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Use of Project Management Information System to Initiate the Quality Gate Process for ERP Implementation

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Abstract—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 happening, a quality check against the standard for quality needs to be conducted at the critical stages of ERP implementation project. 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. Recent research has provided an application with the use of project management information systems (PMIS) for such implementations in improvement of quality management systems requirements [1]. 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. 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.

Index Terms—Project Management Information Systems, PMIS, Project Quality Gates, Q-Gate, ERP, Independent Quality Reviewer, Solution Provider.

I. Introduction

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 [2] 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 [3] 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 [1]. Synergies between the PMIS (or IS) and the QMS according to ISO 9001 standard [4], [5], 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 [6]. 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 [7].

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.

This article is structured as follows: Section II is related to the literature review of quality gates and its adoption. Section III is related to the literature review of PMIS and its current configuration implemented. 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 IV. Finally, Section V is composed by the conclusion.

II. 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., [8]), [9]. 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) [10]. 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 [9].

Project quality gates described in this article are the quality management gates [11], [12] 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 [12]. Project quality gates are used for the strategy [3] 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 [13].

The ERP implementation methodology used by the solution provider has a total of 4 project quality gates embedded based on the traditional waterfall model [3] to assure project quality by formally conducting a quality check against the quality gate checklist [14], [9] before the end of each phase [15] 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. 1.

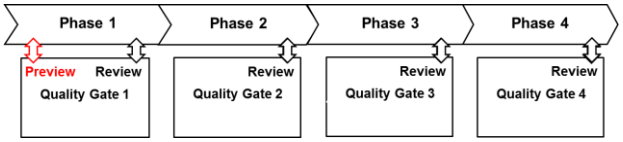

Fig.1. Project Quality Gate Reviews in a Project Lifecycle

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 [14]

Table 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 [2] and ERP (i.e. processes, products and services [5]) implementation methodology since ERP implementation faces many difficulties that cause its failure [26], [27].

III. Literature Review of PMIS and its Production Configuration

PMIS, which is part of enterprise environmental factors, provides access to automated tools, such as scheduling, cost, and resourcing tools, performance indicators, databases, project records, and financials used during the Monitor and Control Project Work process. Automated gathering and reporting on key performance indicators (KPI) can be part of this system [2]. PMIS provides a wide range of functions directly supporting a complex of process involving various project related activities: planning, monitoring, control and others [16]. In the information technology (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 [17]. Using PMIS to manage projects, while not sufficient to insure project success, has thus become a necessity [18]. The most appropriate PMIS configuration defined depends on project situation [19]. Project situation requirements for PMIS have been identified accordingly to project classification [20] 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 [2]. Definition of the PMIS

configuration requirements must include the following information [19] such as data entities or work items used in project, attributes or data fields of each data entity and processes or workflows related to the data.

The configuration use case elements supported by the PMIS implemented for the use by the solution provider are shown in Table 2. It aims to provide the KPIs, risk registers and reports such as project financials in terms of the earned value management (EVM) [2].

Table 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

Table 2. 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) [2], related to the ERP implementation projects and operations support for 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 in an early stage based on the appropriate corrective actions [2], [5] to be implemented ahead of time.

IV. 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.

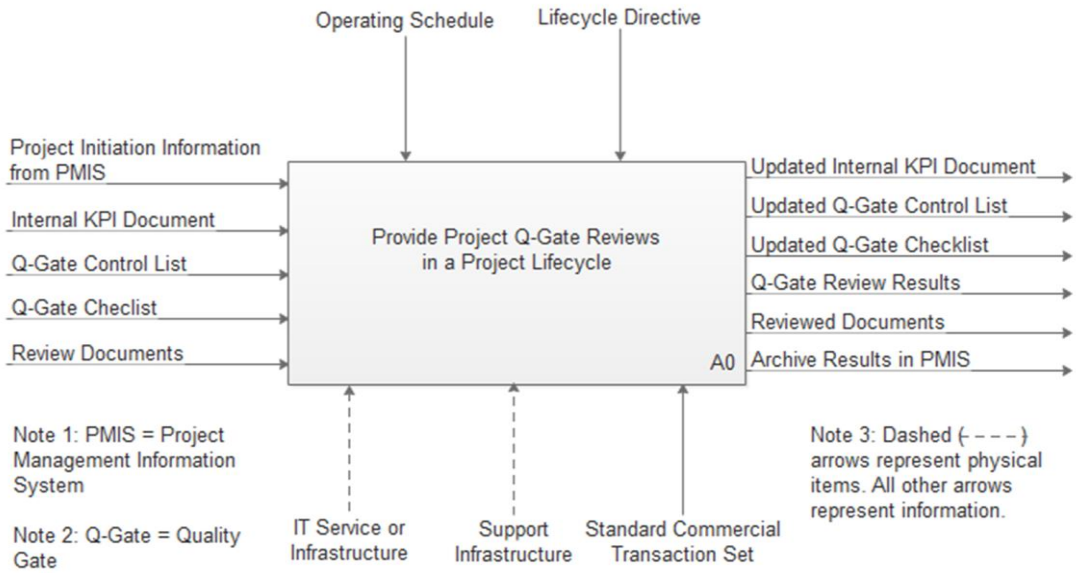

Fig.2. Provide Project Q-Gate Reviews in a Project Lifecycle

A. 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) [21], [22] as shown in Fig. 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. 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 positive, as well as coach and advise 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.

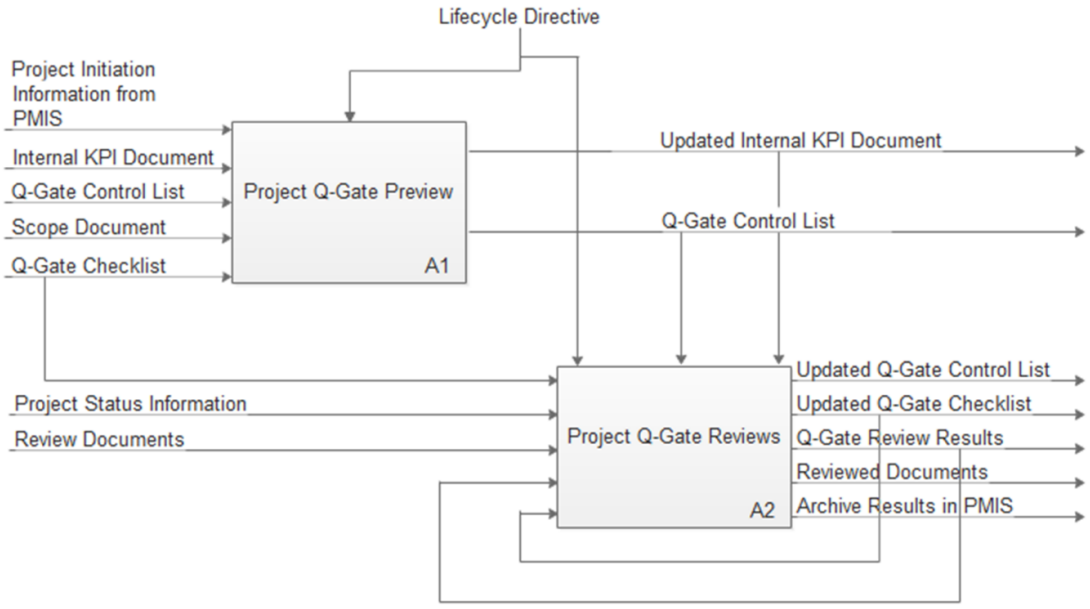

Fig.3. Conduct Project Q-Gate Preview and Project Q-Gate Reviews

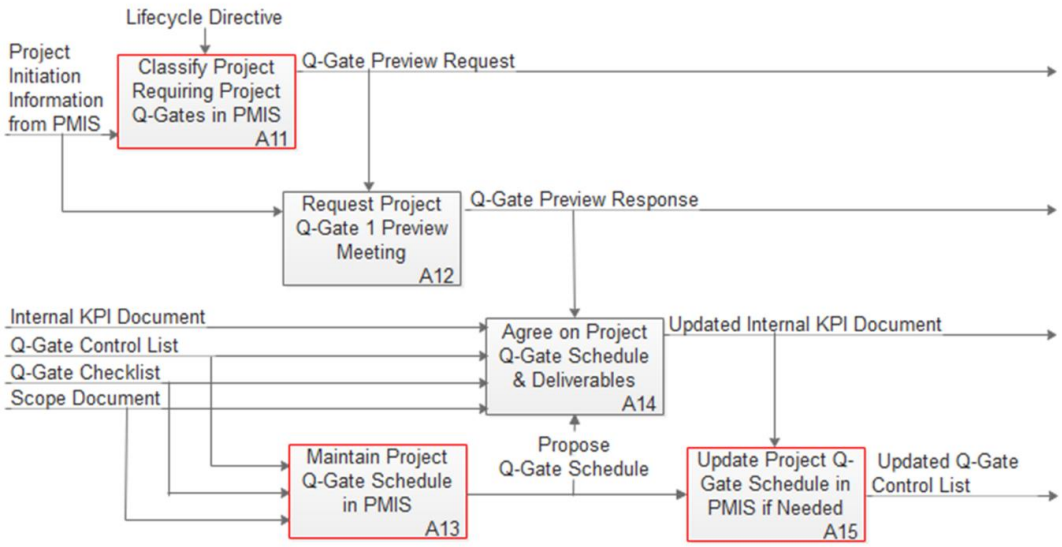

Fig.4. Conduct Project Q-Gate Preview and Get Agreement on Project Q-Gate Review Schedule

B. 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. This process for conducting Quality Gate 1 Preview by the internal 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 management lifecycle.

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 1st 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 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 [23], [24], [25] shown in Fig. 5. Table 3 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.

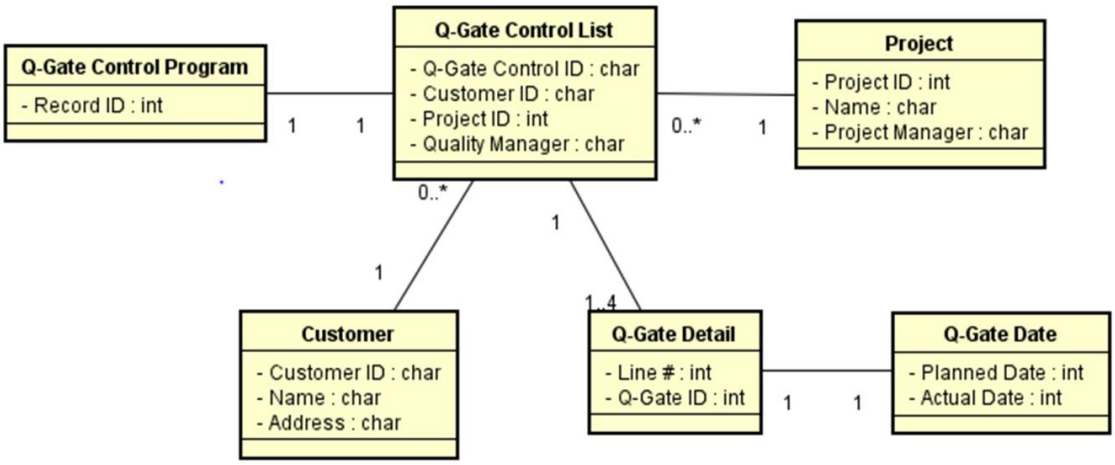

Fig.5. Maintain Q-Gate Schedule in Q-Gate Control List

Table 3. 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 that is a mandatory item in the generic project Q-Gate 1 checklist.

Table 4. 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.

C. Conduct Project Q-Gate Review in Iterative Process

The decomposition of node A2 to 6 activities is shown in Fig. 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.

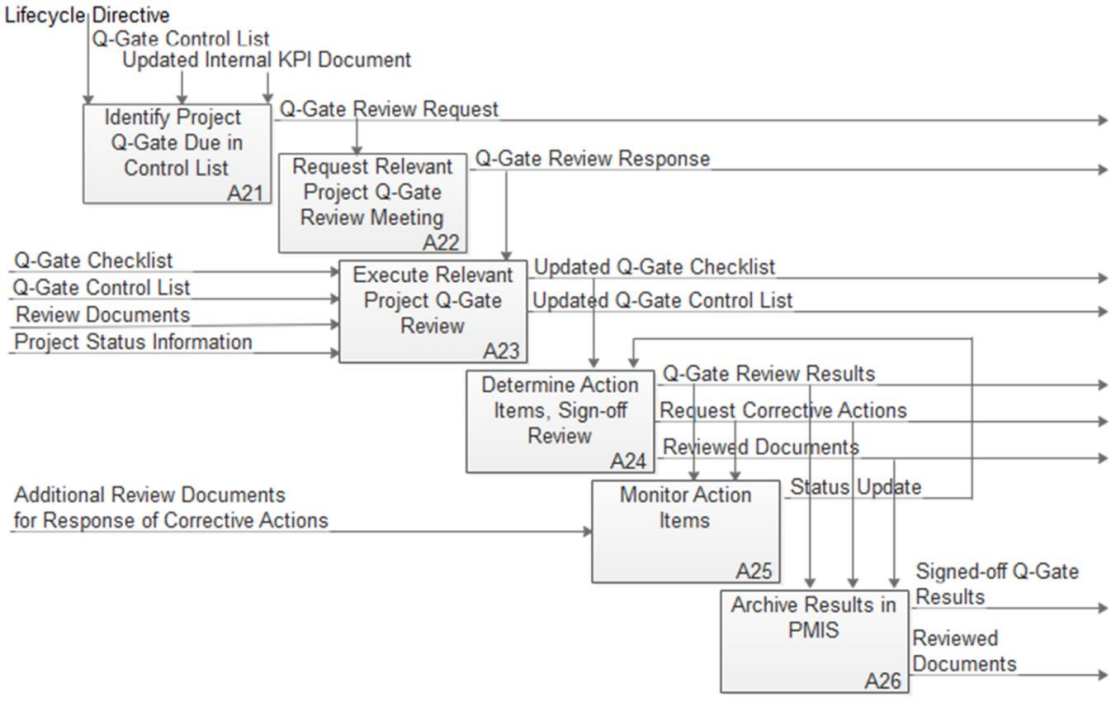

Fig.6. Conduct Project Q-Gate Review in Iterative Process

Table 5. 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	

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 5 shows a sample output of all the project quality gates due in April 2017.
- *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 [4], [5] 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 6 shows a snapshot of Q-Gate Control List updated in PMIS as the results of the Project Q-Gate 1 Review.

Table 6. 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.

V. Conclusion

As described in Section 4, use of 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.

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.

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