
  - Prepare
    - Prepare for interview
  - Conduct
    - Study project documents
    - Perform interviews
    - Apply retrieved lessons learned
    - Analyze project documents
    - Analyze interviews
    - Discuss initial observations
  - Complete
    - Apply retrieved lessons learned
    - Develop findings
    - Develop recommendations

- Develop a detailed report
- Develop a summary report
- Present a summary report
- Present a detailed report
- Close:
  - Maintain project review checklist
  - Maintain lessons learned register
  - Archive review results in PMIS
  - Store in lessons learned repository

Table 5.1 shows the description of the project review checklist for the project document review, which covers the checklist items (use cases and elements) for all phases of the project. The checklist consists of the two major methodologies, the project management knowledge areas [17] and ERP (i.e. processes, products and services [6]) implementation methodology since ERP implementation faces many difficulties that cause its failure [35, 52].

Table 5.2 shows the description of the project review checklist for the project stakeholder interviews, which covers the checklist items (use cases and elements). The checklist consists of the three major methodologies, the project governance, project management knowledge areas and ERP implementation methodology.

Table 5.3 describes the scope of the project review (or quality audit) based on the methodology in terms of the project governance, project management knowledge areas and ERP implementation methodology.

Table 5.4 shows the criteria for evaluation of the audit findings based on the five levels of risk severity, “No Finding”, “Low Risk”, “Medium Risk”, “High Risk” and “Problem”.

Table 5.1. Project Review Checklist for Project Document Review

Methodology	Use Case (Process)	Element (Document Name)	Project Phase 1	Project Phase 2	Project Phase 3	Project Phase 4	Project Postmortem	
Project Management Knowledge Areas	Project Integration Management	Project Statement of Work	X	-	-	-	X	
		Business Case	X	X	-	-	X	
		Organizational Process Assets	-	X	-	-	X	
		Project Charter	X	-	-	-	X	
		Preliminary Scope Statement	X	-	-	-	-	
		Project Management Plan	X	X	X	X	X	
		Project Kick-off Presentation	X	-	-	-	X	
		Issue Management Procedure	X	-	-	-	X	
		Issue Register	X	X	X	X	X	
		Requested Changes	-	X	X	X	X	
	Lessons Learned Register	X	X	X	X	X		
	Stakeholder Register	X	X	X	X	X		
	Project Scope Management	Scope Management Plan	X	-	X	X	X	
		Project Scope Statement	X	X	X	X	X	
		Work Breakdown Structure	X	X	X	X	X	
		Work Breakdown Structure Dictionary	X	X	X	X	X	
		List of Project Deliverables	-	-	X	X	X	
	Project Schedule Management	Accepted Deliverables	-	X	X	X	X	
		Schedule Management Plan	X	-	-	-	X	
	Project Cost Management	Project Schedule	X	X	X	X	X	
		Cost Management Plan	X	-	X	X	X	
	Project Quality Management	Cost Baseline	X	X	X	X	X	
		Quality Management Plan	X	X	X	X	X	
	Project Resource Management	Resource Management Plan	X	X	X	X	X	
		Project Organizational Charts	X	-	X	X	X	
		Roles and Responsibilities	X	X	X	X	X	
		Team Performance Assessments	-	-	X	X	X	
	Project Communications Management	Communications Management Plan	X	X	X	X	X	
		Performance Reports	-	X	X	X	X	
		Project Reports	X	X	X	X	X	
		Latest Steering Committee Meeting Minutes	X	X	X	X	X	
		Latest Project Management Team Meeting Minutes	X	X	X	X	X	
	Project Risk Management	Risk Management Plan	X	X	X	X	X	
		Risk Register	X	X	X	X	X	
	Project Procurement Management	Contract Management Plan	X	-	-	-	-	
	Project Stakeholder Management	Stakeholder Engagement Plan	X	X	X	X	X	
	ERP (Processes, Products and Services) Implementation Methodology	Organizational Change Management (OCM)	OCM Charter	X	-	-	-	X
			OCM Master Plan	-	X	X	X	X
			Stakeholder Analysis	X	-	-	-	X
			Communications Plan	-	-	X	X	X
		Business Process Management	Business Blueprint	-	X	X	X	X
			Functional Specifications - RICEF Objects	-	-	X	X	X
Development List			-	-	X	X	X	
Technical Solution Management		Future Technical System Landscape	X	-	-	-	X	
		Support Expectations	-	X	-	-	-	
		System Administration Procedures	-	X	-	-	-	
		System Landscape Design (DEV, QA, PRD)	-	-	X	X	X	
		Production Support Processes	-	-	X	X	X	
Integrated Solution Management		Development Test Plans	-	-	X	X	X	
		Final Test Plan	-	-	X	X	X	
		End-User Testing	-	-	X	X	X	
Data Management	Data Migration Strategy	X	-	-	-	X		
	Data Migration Plan	-	X	-	-	X		
Training	Project Team Training Plan	-	X	-	-	X		
	End-User Training Documentation	-	-	X	X	X		
	Training Evaluation Results	-	-	X	X	X		
	End-User Training Evaluation Summary	-	-	-	-	X		
Production Cutover	Cutover Plan	-	-	X	X	X		

Table 5.2. Project Review Checklist for Stakeholder Interviews

Methodology	Use Case	Element (Interview Topic)
Project Governance	Sponsor Interview	Project Governance
Project Management Knowledge Areas	Sponsor Interview	Project Sponsor Role and Involvement
		Project Goals and Objectives
		Project Success Criteria
		Value Realization Strategy
		Project Information Sheet Contents
	Functional Team Interview	Project Management Activities (Risk, Scope, etc.)
		Project Issues
ERP (Processes, Products and Services) Implementation	Functional Team Interview	Functionality Definition
		Functionality Status
		Production Support
		Project Team Training and Knowledge Transfer

Table 5.3. Project Review Scope

Methodology	Use Case (Process)
Project Governance	Project Governance – Governance
Project Management Knowledge Areas	Project Integration Management
	Project Scope Management
	Project Schedule Management
	Project Cost Management
	Project Communications Management
	Project Resource Management
	Project Quality Management
	Project Risk Management
	Project Procurement Management
	Project Stakeholder Management
ERP (Processes, Products and Services) Implementation Methodology	Solution Readiness – Requirements
	Solution Readiness – Building
	Solution Readiness – Testing
	Business and User Readiness – Organizational Change Management
	Business and User Readiness – End User Training and Documentation
	Data Readiness – Data Readiness
	Technical Infrastructure Readiness – Technical Infrastructure Readiness
	Support Readiness – Production Support and Center of Excellence
Support Readiness – Knowledge Transfer and Documentation	

Table 5.4. Risk Reporting Levels

Severity	Description	Action Required
No Finding	Topic in good order	No action necessary.
Low Risk	Topic with minor finding	Minimum impact. No management action is required.
Medium Risk	Topic with serious finding	Some disruption may occur. No immediate management action is required. However, continuous risk monitoring has to be initiated and future action may be needed if the situation persists.
High Risk	Topic with critical finding	Unacceptable risk. Major disruption is likely to occur. Priority management attention is required to bring the situation under control.
Problem	Topic with issue	A disruption has already occurred to the project. Immediate management attention is required to bring the situation under control.

Table 5.5 is a sample of the lessons learned register extracted from one of the review results (i.e. based on a postmortem review) based on the record layout consisting of all the mandatory fields. The rest of the lessons learned collected for the reuse from the postmortem review is shown in Appendix A.

Table 5.6 is a sample of the project review dashboard extracted from one of the review results (i.e. based on a postmortem review) stored in the lessons learned repository. It shows a total of 12 lessons learned consisting of one finding with the severity level, “Problem” and eleven findings with the severity level, “High Risk”.

Table 5.5. Lessons Learned Register Sample

Date	2014/8/13
Project ID	PS-05325
Project Name	Project T
Review Period	Postmortem
Method (PMBOK / ERP)	PMBOK
Use Case (Process)	Project Governance – Governance
Element	Accountability (Escalation Procedure)
Lessons Learned (Finding) Headline	Although the issue with delay in creation of the master data by a business unit had been reported week after week, it was never cleared till the end of the project.
Severity	High Risk
Finding	According to the weekly progress report, although the issue with delay in creation of master data by a business unit had been reported week after week, it was never completed due to running out of time based on the comment after all that work could not be completed from lack of man-hours.
Impact	Due to not timely taking effective corrective action for the issue, there is a possibility for the significant impact to occur in the project such as the go-live delay and cost overrun.
Recommendation	By clearly documenting the escalation procedure to define the ultimate accountability, please make sure to be able to timely take effective corrective action for the issue.

Table 5.6. Project Review Dashboard Sample

Methodology	Use Case (Process)	Problem	Risk Reporting Levels			
			High Risk	Medium Risk	Low Risk	No Finding
Project Governance	Project Governance – Governance		2			
Project Management Knowledge Areas	Project Integration Management		3			
	Project Scope Management		2			
	Project Schedule Management		1			
	Project Cost Management					-
	Project Communications Management					-
	Project Resource Management					-
	Project Quality Management					-
	Project Risk Management		1			
	Project Procurement Management					-
	Project Stakeholder Management					-
ERP (Processes, Products and Services) Implementation Methodology	Solution Readiness – Requirements					-
	Solution Readiness – Building					-
	Solution Readiness – Testing		1			
	Business and User Readiness – Organizational Change Management		1			
	Business and User Readiness – End User Training and Documentation					-
	Data Readiness – Data Readiness	1				
	Technical Infrastructure Readiness – Technical Infrastructure Readiness					-
	Support Readiness – Production Support and Center of Excellence					-
	Support Readiness – Knowledge Transfer and Documentation					-

### 5.3 Use of Lessons Learned Effectively to Conduct Project Review for ERP Implementation Project

The process for applying the lessons learned collected from the previous project reviews to conduct the project review for the ERP implementation project consists of two major processes. One is Prepare for Project Review Leveraging Lessons Learned Repository that is conducted at the beginning of the project or phase by the independent quality reviewer when the project is identified to have an agreement with the customer for conducting the project reviews (or quality audits) at the selected phases or project post mortem for continuous improvement. The other is a process of Conduct Project Review that is conducted by the independent quality reviewer once the project review schedule is fixed in the project review control list maintained in

PMIS upon agreement with the project manager for the set of projects described in Section I. PMIS applied to trigger the initiation of the project review systematically during the selected project phases is discussed in detail below.

### ***5.3.1 Apply Lessons Learned Process to Conduct Project Review for ERP Implementation***

Systematic overview of the use of lessons learned process to conduct the project review that is triggered by the appropriate project initiation information from PMIS can be expressed in IDEF0 (Integration DEFinition level 0) [42, 43] as shown in Fig. 5.2. This is the top-level context diagram A-0.

It is decomposed to the next level diagram with a systematic framework that consists of two nodes, A1 and A2 as shown in Fig. 5.3. Node A1 is Prepare for Project Review Leveraging Lessons Learned Repository process that is triggered by the relevant project initiation information from PMIS to be conducted at the beginning of the selected phases of the project. It is specifically positioned in preparation for conducting on-site interviews with key project stakeholders as well as evaluating project documents based on the retrieved lessons learned data collected from the previous project reviews, to influence the phase and project results positively for continuous improvement. Node A2 is a process of Conduct Project Review to be conducted in the selected phases in the project duration. It is positioned to focus on project management, but also assess organizational and technical readiness, and uncover project risks and issues that are documented in a set of review reports, providing actionable recommendations for improvement of project management.

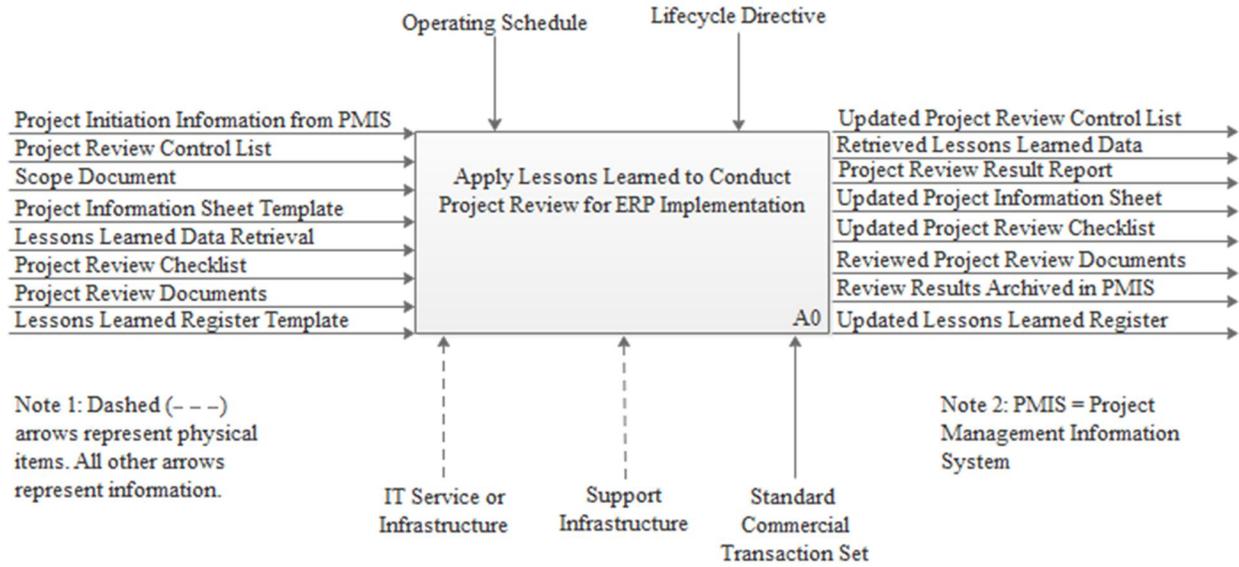


Fig. 5.2. Apply Lessons Learned to Conduct Project Review for ERP Implementation

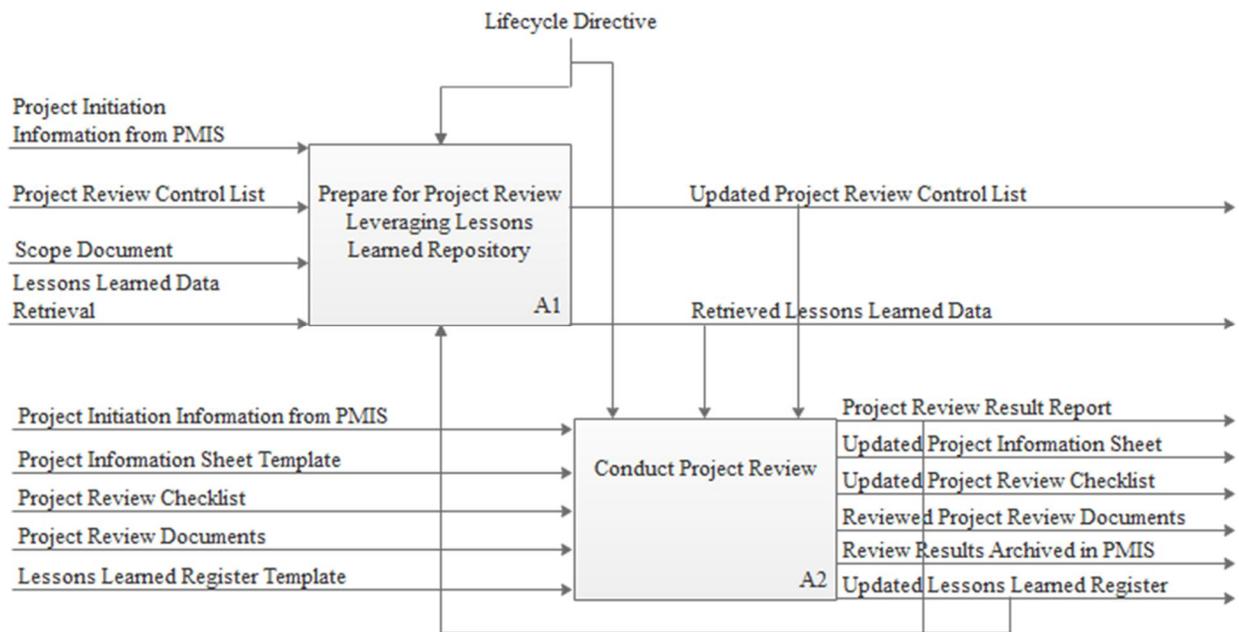


Fig. 5.3. Prepare for Project Review Leveraging Lessons Learned Repository and Conduct Project Review

**5.3.2 Classify Project Having Project Review Contracted, Fix Project Review Schedule in PMIS and Retrieve Lessons Learned Data**

The decomposition of node A1 to 6 activities is shown in Fig. 5.4. PMIS strategically implemented is effectively used by the independent quality reviewer who does not belong to the

organization unit responsible for the project delivery, in searching for the projects classified for the contractual needs of having project reviews conducted at the selected phases of the projects. This process for having the project review conducted by the independent quality reviewer plays the most important role to properly kick off the project review process and get the project review schedule fixed in the project review control list maintained in PMIS based on the agreement with the project manager. Then, the independent project reviewer is to retrieve the lessons learned data collected from the previous project reviews conducted for the ERP projects so that they can be applied to the project review process in preparation for conducting the project document review as well as key project stakeholder interviews.

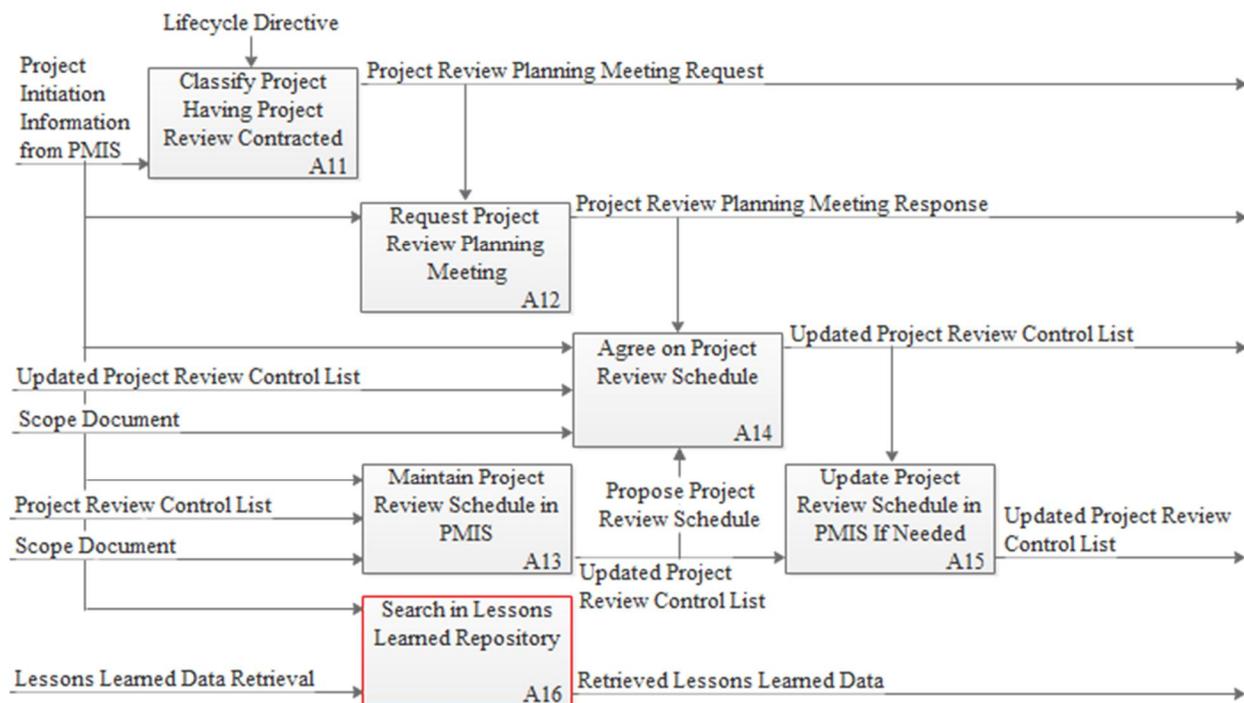


Fig. 5.4. Classify Project Having Project Review Contracted, Fix Project Review Schedule in PMIS and Retrieve Lessons Learned Data

Below are the major activities required to clarify the project having the project review contracted, fix the project review schedule in PMIS and retrieve the lessons learned data from the lesson learned repository.

- **Node A11; Classify Project Having Project Review Contracted:** The independent quality reviewer is to check (during the 1<sup>st</sup> two weeks of the month) if there is any project in PMIS which is having the project review (or quality audit) contracted and relevant for triggering the initiation of the project review process based on the following criteria that the solution provider is:
  - To provide a project manager and project team;
  - To be responsible for providing particular results based on contractual agreements;
  - To provide advisory services that are mainly relevant to meet customers' project goals;
  - To provide project work with the budget of the contract that is greater than the threshold value; and
  - To have an agreement with the customer for conducting the project reviews (or quality audits) at the selected phases or project post mortem for continuous improvement.

Table 5.7 shows a snapshot of the project initiation information from PMIS taken in June 2017 for classifying the project having the project review contracted.

Table 5.7. Online Portfolio Report for Project Having Project Review Contracted

Project ID	Industry Sector	Project Manager	Project Name	Period	Contract Type	Project Type	Planned Finish
PS-10782	Consumer / Trading	Project Manager 1	Project K	2017 M 05	T&M	Consulting Project	2020/3/31
PS-11634	High Tech	Project Manager 2	Project S	2017 M 05	T&M	Consulting Project	2018/3/30

- **Node A12; Request Project Review Planning Meeting:** Once a relevant project is found:
  - The independent quality reviewer is to send an email to the project manager responsible for the execution of the project, which is also copied to the delivery manager in charge of the portfolio category, based on the explanation for the need of getting a project review planning meeting conducted before a proposed due date for completion stated on the email.
  - The project manager is to send back an hour meeting request with a date specified for having the project review planning meeting conducted.
  - The independent quality reviewer is to respond to the meeting invite to have the meeting date finally fixed.
- **Node A13; Maintain Project Review Schedule in PMIS:** The independent quality reviewer is:
  - To set the preliminary project review schedule in the project review control list maintained in PMIS based on the project schedule stated in the scope document which is the addendum of the contract for the project as shown in Table 5.8.

Table 5.8. Project Review Control List Maintained Prior to Conducting Project Review

Industry Sector	Project Name	Project Type	Project Phase	Service Name	Planned Finish	Actual Finish	User Status	Severity
Consumer / Trading	Project K	Consulting Project	Phase 2	Project Review	2017/9/8		In Preparation	⊕
High Tech	Project S	Consulting Project	Phase 3	Project Review	2017/9/26		In Preparation	⊕

- **Node A14; Agree on Project Review Schedule:** The independent quality reviewer is:
  - To have an agreement with the project manager in the project review planning meeting for the scope of the project review as well as the dates and

- duration of the project review in reference to the preliminary project review schedule set in the project review control list which is maintained in PMIS.
- ***Node A15; Update Project Review Schedule in PMIS If Needed:*** The independent quality reviewer is:
    - To update the preliminary project review schedule maintained in the project review control list of PMIS if the proposed preliminary project review schedule was not acceptable to the project manager due to whatever the reason may be.
  - ***Node A16; Search in Lessons Learned Repository:*** Once the project review schedule is agreed and fixed by the project manager:
    - The independent quality reviewer is to search and retrieve the lessons learned data collected from the previous project reviews for the ERP projects conducted by the solution provider so that they can be applied to the project review process in preparation for conducting the project document review as well as key project stakeholder interviews.

### ***5.3.3 Conduct Project Review, Apply Lessons Learned Data, Store in Lessons Learned Repository and Archive Results in PMIS***

The decomposition of node A2 to 6 activities is shown in Fig. 5.5. In an iterative process, the project review (or quality audit) by the independent quality reviewer is to be conducted in the selected phases in the project duration based on the project review scheduled agreed and fixed with the project manager that is maintained in the project review control list of PMIS. It is positioned to focus on project management, but also assess organizational and technical readiness, and uncover project risks and issues that are documented in a set of review reports, providing actionable recommendations for improvement of project management.

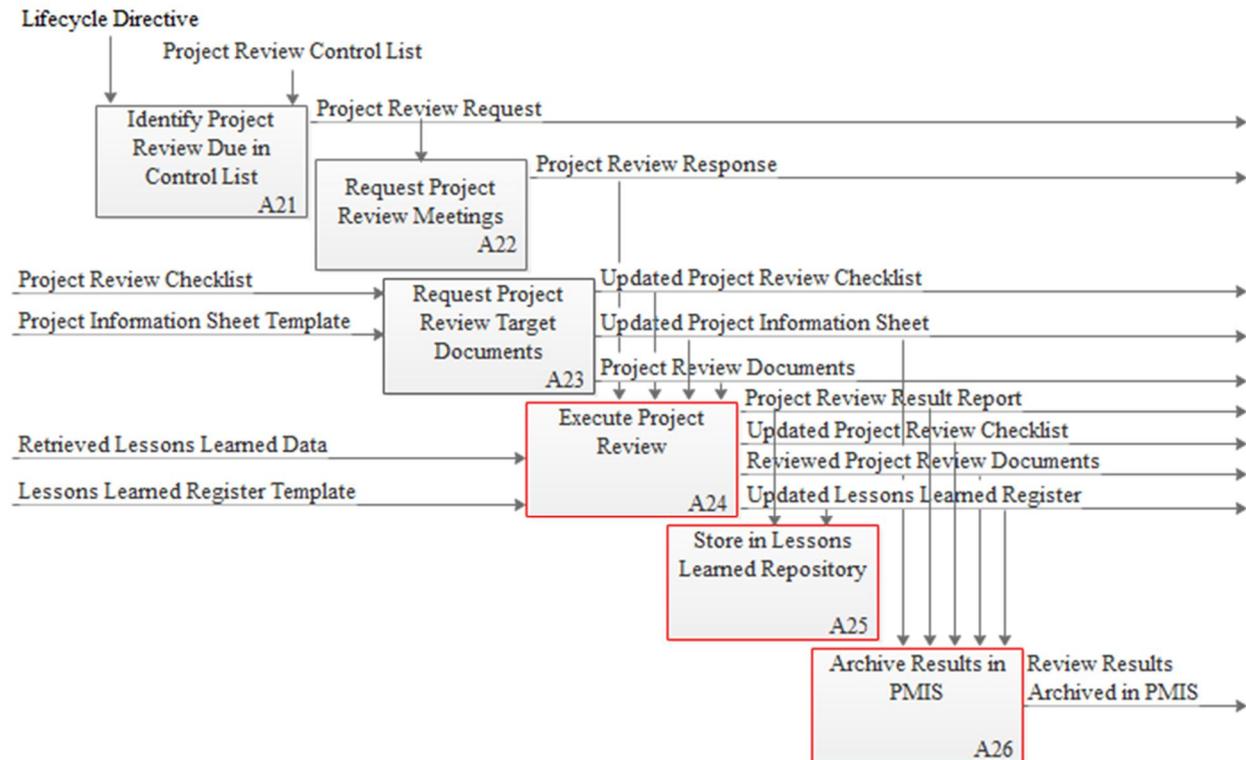


Fig. 5.5. Conduct Project Review, Apply Lessons Learned Data, Store in Lessons Learned Repository and Archive Results in PMIS

Below are the steps of major activities required to conduct the project review, apply lessons learned data, store in lessons learned repository and archive results in PMIS.

- Node A21; Identify Project Review Due in Control List:** By leveraging the project review control list, which is maintained in PMIS, the independent quality reviewer is to check the set of relevant projects (based on the criteria set by the solution provider) for triggering the iterative process of conducting the project review (or quality audit) on the 25<sup>th</sup> of every month. Table 5.9 shows the set of selected projects classified for having the project reviews at the selected phases contracted for continuous improvement.

Table 5.9. Project Review Control List with Project Review Due Next Month

Project ID	Industry Sector	Project Name	Project Type	Project Phase	Service Name	Planned Finish	Actual Finish	User Status	Severity
PS-10782	Consumer / Trading	Project K	Consulting Project	Phase 2	Project Review	2017/9/8		In Preparation	⊕
PS-11634	High Tech	Project S	Consulting Project	Phase 2	Project Review	2017/2/2	2017/2/2	Green	✓
PS-11634	High Tech	Project S	Consulting Project	Phase 3	Project Review	2017/9/26		In Preparation	⊕

- **Node A22; Request Project Review Meetings:** Once a relevant project is found:
  - The independent quality reviewer is to send an email to the project manager responsible for the execution of the project, which is also copied to the delivery manager in charge of the portfolio category, based on the need of having a series of the identified project stakeholder interviews scheduled along with the due date for submission of the response stated on the email.
  - The project manager is to send back the response with the dates and times specified for having the key project stakeholder interviews to be conducted by the due date.
- **Node A23; Request Project Review Target Documents:**
  - The independent quality reviewer is to send an email to the project manager responsible for the execution of the project, which is also copied to the delivery manager in charge of the portfolio category, based on the need of a set of project documents for evaluation based on the project review checklist and project information sheet along with the due date for submission of the response stated on the email
  - The project manager is to send back the response with the updated project review checklist having all the target documents mapped to each checklist item, target project documents for evaluation and updated project information sheet by the due date.

- **Node A24; Execute Project Review:** The independent quality reviewer is to conduct the project review (or quality audit) based on the steps as follows:

Prepare:

- Prepare for interview

Conduct:

- Study project documents
- Perform interviews
- Apply retrieved lessons learned
- Analyze project documents
- Analyze interviews
- Discuss initial observations

Complete:

- Apply retrieved lessons learned
- Develop findings
- Develop recommendations
- Develop a detailed report
- Develop a summary report
- Present a summary report
- Present a detailed report

Criteria for evaluation of the audit findings is based on the five levels of risk severity:

- “No Finding”
- “Low Risk”

- “Medium Risk” 4.2 Related Works
- “High Risk”
- “Problem”

The independent quality reviewer is to present the summary report to the customer sponsor and key project stakeholders. Also, the independent quality reviewer is to submit the detailed report to the customer sponsor as well as the key project stakeholders so that they plan the corrective actions for the recommendations based on the findings as the results of the review.

- **Node A25; Store in Lessons Learned Repository:** The independent quality reviewer is to store the project review result report and updated lessons learned register maintained based on the findings as the results of the project review in the lessons learned repository.
- **Node A26; Archive Results in PMIS:** The independent quality reviewer is to archive the updated project information sheet, project review result report, updated project review checklist, reviewed project review documents and updated lessons learned register maintained based on the findings as the results of the project review in PMIS. Also, the independent quality reviewer is to enter the actual completion date for activating the completion flag for the project review in the project review control list maintained in PMIS as shown in Table 5.10.

Table 5.10. Project Review Control List Updated upon Completion of Project Review

Project ID	Industry Sector	Project Name	Project Type	Project Phase	Service Name	Planned Finish	Actual Finish	User Status	Severity
PS-10782	Consumer / Trading	Project K	Consulting Project	Phase 2	Project Review	2017/9/8	2017/9/8	Green	✓
PS-11634	High Tech	Project S	Consulting Project	Phase 2	Project Review	2017/2/2	2017/2/2	Green	✓
PS-11634	High Tech	Project S	Consulting Project	Phase 3	Project Review	2017/9/26	2017/9/26	Green	✓

## 5.4 Results

There is a total of 102 lessons learned collected from the 17 project reviews performed for the 10 relevant ERP projects conducted by the solution provider in Japan for the period of 4 years from 2014 to 2017 applied to this case study as shown in Table 5.11. Also, details of the 102 lessons learned collected for the reuse during the project reviews conducted from 2014 to 2017 selected for this case study are also shown in Appendix B.

Phase 3 Project Review for Project C completed on February 27, 2015 has been ranked first among the 17 projects reviews with the 14 lessons learned registered. Postmortem Review for Project T on August 13, 2014 with the 12 lessons learned registered is ranked second. Ranked third is Phase 3 Project Review for Project J on June 28, 2016 with the 9 lessons learned registered.

Table 5.11. Number of Lessons Learned Collected in the Case Study

#	Date	Project ID	Project Name	Review Period	Lessons Learned
1	2014/2/12	PS-04406	Project Y	Phase 2	5
2	2014/3/31	PS-02924	Project E	Phase 3	7
3	2014/4/15	PS-03196	Project H	Phase 2	6
4	2014/5/8	PS-04406	Project Y	Phase 3	7
5	2014/6/30	PS-04238	Project N	Phase 3	5
6	2014/7/30	PS-04238	Project N	Phase 4	3
7	2014/8/13	PS-05325	Project T	Postmortem	12
8	2014/11/18	PS-05325	Project T	Phase 3	7
9	2015/2/27	176012765	Project C	Phase 3	14
10	2015/3/10	PS-06790	Project B	Phase 2	3
11	2015/3/17	PS-05325	Project T	Phase 4	5
12	2015/5/27	PS-06790	Project B	Phase 4	3
13	2016/6/28	PS-09862	Project J	Phase 3	9
14	2016/11/22	PS-09862	Project J	Phase 4	2
15	2017/2/1	PS-10717	Project S	Phase 2	5
16	2017/9/7	PS-10782	Project K	Phase 2	5
17	2017/9/25	PS-11634	Project S	Phase 3	4

Total: 102

The reuse of lessons learned is analyzed based on the frequency of use sorted by the element (or topic) and lessons learned headline among the 102 lessons learned data retrieved from the lessons learned repository. Table 5.12 shows the reuse of the lessons learned of the findings with WBS related topics such as progress control 13 times in total among the 13 respective project reviews or 76% that is the reuse % divided by the total of 17 project reviews conducted during the period. Specifically, the index term of lessons learned with “Some tasks not defined in WBS” was repeatedly reused in the 4 respective project reviews. Also, the index term of lessons learned with “Actual dates not maintained in WBS” was repeatedly reused in the 6 respective project reviews.

Likewise, Table 5.13 shows the reuse of the lessons learned of the findings with Requested Changes 10 times in total among the 10 respective project reviews (or 59%). Specifically, the index term of lessons learned with “Change request log not created” was repeatedly reused in the 4 respective project reviews. The index term of lessons learned with “Change request log not updated appropriately” was also repeatedly reused in the 4 respective project reviews.

Lastly, Table 5.14 shows the reuse of the lessons learned of the findings with Risk Management related topics 8 times in total among the 8 respective project reviews (or 47%). The 2 index terms of lessons learned with “Process not functioning in Risk Management” and “Risk Management Plan / process not defined” were repeatedly reused 4 times each in the 4 respective project reviews.

Table 5.12. Reuse of Lessons Learned of Findings with Progress Control in WBS

#	Date	Project Name	Element	Index Term	Lessons Learned (Finding) Headline
1	2014/2/12	Project Y	WBS	Some tasks not defined	As the work packages for the customer tasks in scope are not created and maintained in the WBS, the progress of the entire tasks cannot be managed against the project scope.
2	2014/6/30	Project N	WBS	Some tasks not defined	There is an item described as quality audit (which is named project review in the WBS) on the SOW. It is also stated to be conducted in Phase 3 and Phase 4 on the project approach document. However, those 2 tasks are not actually created in the WBS.
3	2014/8/13	Project T	Progress Control in the WBS	Actual dates not maintained	There are many tasks in the WBS without having the actual start / end dates entered for managing the progress where the planned start / end dates were overdue in the past based on the date of update.
4	2014/8/13	Project T	WBS	Some tasks not defined	Only a part of the users was included in the project team. However, the user tasks were not defined in the WBS to manage the progress although the % of participation for the project work by the user was decided.
5	2014/11/18	Project T	WBS	Actual dates not maintained	There are 13 uncompleted activities having the planned start / end dates in the past compared to the last date of the WBS update. Some have the delayed actual start dates against the plan and others do not even have the actual dates entered. Some activities which are not started have the planned start dates of 40 days in the past.
6	2015/3/17	Project T	WBS	Some tasks not defined	Schedule for retesting the programs related to the 3 systems planned after January 2015 has not been entered in the WBS yet.
7	2016/6/28	Project J	WBS	Actual dates not maintained	As of the WBS update on 2016/6/17, actual start / end dates of the 62 tasks having the planned end dates before 2016/6/16 were not maintained for managing the progress.
8	2016/6/28	Project J	WBS	Misleading date maintenance	End date of the delayed task, the system basic design document update is now expressed "To be scheduled" after having the end date changed over and over.
9	2016/6/28	Project J	WBS	Actual dates not maintained	Due to lack of the management process of another WRICEF WBS updated on 2016/6/18, the actual start / end dates of the 5 tasks having the planned end dates before 2016/6/17 not maintained for managing the progress.
10	2017/2/1	Project S	WBS	Actual dates not maintained	Actual start / end dates of the activities in the WBS are not properly maintained for managing the progress.
11	2017/2/1	Project S	WBS	Process not defined	Schedule management process for the progress of planned activities in the WBS not defined.
12	2017/9/7	Project K	WBS	Actual dates not maintained	Actual start / end dates of the work packages are not properly maintained for timely managing the progress.
13	2017/9/7	Project K	WBS	Dependencies not managed	Dependencies and relationships of the tasks managed by each team in the WBS are not managed against the entire tasks in the WBS in an integrated manner.

Table 5.13. Reuse of Lessons Learned of Findings with Requested Changes

#	Date	Project Name	Element	Index Term	Lessons Learned (Finding) Headline
1	2014/4/15	Project H	Requested Changes	Change request log not created	Change request log to maintain all the change requests is not created although the change requests are already existing.
2	2014/5/8	Project Y	Requested Changes	Change request log not created	Change request log to maintain all the change requests is not created although the change requests are existing.
3	Table 15	Project N	Requested Changes	Process not functioning	There is a knowledge transfer task for training the key users on operating 38 updated functions using the production system on the SOW. However, it is treated out of scope without conducting the change request approval process.
4	2014/8/13	Project T	Requested Changes	Change request log not created	Regarding the change control process, although the change request policy definition and the individual change request sheet exist, the change request log to list all the change requests is not created.
5	2014/11/18	Project T	Requested Changes	Process not done timely	Change request log has the change request related requirements as well as the defects registered. Among the 16 defects registered, one high priority item has 37 change request target objects with the estimated workload of 90.6 man day. It implies the requirements of the timely CR approval judgement process.
6	2015/2/27	Project C	Requested Changes	Change request log not created	Definition of the Change Request Control approach, the individual change request sheet and the change request log to list all the change requests are not created.
7	2015/3/10	Project B	Requested Changes	Change request log not updated	Change request log is not maintained despite some approved change requests existing.
8	2015/5/27	Project B	Requested Changes	Change request log not updated	Change request log created based on the previous finding recommendation is found to be not maintained timely.
9	2016/11/22	Project J	Requested Changes	Change request log not updated	Expected completion date and actual completion date of the 15 approved change request items entered in the change control log are not maintained properly for managing the progress.
10	2017/2/1	Project S	Requested Changes	Change request log not updated	Change request log not properly maintained despite some changes existing.

Table 5.14. Reuse of Lessons Learned of Findings with Risk Management Plan

#	Date	Project Name	Element	Index Term	Lessons Learned (Finding) Headline
1	2014/2/12	Project Y	Risk Management Plan	Process not functioning	Risk management plan defined along with the creation of the risk register is not functioning properly as the risk management process are not conducted by the project teams.
2	2014/6/30	Project N	Risk Management Plan	Process not functioning	Although there was a minimum explanation of the risk management process stated in the risk management plan, the risk register is not created accordingly to the plan and the risks are not managed based on the risk management process defined.
3	2014/8/13	Project T	Risk Management Plan	Plan / process not defined	There is no risk management plan defining the risk management process to be conducted by the project team. Neither the risk register is created.
4	2014/11/18	Project T	Risk Register	Plan / process not defined	Although the risk register is created, there is no risk management plan existing. As the risk management process is not properly functioning, there are some risks initially created in the risk register but not timely maintained for the purpose of effective risk management.
5	2015/2/27	Project C	Risk Planning and Identification	Plan / process not defined	Although the project risk register is created and maintained, there is no risk management plan of the project management plan existing
6	2017/2/1	Project S	Risk Management Plan	Plan / process not defined	Risk management process for handling the risk response plan in the team is not defined.
7	2017/9/7	Project K	Risk Register	Process not functioning	Risk management process is not properly functioning as some items initially registered were not updated for 6 weeks.
8	2017/9/25	Project S	Risk Register	Process not functioning	Risk management process is not functioning as the risk register is not properly managed for some identified case.

Furthermore, there are lessons learned of 13 other topics with the frequency of reuse over 2 times identified in addition to the above mentioned 3 topics of lessons learned most frequently reused in the project reviews conducted during the period.

The breakdown summary list of the reuse of lessons learned over 2 times by topic is shown in Table 5.15. The topic of lessons learned with Issue Management is ranked fourth and reused 6 times. The 2 topics of lessons learned with Testing Plan as well as Training Document are ranked fifth and reused 5 times each. The 2 topics of lessons learned with Stakeholder Analysis as well as Stakeholder Participation are ranked sixth and reused 4 times each. The 4 topics of lessons learned with Documentation Management, Integrated Schedule Management, Project Management Plan, as well as Quality Check Process are ranked seventh and reused 3 times each. Lastly, the 4 topics of lessons learned with Data Migration Plan, Go-live Checklist, Production Data Migration, as well as Production Support Plan are ranked eighth and reused 2 times each.

Table 5.15. Breakdown Summary of Reuse Frequency over 2 by Topic

#	Reference	Topic (Element)	# of Reuse	%	Rank
1	Table 13	WBS	13	76	1
2	Table 14	Requested Changes	10	59	2
3	Table 15	Risk Management Plan	8	47	3
4		Issue Management	6	35	4
5		Testing Plan	5	29	5
6		Training Document	5	29	5
7		Stakeholder Analysis	4	24	6
8		Stakeholder Participation	4	24	6
9		Documentation Management	3	18	7
10		Integrated Schedule Management	3	18	7
11		Project Management Plan	3	18	7
12		Quality Check Process	3	18	7
13		Data Migration Plan	2	12	8
14		Go-live Checklist	2	12	8
15		Production Data Migration	2	12	8
16		Production Support Plan	2	12	8

Total: 75

Consequently, 75 out of the total of 102 lessons learned identified among the 16 topics were found to be effectively applied or reused to analyze the findings and put together the recommendations for the corrective actions, as the results of the project reviews conducted in the succeeding projects carried out during the period used by this case study.



## **Chapter 6. Conclusions and Future Work**

This chapter presents the conclusions for the QM measures based on the results of each case study conducted [10-12] and the potential future work on the QM measure to improve quality of PMIS output information.

### **6.1 Conclusions**

To prevent non-conformance to quality in a project from occurring, a quality check against the standard for quality needs to be conducted without fail at the critical stages of ERP implementation project. However, getting the schedule of each required quality check timely fixed by the independent quality reviewer with the project manager of a newly started project can often be problematic without having a systematic approach implemented.

The case study method was used for evaluation of the effects of the three quality management (QM) measures selected for this research for continuous improvement of quality in project management based on the use of PMIS, “the effects of quality improvement of PMIS output information”, “the effective use of PMIS to initiate the project quality gate process”, as well as “the effective reuse of lessons learned to conduct the quality audit”.

As discussed in Section 3.4, the results of the study for the QM measure to improve quality of PMIS output information, based on the scorecard data taken from the nine target projects which went live during the period of nine months from January 2017 to September 2017, indicate that the continuous improvement on the reporting quality of PMIS was found to be effective in:

- Achieving quality of PMIS output information to help managers in decision making, planning, organizing and controlling the project [2], as they rely on PMIS 100% for the project financials in terms of project management for predicting and controlling the outcome of the project based on the early detection of issues and risks.
- Influencing project management success in terms of the three project management dimensions [15] positively as follows:
  - Doing the project at the acceptable time
  - Observing the budget (cost)
  - Meeting the quality specifications of the project

Since January 2017 till September 30, 2017, a total of nine projects listed in Table 3.6 was completed achieving project management success in terms of respecting the time, cost and quality.

PMIS that captures 100% of the closed contracts used for reporting the monthly project financials can surely influence the project managers on getting the passing score on the reporting quality KPIs for achieving project management success.

As described in Section 4.4, the results of the study for the QM measure to initiate the quality gate process, based on the quality gate control list data maintained in PMIS for the four projects which were due for the project quality gate reviews to be conducted during the month of April 2017, indicate that PMIS was found to be effective in:

- Searching for the newly registered projects relevant for the project quality gate requirements by the independent quality reviewer who does not belong to the organization unit responsible for the project delivery.

- Identifying the project managers in charge of the classified projects to conduct the previews of the project quality gate reviews and setting the soft-booked dates for the project quality gate reviews prior to the previews.
- Notifying and influencing the project managers to timely initiate the iterative process of quality gate review based on the schedule fixed for each project quality gate review as all the four quality gate reviews were accepted and completed in time.

PMIS that captures 100% of the closed contracts used for reporting the monthly project financials can surely influence the project managers on their KPIs for project success.

As described in Section 5.4, the results of the study for the QM measure to have lessons learned collected for the reuse, based on the historical lessons learned data of the ERP implementation projects which were retrieved for the period of four years from 2014 to 2017 to analyze how the lessons learned collected from the project reviews of the earlier projects were reused in those of the succeeding projects conducted during the period, indicate that the use of lessons learned based on the past project review results was found to be effective in focusing on the specific areas projected for improvement during the processes of conducting the project document review and key stakeholder interviews, as well as putting together the practical recommendations for the findings to finalize the results of the project review for continuous improvement, which were to be formally presented and submitted to the customer as the results of the quality audit.

In conclusion, for all the three QM measures, PMIS was found to be effective to improve QMS requirements and positively influence project management success in terms of time, cost and quality.

## 6.2 Future Work

Taking the QM measure to improve quality of PMIS output information as an example, after this research, the main goal is to continue refining the metric of performance measurement on the scorecard for the reporting quality KPIs to achieve further improvement on the quality of PMIS output information for project management success.

As the results of the case study conducted, the Client Expectation Management KPI which is one of the eight metrics was found to be ineffective in terms of performance measurement as there was not any project manager who could score the two points from that KPI among the nine projects that completed during the case study period of nine months. Replacing it with something more realistic such as scheduling and execution of the project quality gate review for continuous improvement in project management with the passing score threshold getting adjusted higher could be a good candidate.

## **Dedication**

This thesis work is dedicated to my wife and daughter, Noriko and Shiho, who have been a constant source of support and encouragement during the challenges of research and life. I am truly thankful for having you in my life. This work is also dedicated to my parents, who have always loved me unconditionally and whose good examples have taught me to work hard for the things that I aspire to achieve.



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## Appendix A. Lessons Learned Register (Postmortem Review)

Lessons Learned put together as the practical recommendations for the 12 findings to finalize the results of the project review (postmortem) conducted in 2014 and stored in the lessons learned register for reuse during the process of continuous improvement.

### A.1 Lessons Learned from Stakeholder Participation

Date	2014/8/13
Project ID	PS-05325
Project Name	Project T
Review Period	Postmortem
Method (PMBOK / ERP)	PMBOK
Use Case (Process)	Project Governance – Governance
Element	Stakeholder Participation
Lessons Learned (Finding) Headline	It is necessary to form the project team based on the understanding of what the project means by all the stakeholders based on the man-hours required for executing the project work by each member assigned.
Severity	High Risk
Finding	It is necessary to form the project team based on an understanding of what the project means by all the stakeholders. Specifically, regarding the man-hours required for the project work by the user department, it is necessary to have an agreement at the beginning with the department heads based on the WBS based tasks and schedule to prioritize the project tasks over the daily business operations to avoid confusion.
Impact	Due to the misunderstanding of the roles and responsibilities by project members for execution of the project tasks with the user departments, there is a possibility for the significant impact to occur in the project go-live in some cases such as the schedule delay and cost overrun.
Recommendation	Please make sure to have an agreement with the respective department heads for the members' roles and responsibilities of their project tasks, priorities and required man-hours for the project work based on the selection of project members upon consideration of particularities of business requirements, after confirmation of the coverage by all the stakeholders and user departments when the project team is formed.

## A.2 Lessons Learned from Accountability (Escalation Procedure)

Date	2014/8/13
Project ID	PS-05325
Project Name	Project T
Review Period	Postmortem
Method (PMBOK / ERP)	PMBOK
Use Case (Process)	Project Governance – Governance
Element	Accountability (Escalation Procedure)
Lessons Learned (Finding) Headline	Although the issue with delay in creation of the master data by a business unit had been reported week after week, it was never cleared till the end of the project.
Severity	High Risk
Finding	According to the weekly progress report, although the issue with delay in creation of master data by a business unit had been reported week after week, it was never completed due to running out of time based on the comment after all that work could not be completed from lack of man-hours.
Impact	Due to not timely taking effective corrective action for the issue, there is a possibility for the significant impact to occur in the project such as the go-live delay and cost overrun.
Recommendation	By clearly documenting the escalation procedure to define the ultimate accountability, please make sure to be able to timely take effective corrective action for the issue.

## A.3 Lessons Learned from Requested Changes

Date	2014/8/13
Project ID	PS-05325
Project Name	Project T
Review Period	Postmortem
Method (PMBOK / ERP)	PMBOK
Use Case (Process)	Project Integration Management
Element	Requested Changes
Lessons Learned (Finding) Headline	Regarding the change control process, although the change request policy definition and the individual change request sheet exist, the change request log to list all the change requests is not created.
Severity	High Risk
Finding	Regarding the change control process, although the change request policy definition and the individual change request sheet exist, the change request log to list all the change requests is not created.
Impact	Due to the increased unplanned project work which is out-of-scope based on the occurrence of change requests, there is a possibility for the significant impact to occur in the project such as the schedule delay and cost overrun.
Recommendation	Please make sure to be able to timely judge the advisability of the change request based on identification of the risk on the schedule and cost and analysis on the impact upon creation of the change request log by the integrated change control process.

**A.4 Lessons Learned from Issue Management Process**

Date	2014/8/13
Project ID	PS-05325
Project Name	Project T
Review Period	Postmortem
Method (PMBOK / ERP)	PMBOK
Use Case (Process)	Project Integration Management
Element	Issue Management Process
Lessons Learned (Finding) Headline	Although the issue log exists, some critical issues have not been managed effectively toward resolution based on the involvement of appropriate level of management.
Severity	High Risk
Finding	Although the issue log exists, some critical issues have not been managed effectively toward resolution based on the involvement of appropriate level of management.
Impact	Due to not timely taking effective corrective action for the issue, there is a possibility for the significant impact to occur in the project such as the go-live delay and cost overrun.
Recommendation	The issue log is a formal record to manage the issues occurred in the project. Please make sure to conduct effective issue management to track the progress toward resolution of the issue according to the project issue management procedure with the involvement of appropriate level of management based on the decision on the issue.

**A.5 Lessons Learned from Project Phase Close**

Date	2014/8/13
Project ID	PS-05325
Project Name	Project T
Review Period	Postmortem
Method (PMBOK / ERP)	PMBOK
Use Case (Process)	Project Integration Management
Element	Project Phase Close
Lessons Learned (Finding) Headline	Without correct understanding of the purpose and meaning of the quality gate, the project phase close was not conducted at the right timing.
Severity	High Risk
Finding	Without correct understanding of the purpose and meaning of the quality gate, the project phase close was not conducted at the right timing.
Impact	Due to initiation of the subsequent phase with the situation where the critical issues regarding the checklist items of the quality gate are still remaining unresolved, there is a possibility for the significant impact to occur in the project such as the go-live delay and cost overrun.
Recommendation	Please make sure to avoid the sign-off of the project phase close by the project management and the sponsor to approve the completion and correctness of all the deliverables required when the critical issues on the checklist items of the quality gate are still remaining unresolved.

## A.6 Lessons Learned from Scope Definition

Date	2014/8/13
Project ID	PS-05325
Project Name	Project T
Review Period	Postmortem
Method (PMBOK / ERP)	PMBOK
Use Case (Process)	Project Scope Management
Element	Scope Definition
Lessons Learned (Finding) Headline	The 1st implementation project in the USA as part of the global project faced the problem with goods issue, the user readiness problem for the use of system and the problem with data consistency. Although the implementation in Japan was initiated upon revision of the budget, schedule and scope based on the lessons learned, the same problem regarding the data consistency occurred. It is due to the fact that the investigation on how the current data is structured was not conducted.
Severity	High Risk
Finding	The 1st implementation project in the USA as part of the global project faced the problem with goods issue, the user readiness problem for the use of system and the problem with data consistency. Although the implementation in Japan was initiated upon revision of the budget, schedule and scope based on the lessons learned, the same problem regarding the data consistency occurred. It is due to the fact that the investigation on how the current data is structured was not conducted. Specifically, besides the use of a mainframe over 40 years by the head offices, there are many other systems used by the business units. As there is a lack of the resources who understand the systems, there happened to be the work volume which could not be completed during the scheduled period.
Impact	Due to the member allocation, roles and responsibilities and validity of the man-hours of work based on the schedule created without understanding the project scope and coverage of all the requirements, there is a possibility for the significant impact to occur in the project go-live in some cases such as the schedule delay and cost overrun.
Recommendation	Please make sure to create the feasible project schedule upon finalization of the member allocation, roles and responsibilities and estimate for the man-hours of work based on the scope defined after adequate investigation of the requirements from all the user departments.

**A.7 Lessons Learned from WBS**

Date	2014/8/13
Project ID	PS-05325
Project Name	Project T
Review Period	Postmortem
Method (PMBOK / ERP)	PMBOK
Use Case (Process)	Project Scope Management
Element	WBS
Lessons Learned (Finding) Headline	Only a part of the users was included in the project team. However, the user tasks were not defined in the WBS to manage the progress although the % of participation for the project work by the user was decided.
Severity	High Risk
Finding	Only a part of the users was included in the project team. Furthermore, the user tasks were not defined in the WBS although the % of participation for the project work (from the operational duties) by the user was decided.
Impact	Due to the lack of visualization of the member allocation, roles and responsibilities and work schedule for the project tasks to be conducted with the user departments, there is a possibility for the significant impact to occur in the project go-live in some cases such as the schedule delay and cost overrun.
Recommendation	Please make sure to define all the user tasks in the WBS and update the progress of work according to the process defined in the time management plan to manage the progress in a manner of schedule integration.

## A.8 Lessons Learned from Progress Control in the WBS

Date	2014/8/13
Project ID	PS-05325
Project Name	Project T
Review Period	Postmortem
Method (PMBOK / ERP)	PMBOK
Use Case (Process)	Project Schedule Management
Element	Progress Control in the WBS
Lessons Learned (Finding) Headline	There are many tasks in the WBS without having the actual start / end dates entered for managing the progress where the planned start / end dates were overdue in the past based on the date of update.
Severity	High Risk
Finding	It is defined to manage the progress of the tasks by the implementation consulting team and the customer team upon creation of the WBS according to the time management plan (i.e., the progress management) of the project management plan based on the method of update, timing and frequency agreed. However, there are many tasks without entry on the actual start date or the end date where the planned start date and end date were in the past (based on the date of last update).
Impact	Due to the inadequate means of control for monitoring the schedule and understanding the dependencies of milestones, there is a possibility for the significant impact to occur in the project go-live in some cases such as the schedule delay and cost overrun.
Recommendation	Please make sure to be able to take corrective action as needed upon establishment of the means of control for understanding all the related project activities and the dependencies of milestones when the schedule is delayed based on the update of the progress of the WBS tasks in the agreed frequency and timing to manage in an integrated manner.

**A.9 Lessons Learned from Risk Management Plan**

Date	2014/8/13
Project ID	PS-05325
Project Name	Project T
Review Period	Postmortem
Method (PMBOK / ERP)	PMBOK
Use Case (Process)	Project Risk Management
Element	Risk Management Plan
Lessons Learned (Finding) Headline	There is no risk management plan defining the risk management process to be conducted by the project team. Neither the risk register is created.
Severity	High Risk
Finding	There is no risk management plan (i.e., risk management policy) of the project management plan existing. Neither the project risk register is created. Only a part of risks is entered in the issue log and the risk response plan such as identification, analysis, response, monitoring and control is not conducted by the project team.
Impact	Due to the inadequate identification, monitoring and control of the risks and not deciding the response plans by risk exposure based on the technique of the risk acceptance, avoidance, mitigation or transference in the order of priority with the assignment of the accountable person, there is a possibility for the significant impact to occur in the project such as the schedule delay and cost overrun.
Recommendation	Please urgently create the risk management plan along with the project risk register to be managed by the project team according to the risk management process for the purpose of risk planning and identification, analysis, response, monitoring and control and the status is to be shared at the project progress meeting.

**A.10 Lessons Learned from Test Plan**

Date	2014/8/13
Project ID	PS-05325
Project Name	Project T
Review Period	Postmortem
Method (PMBOK / ERP)	ERP
Use Case (Process)	Solution Readiness – Testing
Element	Test Plan
Lessons Learned (Finding) Headline	Regarding the coverage of master data, most of the master data required between the companies did not get entered. As the several scenarios were tested only with the general business flow, a number of errors occurred when tested with the mass data. The end-to-end testing based on all the required scenarios was not conducted.
Severity	High Risk
Finding	Regarding the coverage of master data, most of the master data required between the companies did not get entered. Based on the use of December 2013 data, several scenarios were tested. However, since it was tested with only the general business flow, a number of errors occurred when tested with the mass data. The end-to-end test based on all the required scenarios was not conducted.
Impact	Due to the inadequate coverage of the business scenarios and test cases and the execution of the incomplete test in terms of coverage not enabling the complete data migration, there is a possibility for the significant impact to occur in the project such as the schedule delay and cost overrun.
Recommendation	Please make sure to be able to effectively conduct the System Integration Test upon completion of the adequate String Test based on the confirmed coverage of the business scenarios and test cases toward the System Integration Test to respond to the business requirements by all the business users.

**A.11 Lessons Learned from Stakeholder Analysis and Management**

Date	2014/8/13
Project ID	PS-05325
Project Name	Project T
Review Period	Postmortem
Method (PMBOK / ERP)	ERP
Use Case (Process)	Business and User Readiness – Organizational Change Management
Element	Stakeholder Analysis and Management
Lessons Learned (Finding) Headline	Since there are many stakeholders outside the head offices, it is necessary to analyze each stakeholder and take care of its requirements and expectations.
Severity	High Risk
Finding	Since there are many stakeholders outside the head offices, it is necessary to analyze each stakeholder and take care of its requirements and expectations.
Impact	Due to the ideal based functional requirements against the policy to adapt the business to the template based system implementation by the head offices, there is a possibility for the significant impact to occur in the entire project such as the schedule delay and cost overrun.
Recommendation	First of all, please start with the identification of the stakeholders and the determination of the response method. For the purpose of understanding the policy to adapt the business to the template based system implementation, it is necessary to show the major stakeholders including the heads of business units the system being able to handle the business requirements based on the standard functionalities.

**A.12 Lessons Learned from Production Data Migration**

Date	2014/8/13
Project ID	PS-05325
Project Name	Project T
Review Period	Postmortem
Method (PMBOK / ERP)	ERP
Use Case (Process)	Data Readiness – Data Readiness
Element	Production Data Migration
Lessons Learned (Finding) Headline	In terms of data consistency, since there was only 50% of the transactional data entered in the system, the project go-live was judged to be postponed.
Severity	Problem
Finding	In terms of data consistency, since only 50% of the transactional data was entered in the system in Phase I, the project go-live was postponed based on the discussion with PMO in September 2013.
Impact	Due to the lack of migration data and the incomplete coverage of required data by the data consistency problem, there is a possibility for the significant impact to occur in the project such as the go-live delay and cost overrun.
Recommendation	Please make sure to test thoroughly based on the selection of optimum business scenarios for confirmation of the consistency and coverage of the migration data throughout the String Test, the System Integration Test and the User Acceptance Test.

## Appendix B. Historical Lessons Learned (2014 – 2017)

Lessons Learned collected for the reuse during the project reviews conducted from 2014 to 2017.

### B.1 Lessons Learned Collected in 2014 (1/5)

Date	Project ID	Review Period	Element	Lessons Learned (Finding) Headline
2014/2/12	PS-04406	Phase 2	Integrated Schedule Management	Although the schedule management plan states all the tasks by customer and solution provider to be managed in the WBS, it does not define the procedure for maintaining the customer WBS.
2014/2/12	PS-04406	Phase 2	OS Installation	One week delay occurred in the installation of the OS on the new server which was originally scheduled on 2014/1/17.
2014/2/12	PS-04406	Phase 2	Risk Management Plan	Risk management plan defined along with the creation of the risk register is not functioning properly as the risk management process are not conducted by the project teams.
2014/2/12	PS-04406	Phase 2	Training Plan	Training for the system operating procedures and the update of the operating manual are not planned.
2014/2/12	PS-04406	Phase 2	WBS	As the work packages for the customer tasks in scope are not created and maintained in the WBS, the progress of the entire tasks cannot be managed against the project scope.
2014/3/31	PS-02924	Phase 3	Project Management Plan	As the project management responsibilities are to be handed over to an implementation partner from the next phase, the project kick-off meeting is to be conducted based on the partner's implementation methodology.
2014/3/31	PS-02924	Phase 3	Quality Control - Transport Request Result Confirmation	Quality check process for confirming the transport request results by the reviewer for applying the programming changes in the production environment is not properly functioning.
2014/3/31	PS-02924	Phase 3	Scope Definition	In February 2014, go-live of the best practice based rollout project conducted at the subsidiary in Mexico was postponed to the next year.
2014/3/31	PS-02924	Phase 3	Scope Variance	Main cause for the go-live of the best practice based rollout project postponed in February 2014 was due to the fact that requirements definition conducted from August to November 2013 was not really concluded.
2014/3/31	PS-02924	Phase 3	Stakeholder Analysis and Expectation Management	Based on the results of the stakeholder analysis conducted, the way to respond needs to be decided to effectively manage the expectation.
2014/3/31	PS-02924	Phase 3	Transparency	Although the top management at the subsidiary in Mexico communicated to the team that the system implementation would be rolled out best practice based, the local team expressed their interest in pursuing the to-be based approach. Ever since then, the local team thought that their wish was accepted to conduct the rollout.
2014/3/31	PS-02924	Phase 3	User Acceptance Testing by End User Department	Although there was no complaint from the end users who use the system as the adequate operating manual was provided, the management level did not like it as the functional requirements were not covered the way they wanted.

**B.1 Lessons Learned Collected in 2014 (2/5)**

Date	Project ID	Review Period	Element	Lessons Learned (Finding) Headline
2014/4/15	PS-03196	Phase 2	Integrated Schedule Management	Although the schedule management plan states all the tasks by customer and solution provider to be managed in the WBS, it does not define the procedure for maintaining the customer WBS.
2014/4/15	PS-03196	Phase 2	Quality Check Process	Quality check process for confirming the final results by the reviewer for applying the programming changes in the production environment needs to be established for the upcoming testing.
2014/4/15	PS-03196	Phase 2	Requested Changes	Change request log to maintain all the change requests is not created although the change requests are already existing.
2014/4/15	PS-03196	Phase 2	Requirements Definition	Make sure to include the team member in charge of the target country to collect and finalize the requirements specific to the local needs based on the global template.
2014/4/15	PS-03196	Phase 2	Requirements Definition	Continuous communications are required to verify the requirements specific to the local needs collected with the members of the succeeding target locations for the final specifications based on the global template.
2014/4/15	PS-03196	Phase 2	Stakeholder Participation	Customer stakeholder participation for executing the customer tasks of this global rollout project is essential by reinforcing the staffing of the IT resources with English skills.
2014/5/8	PS-04406	Phase 3	Authorization Policy Document	Although task for creation of the authorization policy was not entered in the WBS, the planned end date was confirmed to be 2014/05/09.
2014/5/8	PS-04406	Phase 3	Data Migration Plan	Although task for creation of the go-live checklist was entered in the WBS with the planned end date of 2014/04/25, it has not been started yet.
2014/5/8	PS-04406	Phase 3	Go-Live Checklist	Although task for creation of the data migration plan was entered in the WBS, the planned end date was just changed from 2014/04/18 to 2014/05/08.
2014/5/8	PS-04406	Phase 3	Requested Changes	Change request log to maintain all the change requests is not created although the change requests are existing.
2014/5/8	PS-04406	Phase 3	Router Connection	Router connection issue to slow down the effectiveness of the work remotely was resolved by changing the static routing setting.
2014/5/8	PS-04406	Phase 3	Technical Upgrade	Although there was 3 week delay due to the technical upgrade issue, the delay was recovered by setting up another development environment based on the rearrangement of subsequent activities taking the dependencies and relationships into consideration.
2014/5/8	PS-04406	Phase 3	Training Document	Although task for creation of the training document for knowledge transfer was not entered in the WBS, the planned end date was confirmed to be 2014/05/09.

**B.1 Lessons Learned Collected in 2014 (3/5)**

Date	Project ID	Review Period	Element	Lessons Learned (Finding) Headline
2014/6/30	PS-04238	Phase 3	Integrated Schedule Management	Although the schedule management plan states all the tasks by customer and solution provider to be maintained in the WBS based on the timing and frequency of the update predefined. However, there are many tasks without the resource names assigned and the actual start / end dates entered existing.
2014/6/30	PS-04238	Phase 3	Requested Changes	There is a knowledge transfer task for training the key users on operating 38 updated functions using the production system on the SOW. However, it is treated out of scope without conducting the change request approval process.
2014/6/30	PS-04238	Phase 3	Risk Management Plan	Although there was a minimum explanation of the risk management process stated in the risk management plan, the risk register is not created accordingly to the plan and the risks are not managed based on the risk management process defined.
2014/6/30	PS-04238	Phase 3	User Acceptance Testing	User acceptance testing is planned to cover so many patterns and scenarios in such a short period without consideration of lag.
2014/6/30	PS-04238	Phase 3	WBS	There is an item described as quality audit (which is named project review in the WBS) on the SOW. It is also stated to be conducted in Phase 3 and Phase 4 on the project approach document. However, those 2 tasks are not actually created in the WBS.
2014/7/30	PS-04238	Phase 4	EDI Customer Handling	After the go-live of the cloud based production system, the EDI production server and the existing EDI customers need to conduct the encrypted connection and server authentication setting.
2014/7/30	PS-04238	Phase 4	Production Data Migration Plan	Although the production data migration plan is created with the buffer of 8 hours for the go-live, the needs for conducting the walk-through on the fallback plan and verification of the procedure are still required.
2014/7/30	PS-04238	Phase 4	Support Handover Document	Although there is a list of support handover items from the current vendor to the new vendor existing, the detailed list of work for each support item is not available.

**B.1 Lessons Learned Collected in 2014 (4/5)**

Date	Project ID	Review Period	Element	Lessons Learned (Finding) Headline
2014/8/13	PS-05325	Postmortem	Accountability (Escalation Procedure)	Although the issue with delay in creation of the master data by a business unit had been reported week after week, it was never cleared till the end of the project.
2014/8/13	PS-05325	Postmortem	Issue Management Process	Although the issue log exists, some critical issues have not been managed effectively toward resolution based on the involvement of appropriate level of management.
2014/8/13	PS-05325	Postmortem	Production Data Migration	In terms of data consistency, since there was only 50% of the transactional data entered in the system, the project go-live was judged to be postponed.
2014/8/13	PS-05325	Postmortem	Progress Control in the WBS	There are many tasks in the WBS without having the actual start / end dates entered for managing the progress where the planned start / end dates were overdue in the past based on the date of update.
2014/8/13	PS-05325	Postmortem	Project Phase Close	Without correct understanding of the purpose and meaning of the quality gate, the project phase close was not conducted at the right timing.
2014/8/13	PS-05325	Postmortem	Requested Changes	Regarding the change control process, although the change request policy definition and the individual change request sheet exist, the change request log to list all the change requests is not created.
2014/8/13	PS-05325	Postmortem	Risk Management Plan	There is no risk management plan defining the risk management process to be conducted by the project team. Neither the risk register is created.
2014/8/13	PS-05325	Postmortem	Scope Definition	The 1st implementation project in the USA as part of the global project faced the problem with goods issue, the user readiness problem for the use of system and the problem with data consistency. Although the implementation in Japan was initiated upon revision of the budget, schedule and scope based on the lessons learned, the same problem regarding the data consistency occurred. It is due to the fact that the investigation on how the current data is structured was not conducted.
2014/8/13	PS-05325	Postmortem	Stakeholder Analysis and Management	Since there are many stakeholders outside the head offices, it is necessary to analyze each stakeholder and take care of its requirements and expectations.
2014/8/13	PS-05325	Postmortem	Stakeholder Participation	It is necessary to form the project team based on the understanding of what the project means by all the stakeholders based on the man-hours required for executing the project work by each member assigned.
2014/8/13	PS-05325	Postmortem	Test Plan	Regarding the coverage of master data, most of the master data required between the companies did not get entered. As the several scenarios were tested only with the general business flow, a number of errors occurred when tested with the mass data. The end-to-end testing based on all the required scenarios was not conducted.
2014/8/13	PS-05325	Postmortem	WBS	Only a part of the users was included in the project team. However, the user tasks were not defined in the WBS to manage the progress although the % of participation for the project work by the user was decided.

**B.1 Lessons Learned Collected in 2014 (5/5)**

Date	Project ID	Review Period	Element	Lessons Learned (Finding) Headline
2014/11/18	PS-05325	Phase 3	Issue Log	There are many issues maintained in the issue log which are overdue for the expected date for resolution. Among them, some issues are even over 40 day overdue for the expected date for resolution. Some medium priority issues also have the status of progress at 0% as well.
2014/11/18	PS-05325	Phase 3	Project Management Plan	Risk management plan is not described anywhere in the project management plan although risk is defined in the issue management rule. Although the meetings are described in the project integration management, it should be included under the communications management to be more appropriate.
2014/11/18	PS-05325	Phase 3	Requested Changes	Change request log has the change request related requirements as well as the defects registered. Among the 16 defects registered, one high priority item has 37 change request target objects with the estimated workload of 90.6 man day. It implies the requirements of the timely CR approval judgement process.
2014/11/18	PS-05325	Phase 3	Risk Register	Although the risk register is created, there is no risk management plan existing. As the risk management process is not properly functioning, there are some risks initially created in the risk register but not timely maintained for the purpose of effective risk management.
2014/11/18	PS-05325	Phase 3	Scope Definition	Coverage for the business processes in scope for systematization is analyzed based on the use of a tool to confirm the processes and steps in scope. However, confirmation on the coverage with the user departments is still required.
2014/11/18	PS-05325	Phase 3	Stakeholder Register	Stakeholder register is just created by the newly assigned change agent. Primary focus is set to analyze the participation rate for the training requirements to see if any immediate corrective actions are required.
2014/11/18	PS-05325	Phase 3	WBS	There are 13 uncompleted activities having the planned start / end dates in the past compared to the last date of the WBS update. Some have the delayed actual start dates against the plan and others do not even have the actual dates entered. Some activities which are not started have the planned start dates of 40 days in the past.

**B.2 Lessons Learned Collected in 2015 (1/2)**

Date	Project ID	Review Period	Element	Lessons Learned (Finding) Headline
2015/2/27	176012765	Phase 3	Issue Management	There is no issue management plan of the project management plan existing which defines the procedures to provide a consistent method of identifying, tracking and resolving project issues.
2015/2/27	176012765	Phase 3	Phase Closure Documents	There is no quality gate planned in the selected phases in the WBS to check the status of phase close against the checklist items of the quality gate so as to make a "Go-No-go" decision properly.
2015/2/27	176012765	Phase 3	Production Support Plan	There is no cutover plan existing as of 2015/2/20 although all the Wave 1 Daily Reports are due to go-live on 2015/4/1.
2015/2/27	176012765	Phase 3	Production Support Strategy	There is no document including the production support processes existing as of 2015/2/20 although all the Wave 1 Daily Reports is due to go-live on 2015/4/1.
2015/2/27	176012765	Phase 3	Project Management Plan	There is no project management plan existing for this project.
2015/2/27	176012765	Phase 3	Project Schedule	There is a high level project schedule available beside the deliverable based WBS just to show if the planned tasks are completed.
2015/2/27	176012765	Phase 3	Requested Changes	Definition of the Change Request Control approach, the individual change request sheet and the change request log to list all the change requests are not created.
2015/2/27	176012765	Phase 3	Risk Planning and Identification	Although the project risk register is created and maintained, there is no risk management plan of the project management plan existing.
2015/2/27	176012765	Phase 3	Stakeholder Participation	Not all the Power Users of the Order-to-Cash Team who use 6 out of 9 Daily Reports scheduled to go-live on 2015/04/01 have been identified as of 2015/2/20.
2015/2/27	176012765	Phase 3	Test Plan - Final Test Plan	There is no final test plan existing as of 2015/2/20 although the E2E test is scheduled to start on 2015/03/02.
2015/2/27	176012765	Phase 3	Test Strategy - Development Test Plans	There are no development test plans existing as of 2015/2/20 although all the Wave 1 development is due to be completed on 2015/03/02.
2015/2/27	176012765	Phase 3	Testing Management and Tracking - End-User Testing	There is no final test plan existing as of 2015/2/20 although the UAT is scheduled to start on 2015/3/16.
2015/2/27	176012765	Phase 3	Training Content & Documentation	There is no end-user training documentation existing as of 2015/2/20 although the UAT is scheduled to start on 2015/3/16.
2015/2/27	176012765	Phase 3	Training Effectiveness	There is no training evaluation results existing as of 2015/2/20 although the UAT is scheduled to start on 2015/3/16.

**B.2 Lessons Learned Collected in 2015 (2/2)**

Date	Project ID	Review Period	Element	Lessons Learned (Finding) Headline
2015/3/10	PS-06790	Phase 2	End User Training Plan	End user training plan describing the system operations and documentation of the functional changes is not created.
2015/3/10	PS-06790	Phase 2	Quality Check Process	Quality check process for confirming the final project documents by the reviewer is not properly functioning.
2015/3/10	PS-06790	Phase 2	Requested Changes	Change request log is not maintained despite some approved change requests existing.
2015/3/17	PS-05325	Phase 4	End User Training Results	As the end user training is still in progress, the evaluation document for the training effect is not available despite the fact of the go-live planned on 2015/04/09.
2015/3/17	PS-05325	Phase 4	Go-live Checklist	Although checking the results of the production master data migration based on the go-live checklist in a series is planned, the walk-through on the fallback plan and the procedure is also to be verified.
2015/3/17	PS-05325	Phase 4	Stakeholder Analysis	Stakeholder analysis results show that the participation rate and level of understanding of 12 middle managers and key users were low at the completion of the user acceptance testing.
2015/3/17	PS-05325	Phase 4	Training Manual and Supporting Documents	End user training was delayed by 2 weeks and started in March 2015 and the training manual and other supporting documents to be created were not available.
2015/3/17	PS-05325	Phase 4	WBS	Schedule for retesting the programs related to the 3 systems planned after January 2015 has not been entered in the WBS yet.
2015/5/27	PS-06790	Phase 4	Quality Check Process	Quality check process for confirming the final results by the reviewer for applying the programming changes in the production environment is not properly functioning.
2015/5/27	PS-06790	Phase 4	Requested Changes	Change request log created based on the previous finding recommendation is found to be not maintained timely.
2015/5/27	PS-06790	Phase 4	User Acceptance Test Results	Delay in the user acceptance testing due to the rework on programming efforts caused by the inadequate requirements definition.

**B.3 Lessons Learned Collected in 2016**

Date	Project ID	Review Period	Element	Lessons Learned (Finding) Headline
2016/6/28	PS-09862	Phase 3	Data Migration Plan	Detailed procedure required in the fallback plan described in the data migration plan.
2016/6/28	PS-09862	Phase 3	Document Management	Document version control defined in the project management plan not properly applied to all the project documents.
2016/6/28	PS-09862	Phase 3	Issue Log	Some issues not having been managed in the Issue Log identified.
2016/6/28	PS-09862	Phase 3	Issue Log	3 ongoing issues found in the issue log with the due for completion dates in the past.
2016/6/28	PS-09862	Phase 3	Test Plan	As the test plan for performance testing related is not defined, risk for not completing all the testing requirements with the period planned.
2016/6/28	PS-09862	Phase 3	WBS	As of the WBS update on 2016/6/17, actual start / end dates of the 62 tasks having the planned end dates before 2016/6/16 were not maintained for managing the progress.
2016/6/28	PS-09862	Phase 3	WBS	End date of the delayed task, the system basic design document update is now expressed "To be scheduled" after having the end date changed over and over.
2016/6/28	PS-09862	Phase 3	WBS	Due to lack of the management process of another WRICEF WBS updated on 2016/6/18, the actual start / end dates of the 5 tasks having the planned end dates before 2016/6/17 not maintained for managing the progress.
2016/6/28	PS-09862	Phase 3	Weekly Progress Report	Although the format of the weekly progress report used by all the teams is same, the way the actual progress expressed is not aligned and appropriate.
2016/11/22	PS-09862	Phase 4	Requested Changes	Expected completion date and actual completion date of the 15 approved change request items entered in the change control log are not maintained properly for managing the progress.
2016/11/22	PS-09862	Phase 4	System Integration Test Plan	Some team member names are not properly entered in the organizational chart described in the final approved version of the system integration test plan.

**B.4 Lessons Learned Collected in 2017**

Date	Project ID	Review Period	Element	Lessons Learned (Finding) Headline
2017/2/1	PS-10717	Phase 2	Requested Changes	Change request log not properly maintained despite some changes existing.
2017/2/1	PS-10717	Phase 2	Risk Management Plan	Risk management process for handling the risk response plan in the team is not defined.
2017/2/1	PS-10717	Phase 2	Stakeholder Analysis	Stakeholder analysis result is not created as defined.
2017/2/1	PS-10717	Phase 2	WBS	Actual start / end dates of the activities in the WBS are not properly maintained for managing the progress.
2017/2/1	PS-10717	Phase 2	WBS	Schedule management process for the progress of planned activities in the WBS not defined.
2017/9/7	PS-10782	Phase 2	Document Management	Document version control process defined in the project management plan is not properly applied to all the project documents.
2017/9/7	PS-10782	Phase 2	Risk Register	Risk management process is not properly functioning as some items initially registered were not updated for 6 weeks.
2017/9/7	PS-10782	Phase 2	Solution Documents	Some mandatory items of the documents described are not aligned with the document description guidelines.
2017/9/7	PS-10782	Phase 2	WBS	Actual start / end dates of the work packages are not properly maintained for timely managing the progress.
2017/9/7	PS-10782	Phase 2	WBS	Dependencies and relationships of the tasks managed by each team in the WBS are not managed against the entire tasks in the WBS in an integrated manner.
2017/9/25	PS-11634	Phase 3	Document Management	Document version control process is not properly applied to all the project documents.
2017/9/25	PS-11634	Phase 3	Issue Log	Status and progress of 2 items in the issue log are not properly maintained and managed.
2017/9/25	PS-11634	Phase 3	Organizational Chart	Project team member names are not properly entered in the organizational chart.
2017/9/25	PS-11634	Phase 3	Risk Register	Risk management process is not functioning as the risk register is not properly managed for some identified case.