An Integrated Continuous Auditing Project Management Model (CAPM)

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ABSTRACT

In large scale complex projects, there is a need to constantly monitor and audit the various components and indicators of the project in order to identify and detect performance significant variances, and a result, shortcomings, errors, omissions, and possible fraud. In a paper-based traditional project management approach, project activities are typically monitored and audited infrequently and with a time lag which sometimes may be extended to weeks or even months. Auditing of project management activities with a time lag can create inefficiencies in time delays and cost overruns as appropriate interventions are not rendered immediately after the incidence or on a real time bases. In this paper we present a continuous auditing model for complex projects that requires constant monitoring and exception reporting. The authors believe that the Integrated Continuous Auditing Project Management Model (CAPM) can significantly enhance the project management team's capability to monitor project activities. In the first section of the paper, we will discuss how continuous auditing works to facilitate project management monitoring and control of project activities. The second section of the paper deals with the project management internal controls using IPMA\(^1\) excellence model.

KEYWORDS: Continuous Auditing, Project Management, Internal Controls

\(^1\) International Project Management Association
Introduction

In this paper we will examine the application of continuous auditing model in project management. First we will describe continuous auditing and examine its applications. Then we will describe the areas in project management that will benefit from continuous auditing. The model presented in this paper has been successfully tested in financial services, transportation, and manufacturing environments.

Applications of Continuous Auditing

The evolution of information technology and the rapid growth of digital economy have significantly changed the auditing methods and tools. Many large corporations are investing in auditing systems that will give them the capability to constantly monitor and report on their internal control systems and to enhance the efficiency, effectiveness, and coverage of their audits. Continuous auditing is a rapidly emerging field in auditing and has been defined as “a process or methodology that enables independent auditors to provide written assurance on a subject matter using a series of auditors’ reports issued simultaneously with, or a short period of time after, the occurrence of events underlying the subject matter” (Groomer, 2000). Figure 1 shows a typical internal audit review process. In continuous auditing many of these steps are automated and can be performed rapidly using information technology.

Figure 1: A Typical Internal Audit Review Process

The advancements in information technology and using data warehousing and data mining tools has created opportunities for organizations to store, process and report on data captured from various sources on a continuous basis with efficiency and effectiveness (Rezaee, Sharbatoghlie, et al. 2002).
A variety of Continuous Audit tools and techniques (CATTs) has been recently developed that enable auditors to assess risk, evaluate internal controls, and electronically perform a variety of audit procedures, including extracting data, downloading information for analytical review, counting records, selecting samples for tests of controls and substantive tests, identifying exceptions, and performing confirmations (Rezaee, Sharbatoghlie, et al. 2002).

One of the key enabling technologies that have enhanced the auditors’ ability to instantly access data from multiple platforms for analytical review is data warehousing. Figure 2 represents a generic data warehousing model that can be used in the context of large scale project managements. The data obtained from multiple sources such as procurement data, project personnel data, inventory and cost variance data etc. are stored in audit data warehouse using data extraction, transformation, and loading (ETL). Once the project management data is available in standardized and normalized format in the data warehouse, various audit queries can be used to generate variance and exception reports.

Figure 1: A generic data warehousing model

Elsewhere in a more detailed monograph we have presented an operational model of CA (Abdolmohammadi and Sharbatoghlie, 2005). In that monograph a five step methodology for creating a generic CA system is proposed. Those five steps are as follows:

I. Determine audit objectives and scope
II. Determine data analysis requirements
III. Collect meta-data
IV. Acquire and transform data
V. Analyze data and produce exception reports

It is possible to use audit data warehousing to capture and audit data from multiple large-scale projects simultaneously. Therefore, it is possible to have a single project management audit data warehouse for the corporation or government agency as a whole. Figure 3 presents an example of a data warehousing architecture developed for a large
financial services corporation in the United States. As shown in the figure, the data warehouse extracts data from various transaction databases such as procurement, payroll, and accounting and loads them into the data warehouse. The auditors can then use a variety of data query tools such as Oracle Discoverer, ACL, Business Objects, Microsoft Access, and SAS or use data mining software such as SAS Enterprise Miner or IBM’s Intelligent Miner to create exception and variance reports for further investigation.

Figure 3: A Continuous Auditing Architecture


Of course, CA cannot be implemented in all project management contexts. In order to perform a CA, several conditions must be met. These conditions have been delineated by Murthy and Groomer (2004, p. 147):

- The client must have highly reliable systems. These systems must be able to provide the necessary subject matter to the auditor on a timely basis.
- The subject of the audit has suitable characteristics necessary to conduct the audit. For example, if the audit is focused on evaluating internal controls, then the auditor must be able to electronically interrogate these controls.
- The auditor must have a high degree of proficiency in information systems, computer technology, and the audited subject matter.
- Automated audit procedures will provide most of the audit evidence necessary to opine on the subject of the audit.
The auditor must have a reliable means of obtaining the necessary audit evidence so that an opinion can be reached. The auditor must have timely access to and control over any audit evidence generated as a result of the continuous auditing procedures.

It is necessary to have a “highly placed executive” in the client organization who will serve as a champion for the adoption and support of continuous auditing.

Therefore, in smaller scale projects that do not have stable electronic systems to capture and maintain data, continuous auditing will not be a viable option. However, for large-scale projects with many interdependent components, implementation of continuous auditing can significantly improve the audit efficiency and project performance. The authors believe that the savings accrued from the detection of inefficiencies, mismanagements, and possible fraud will be substantial if continuous auditing is employed. Furthermore, once the initial investments on CA are made future project management audits can be performed with much less cost and enhanced quality and speed compared to the traditional auditing.

The proposed model has been successfully tested in financial services fields by one of the authors of this article. CA has many applications in large scale project in a variety of organizations and fields such as financial services, transportation, healthcare, manufacturing, and even construction. Project management functions that need to monitor various project activities on a real-time basis can benefit from CA.

While continuous auditing has been used extensively in the auditing literature, to the best of the knowledge of the authors, it has not been used in the project management field. However, continuous auditing has many applications in the project management field such as for instantly obtaining data and reporting on material price variance, cost performance measurement, determination of material cost variances attributable to the excess usage of material, detecting conflict of interests, detecting roles and scheduling conflicts, etc.

The model presented in this paper has been validated in several real projects in various industries. For example, in a transportation project the continuous auditing model was able to reduce the project monitoring and exception reporting time from 218 hours in four quarters to about 8 hours with an estimated cost savings of $56,700. Similarly, in a financial services company, the application of continuous auditing model in corporate financial project estimated to result in 4 million dollars in cost savings over a four year period (Abdoul Mohammadi and Sharbatoghlie, 2005).

In the next section of the paper we will deal with some of the project internal controls that can be used for continuous auditing.

**Project Control**

Every project must have a set of internal controls for monitoring the project activities. Major effort is initially spent in each project negotiating and planning various activities and their details of material and labor consumption. As various projects are not only different but are also usually unique and possibly in unfamiliar territories, estimating and planning is done based on guesswork, or based on expert judgment at best which is prone to error and vagueness. As project progresses, actual data differs from the estimated or budgeted numbers. Projects are controlled to monitor such variances and decide on any course of action and possible correction. Controlling a project requires many variables, as one measure cannot
give the whole picture. The critical questions in designing a CA system for project management are:

- Which variables in a project should be measured and reported on a continual basis?
- Who or at what level, strategic or operational, should monitor and intervene for each variable?
- How often each variable should be measured and monitored?
- What would be a tolerance margin for each variable according to tolerance and criticality?

The above questions may be answered by using brainstorming sessions between the project management and operational teams. The aim is to create a control map consisting of key control variables and the persons responsible for monitoring the activities of the control variables.

### Control Variables

As there are numerous variables in a project, which require management control and attention, we have selected a sample few major areas and variables related to project management for tracking and monitoring continuously. Many other variables may be selected later in future research. Sample variables are listed in this paper to illustrate our model here. Each variable may be controlled on an aggregated basis for the whole project, or on detailed basis for each component or activity in the project. The activities may be continuous or discrete or simply zero or one. Examples of the major variables for continuously auditing are chosen to be:

- Time Variance Index: percentage of variance between budgeted cost of work performed and budgeted cost of work scheduled.
- Cost Variance Index: percentage of variance between actual cost for work performed and budgeted cost for work performed.

Figure 4: Internal Control Variable: Cost Variance


We are using IPMA's Project Excellence Model, as a basis for choosing a comprehensive and all inclusive set of variables. As the ultimate aim for all projects is to
reach excellence, and as this framework is a generally accepted framework for project evaluation.

In the IPMA model key variables are divided into two major categories: (1) Enabler Variables; (2) Results Variables. The list of the variables in each of these categories are presented below:

**Enabler variables:**
- Project Objectives
- Leadership
- People
- Resources
- Processes

**Results variables:**
- Customer results
- People results
- Results of other parties involved
- Key Performance and Project Results

![Figure 5: IPMA's Project Excellence Model](source: IMPA web site, see [www.ipma.ch/](http://www.ipma.ch/), accessed July 12, 2008.)

Each of the above key variables will need to be measured in a continuous audit system. The development of internal control variables is context sensitive and differs from project to project. For example, a construction project management may have different internal control variables than an IT project management. However, the both share have enabler and results variables. In the following sections some of the key areas that can be used in a CAPM system are listed:

**Variable Set 1 - People:** How project team members are involved, how their potential is seen and used (It has to prove how the employees' potential is seen, used to achieve the project results, maintained and developed).

A. in the selection of new employees, their abilities and needs are identified, classified and adapted to the needs of the project

B. personnel planning and procurement (eg teamwork ability as employment criteria), as well as a goal-directed use of

C. assessment and career planning systems, are handled
D. the capacity planning of required personnel resources is realized
E. assessment and career planning systems to support improvements and participation
F. fair employment conditions are guaranteed
G. innovative strategies for work organization, and improving working methods, are used
H. qualification programs are developed and realized
I. the effectiveness of training programs is checked
J. teamwork ability is built up
K. continuous learning is supported
L. employees are trained and educated to achieve the project objectives more easily
M. regular feedback, as well as regular reviews, are given
N. employee polls are worked out and used
O. the future development of project team members is supported

Variable Set 2 - Resources: How existing resources are used effectively and efficiently. (It has to prove how the project plans and steers information.)
A. information is structured and used accordingly to support objective attainment
B. validity, integrity and protection of information is guaranteed and improved
C. data availability, data security and data quality is considered
D. configuration management works (e.g. revision, modification service)
E. an effective handling of knowledge and information management is guaranteed, to make necessary information available at any time for all people involved.

Variable Set 3 - Resources: How existing resources are used effectively and efficiently. (It has to prove how the project plans and steers suppliers and their services)
A. relates to suppliers in accordance with its objectives
B. maximizes appreciation of suppliers
C. chooses system suppliers if necessary
D. reaches quality agreements
E. uses benchmarking
F. sees to it that there is an effective communication between the project and suppliers
G. optimizes actual stock.

Variable Set 4 - Resources: How existing resources are used effectively and efficiently. (It has to prove how the project plans and steers other resources.)
A. lowers the consumption of supply resources (e.g. water, energy)
B. lowers the consumption of support and working material
C. guarantees the protection of intellectual property (e.g. discoveries), inventions, knowledge and innovations
D. uses technology to improve processes, information systems and other systems
E. supports optimal use of resources, reduces/eliminates waste and promotes effective recycling
F. meets requirements by paying special attention to non-renewable resources.

Variable Set 5 - Processes: How important processes within the project are identified, checked and changed, if necessary. (It has to prove how the processes needed for project success are identified systematically, managed, checked, adapted and optimized.)
A. defines and identifies key processes and judges their effects on the project
B. defines process ownership and process management
C. defines and checks working standards and uses measurement charts for its process management
D. includes requests from all parties involved in its process developments
E. guarantees effective management between internal and external parties
F. measures current achievements and relates improvement objectives to achievements in the past
G. tests new or changed processes and checks their implementation (e.g. pilot schemes, test specification)
H. publicizes and checks process changes to guarantee the achievement of the intended results (e.g. information, training, internal audits)
I. deals with a permanent measurement and observation of process satisfaction of users, sponsors and project initiators (customer satisfaction)
J. uses the feedback of all people concerned (internal and external) to optimize the process
K. deals with project organization (e.g. project manager, review team)
L. maintains milestone control
M. permanently checks the satisfaction of other parties involved
N. guarantees to control the state of the project

Variable Set 6 - Processes: How important processes within the project are identified, checked and changed, if necessary. (It has to prove how project management methods and systems are effectively adopted, how they are used and improved.)
A. chooses project management methods appropriate to the project objective.
B. resolutely pursues the use of project management systems (e.g. PM procedure standards, IPMA Competence Baseline)
C. deals with process support means, e.g. software, PM tools and visual aids
D. enables PM techniques and expediency (e.g. presentation, communication) to be used
E. guarantees support with documentation (e.g. PM handbook)
F. manages the use and observation of new principles, technologies and philosophies of project management
G. puts the most effective methods and processes down in writing
H. uses project control.

Variable Set 7 - Key Performance and Project Results: What the project achieves concerning the intended project results. (It has to prove the performance of the project taking into account measurements beyond 9.1.)
A. balance in the triangle: time, costs, quality
B. budget
C. profit and loss account results
D. investments and their results
E. number of necessary storage places
F. number of suppliers
G. consideration of market price tendency
H. indirect costs (general costs)
I. appreciation
J. profit before tax
K. costs of errors
L. productivity
M. process times
N. process costs
O. reaction times
P. lead time to completion/launch
Q. benchmarks  
R. quality/number of improvement suggestions  
S. use of capacity eg of employees and equipment  
T. innovation rate/number of patents  
U. frequency of complaints  
V. product life cycle  

From each of the above IPMA areas specific variables and their respective measurement scales can be developed by project management and operations management teams for continuous auditing.

Conclusion:

In this article we have proposed a new approach for internal audit departments titled an Integrated Project Management Continuous Auditing Model (PMCA). The key elements of this new approach is the introduction of an advanced dynamic internal audit system for identifying, capturing, and storing the critical data, information, and knowledge generated during the implementation of a project. Using IPMA's excellence model we identified a number of key enabler and results areas and variables within each area that can potentially be used for continuous auditing. Utilizing the data, information, and available knowledge, public or private corporations and government agencies can monitor and report on their key internal control variables on a continuous basis.

References


