Integrating Six Sigma and PRINCE2™ 2009

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Abstract

A number of articles have been written about integrating Project Management methods, but why is it worth doing this? Most methods provide a process, with some techniques, tools, and guidance about organizational governance; PRINCE2™ and Six Sigma are no exception. This paper discusses the key aspects of PRINCE2™ and Six Sigma, and shows how the methods can be integrated to provide a very rich framework which may be applied to certain types of project, to great effect.

Introduction

Why integrate project methods?

Integrating PRINCE2™ and Six Sigma provides a way of harnessing the best aspects of two world-renowned project management methods. With PRINCE2™ you get control, with strong attention to the quality aspects of project management, a unique insight into the specification of products using Product Descriptions and a clear specification of project governance. Six Sigma brings with it an analytical approach to project management and a strong focus on data measures – this is especially useful when considering the measures one needs to apply in order to understand

- the rationale for embarking on a project and
- the benefits that the project will bring to the organization.

What has been done before

It is interesting to note that there have been a number of published papers integrating PRINCE2™ with other methods [7,8,9], or integrating Six Sigma with other methods such as PMBOK [4], but to the author's knowledge, no published articles exist showing how PRINCE2™ and Six Sigma could be integrated.

What this paper will show

This paper will explore some of the history of the two methods, their background and insights into the thinking behind them; it will then compare the key principles of the methods to show where they best apply in project management. The paper will also address the very important aspect of the organization in which the methods are expected to operate effectively, because without this being addressed appropriately, neither method will ever be successfully adopted.

Background: Culture/Insights/ Usage

History of PRINCE2™

PRINCE2™ stands for PRojects IN Controlled Environments. The method was originally released as PROMPT in 1979 for the management of IT Projects and it was later updated to PRINCE®. PRINCE2™ was launched in 1996 to cover all types of projects, not just those that are IT projects and as part of a continual improvement process it was refreshed in 2009.

PRINCE2™ is a non-proprietary method used extensively in more than 150 countries around the world, and its take-up grows daily. It is widely considered as the leading method in project management, with in excess of 20,000 organizations already benefiting from its pioneering and trusted approach. This is largely due to the fact that PRINCE2™ is truly generic: it can be applied to any project regardless of project scale, type, organization, geography or culture.

PRINCE2™ achieves this by isolating the management aspects of project work from the specialist contributions such as design or construction. The specialist aspects of any type of project are easily integrated with the PRINCE2™ method and when used alongside PRINCE2™ they provide a secure overall framework for the project work.

What is PRINCE2™?

The 2009 version of PRINCE2™ states "PRINCE2™ is a structured project management method based on experience drawn from thousands of projects – and from the contributions of countless project sponsors, Project Managers, project teams, academics, trainers and consultants." PRINCE2™ describes what the organizations and people involved in a project should do.

There are two volumes which make up PRINCE2™: Managing Successful Projects with PRINCE2™ and Directing Successful Projects with PRINCE2™.

- Managing – this is aimed at the project practitioner, primarily the Project Manager and it describes the approaches one should take in order to execute a project, including processes, techniques and guidance.

- Directing – this is aimed at the senior manager responsible for a project, specifically those managers undertaking an executive role on a project for the first time. It covers the duties and behaviours expected of members of the Project Board and can be used as a reference at any stage to check what is required.

History of Six Sigma

Six Sigma is a framework used for process improvement. Its name is derived from statistical analysis; Six Sigma means 3.4 failures in 1 million given normal distribution. Six Sigma has its roots in Statistical Process Control developed in the 1920s. It was released by Motorola in the 1980s and has been adopted by other large organizations such as GE, Toyota and many others.

What is Six Sigma?

Six Sigma seeks to improve the quality of process outputs by identifying and removing the causes of defects (errors) and variation in manufacturing and business processes. It uses a set of quality management methods, including statistical methods, and creates a special infrastructure of people within the organization ("Black Belts" etc.) who are experts in these

methods. Each Six Sigma project carried out within an organization follows a defined sequence of steps and has quantified financial targets (cost reduction or profit increase). [http://en.wikipedia.org/wiki/Six_Sigma]

Six Sigma has two main processes; DMAIC for process improvement and DMADV for process design.

Readers may also have heard of Lean (used to optimise processes, often in cross-functional business improvement) and Kaizen (used for ongoing or continuous improvement and very appropriate when trying to eliminate waste); both these methods are discussed in Six Sigma forums and the tools from these other methods can be very useful in some Six Sigma projects.

- DMAIC stands for Define, Measure, Analyze, Improve, Control. This process is used to analyze processes in order to identify the root causes of unacceptable variation and to develop solutions to reduce or remove errors.
- DMADV stands for Define, Measure, Analyse, Design, Verify. This process is to be used when developing a product or process.

Considerations to apply when planning integration

There are three main areas to consider when integrating PRINCE2™ and Six Sigma. These areas are treated equally well by both methods, but to do both would be an unnecessary burden:

1. The Organization: *the roles & responsibilities of key people on the project need to be clarified and the terms need to be agreed.*
   a. PRINCE2™ Roles: Project Manager, Senior User, Senior Supplier, Executive.
   b. Six Sigma Roles: Sponsor, Champion, Process Owner, Green Belt, Black Belt, Master Black Belt.
2. Remove the overlap in some Management Products.
   Both PRINCE2™ and Six Sigma require many management products

(deliverables) to be produced (see Appendix 1 and Appendix 2). The contents of the Charter (Six Sigma) and the Project Brief / Project Initiation Documentation / Business Case (PRINCE2™) have much in common.

3. Align the PRINCE2™ Stages with Six Sigma Steps.
   a. PRINCE2™ uses the concept of a Management Stage to provide an appropriate level of detail to the plans within the boundary of the "planning horizon". PRINCE2™ also uses a concept of a Technical Stage to reflect the lifecycle of the products being produced (e.g. Design, Build, Release).
   b. Six Sigma is divided into 5 phases.
   The project must decide whether the phases in Six Sigma align to Management or Technical Stages in PRINCE2™.

Each of these topics are described in more detail below.

The Organization, Roles and Responsibilities

PRINCE2™: Governance Framework

One of the seven principles of PRINCE2™ is that a project has defined and agreed roles and responsibilities, with an organization structure that engages the business, user and supplier stakeholder interests.

The Project Board represents the most senior level of management within the PRINCE2™ project management team. Project Board members are accountable for the work they direct, but the extent of their business responsibilities is usually much wider than the project. They can rarely afford to get involved in the detail of every project for which they are responsible. This means that the effectiveness with which project work can be delegated is crucial. The Project Board comprises:

- Executive - has overall responsibility for ensuring that a project meets its objectives and delivers the projected benefits. This individual should ensure

that the project maintains its business focus, that it has clear authority, and that the work, including risks, is actively managed.
- Senior User – is accountable for ensuring that user needs are specified correctly and that the solution meets those needs.
- Senior Supplier – represents the supplier interests within the project and provides supplier resources.
- Assurance – The Project Board is responsible, via its Project Assurance role, for monitoring all aspects of the project's performance and products independently of the Project Manager.

Six Sigma: Coaching & Guiding

There is no prescribed organizational structure for a Six Sigma organization; however there are clear roles allocated:

- Sponsors – members of the executive team who direct the Champions on a day-to-day basis.
- Champions – senior managers who take responsibility for one or more Six Sigma projects. Champions approve plans, authorise resources, and act as a conduit back to the Executive Team.
- Process Owners – owners of the process in their area. They could also be considered to be Business Change Managers for their area.
- Green Belts – part-time Six Sigma practitioners who may be the Project Managers.
- Black Belts – full-time Six Sigma practitioners who act as Project Managers for more complex projects and offer advice and guidance to Green Belts.
- Master Black Belts – Technical Leaders or "change advocates" who also train Black Belts and Green Belts in Six Sigma techniques.
- Project Teams – workers who have been allocated to the project by the Champion.

Summary

There are three organizational levels which can be described and applied as follows:

Level	PRINCE2™	Six Sigma
Directing	Corporate/Programme Management	Sponsor
Managing	Project Board including Project Executive, Senior Supplier and Senior User	Champion/Master Black Belt
Delivering	Project Manager and Team	Black Belt, Process Owner and Team

When integrating PRINCE2™ and Six Sigma, carefully consider roles and responsibilities at each level. The roles of Champion and Executive should be coalesced. The Sponsor role is likely to be fulfilled by a corporate executive team member, who may also sit on the Project Board as a Senior User.

The roles of Project Manager and Black Belt could be coalesced. The Black Belt may take on the role of the PRINCE2™ Project Manager, or the Project Manager may be a Green Belt being supervised on the project by a more experienced Black Belt.

Management Review & Management Products

There are a number of formal management products which need to be produced, e.g. PRINCE2™ has Project Initiation Documentation and Six Sigma has a Charter. A subset of the management products (in PRINCE2™) is used to report progress, but interestingly, Six Sigma does not specifically ask for any form of progress report, rather, regular meetings to discuss progress are held with the Champion. At the end of each Six Sigma phase, a tollgate review takes place; in PRINCE2™, the Project Board is asked to make a decision as to whether to approve the next stage – this does not have to be a formal meeting.

PRINCE2™

- Checkpoint Report: The Team Manager will produce this to provide the Project Manager with details of progress against the Work Package. The Work Package will include the frequency of Checkpoint Reports required. The Project Manager will collate Checkpoint Reports and use these as part of the progress assessment when reviewing stage status.
- Highlight Report: A regular report is sent by the Project Manager to the Project Board during the stage to show what progress is being made.
- End Stage Report: This is produced by the Project Manager towards the end of each management stage, providing the Project Board with the information on the progress to date, the overall project situation and (in tandem with the next Stage Plan) sufficient information to ask for a Project Board decision on what to do next with the project.
- End Project Report: This is produced by the Project Manager towards the end of the project, during the Closing a Project process, and is used by the Project Board to evaluate the project and authorize closure.

Six Sigma

At the end of each phase, there is a formal process where the Sponsor and Champion can review progress and results, which is called the Tollgate. The Tollgate process includes a series of questions to ask the team which differs depending on the phase being concluded.

Regular reviews (possibly weekly) are held with the Champion and the project team to review progress.

Summary

By creating a Product Description for the Management Products that will be produced by the integrated project, the team will understand exactly what is required and what the management product will look like.

Alignment of Stages/ Phases

PRINCE2™ uses the notion of stages to divide up the project into time-based (though not equal) chunks of time; there are two types of stage, Management Stages and Technical Stages.

- Management Stage: The section of a project that the Project Manager is managing on behalf of the Project Board at any one time; at the end of which the Project Board will wish to review progress to date, the state of the Project Plan, the Business Case and risks, and the next Stage Plan in order to decide whether to continue with the project.
- Technical Stage: A method of grouping work together by the set of techniques used, or the products created. This results in stages covering elements such as design, build and implementation. Such stages are technical stages and are a separate concept from management stages.

The processes of Six Sigma are divided into five phases (DMAIC or DMADV), which can either align one-to-one with Management stages of PRINCE2™. or be regarded as technical stages. Some phases can be combined together into a Management Stage, or longer phases can be split into two Management Stages. For example, one of the six sigma phases may be split into two management stages if there is significant work involved, e.g. pilot solution (taking say three months) then rollout solution (taking say six months); here the Project Board would want to formally review progress at the

end of the Pilot Stage.

The names of the stages in PRINCE2™ are left to the Project Manager to define.

Conclusion

In summary, integration is especially appropriate for Process Improvement Projects, but should not be considered for the very simple DMAIC projects. Consider integration for significant process improvement or process design. For example, if your organization is embarking on development of a standard for bid or project management, and if this spans multiple departments or countries, then this would fit well.

Neither PRINCE2™ nor Six Sigma are just processes, and both require considerable organizational change in order to operate successfully. Six Sigma forces justification of the project based on customer focus and process data. PRINCE2™ forces control on project execution e.g. risk, quality, whereas Six Sigma does not really provide this.

Both methods have a range of techniques to help: Six Sigma has techniques such as Voice-of-Customer (VOC), 5Ys (a method for performing root-cause-analysis) and Data Analysis whereas PRINCE2™ has a focus on Stakeholder Engagement, Quality Review and Product Based Planning. Both methods are orientated around the Business Case, and both require benefits to be defined and measured.

This paper has reviewed the key aspects of PRINCE2™ and Six Sigma and showed how both methods can be used together on a single project. The new questions the author poses are: "How should we adopt PRINCE2™ if we are already aligned to Six Sigma?" or "Having adopted PRINCE2™, what can we do to improve our capability still further?"

Further information is available in the form of a Vodcast at the following web site **www.best-management-practice.tv**. It is also worth noting that PRINCE2™ 2009 includes guidance on integrating other frameworks into the method. For more information on PRINCE2™ 2009 qualifications and publications visit **www.best-management-practice.com**.

APPENDIX 1: Principles & Concepts of PRINCE2™

PRINCE2™ is made up of a number of key elements which are briefly described below.

Principles

PRINCE2™ contains seven principles which are explained below:

- **Continued business justification:** throughout the life of the project, there must be adequate justification to continue.
- **Learning from experience:** lessons are sought, recorded and acted upon throughout the life of the project.
- **Defined roles & responsibilities:** with an organization structure that engages the business, user and supplier stakeholder interests.
- **Manage by stages:** the project is planned, monitored and controlled on a stage-by-stage basis.
- **Manage by exception:** the project has defined tolerances for each project objective to establish limits of delegated authority.
- **Focus on products:** definition and delivery of products, in particular their scope and quality requirements.
- **Tailor to suit the project environment:** taking into account size, complexity, importance, capability and risk.

Themes

There are seven themes – covering Business Case, Organization, Quality, Plans, Risk, Changes and Progress. Each theme gets a thorough treatment in the guide [1]. The following list may act as a prompt to understand each of the themes:

- Business Case – **why** are we doing this?
- Organization – **who** is involved?
- Quality – **what** makes products fit for purpose?
- Plans – **how** will the project be delivered (and for how much, and when)?
- Risk – **what** if this happens?
- Changes – **so what** is the impact?
- Progress – **where are we?**

Processes

There are a number of processes for directing, managing and delivering projects:

- Starting Up a Project
- Directing a Project
- Initiating a Project
- Controlling a Stage
- Managing Product Delivery
- Managing a Stage Boundary
- Closing a Project.

Management Products

There are 26 management products; there is guidance on their evolution (when they are created and modified) and which ones can be combined.

Tailoring PRINCE2™

PRINCE2™ includes guidance on how it can be adapted to suit a variety of organizations and project scales. It should be noted that there is nothing specific within the PRINCE2™ guides on how to embed PRINCE2™ into an organization since the core guides describe how to direct and manage projects. However, material is available on how to embed PRINCE2™ in an organization in the book "Improving Project Performance using the PRINCE2™ Maturity Model" [3].

PRINCE2™ also includes two specialist techniques which are discussed later.

APPENDIX 2: Principles & Concepts of Six Sigma

Six Sigma can be considered to be a Management System, a Method and a Metric (as described in the Six Sigma Black Belt Handbook [6]). The metric is used to assess process performance and the results of improvement projects. The method applies a rigorous process (DMAIC or DMADV) to analyse processes, develop new processes and to control variation and is supported by a number of process improvement tools. The Management System is a practical approach to aid continuous business improvement in an organization.

The Management System

The Management System focuses on the management team and the organization in four key areas:

- Understanding and managing customer requirements by listening to the Voice of the Customer (VOC)
- Aligning the processes to achieve the requirements
- Using data to analyse processes in order to minimise variation
- Driving sustainable improvement into the business processes.

A number of large multinational companies are using Six Sigma (e.g. ITT and GE, Rathyon, and including the author's experiences at Sun Microsystems) to embed the Six Sigma culture in the organization. For example, GE has created a list of concepts [http://www. ge.com/en/company/companyinfo/ quality/whatis.htm]:

- **Critical to Quality:** Attributes most important to the customer

- **Defect:** Failing to deliver what the customer wants
- **Process Capability:** What your process can deliver
- **Variation:** What the customer sees and feels
- **Stable Operations:** Ensuring consistent, predictable processes to improve what the customer sees and feels
- **Design for Six Sigma:** Designing to meet customer needs and process capability.

The Method

By reviewing the deliverables required by one of primary methods in Six Sigma, DMAIC, the key points in the process can be highlighted. There are many similarities between DMAIC and DMADV, and the first three phases have the same names; the deliverables however are slightly different since different questions have to be answered.

Each of the five phases of the DMAIC approach require key deliverables to be produced:

- Define
  - Charter: this is used to gain a clear understanding of the project and contains the following:
    - Business Case
    - Goal Statement
    - Opportunity Statement
    - Project Scope
    - Project Plan
    - Team Selection
  - Requirements: i.e. clear articulation of "customer" requirements
  - Process Measures: the requirements are translated into "critical to quality" and "critical to process" metrics
  - As-is Process Maps: a description of the current process
  - Quick Wins: a list of obvious fixes which can be immediately addressed.

- Measure
  - Data to be collected: in order to understand the way in which the current process is operating a list of variables to be monitored is required
  - Operational Definition: a precise definition of each of the variables to be measured is produced
  - Data Collection Plan: this defines when the data will be collected, by whom, over what period, etc.
  - Measurement System Analysis: verify that the measurement system will produce valid data
  - Baselined Data: analyze the data to produce a Sigma level, capability index etc.
- Analyze
  - Validated Root Causes: identify the root cause of the process variation by analytical analysis, probing, experimentation and simulation
- Improve
  - Proposed Solutions: a number of solutions are proposed and these are assessed in order to rank and cost them
  - Cost benefit analysis: update the business case with more likely information
  - Pilot Plan: try out the solution and see if it has the desired effect.
- Control
  - Solution Implementation Plan: using the results from the pilot, create the plan for rollout
  - Successful Solution: execute the implementation plan
  - Process Control Plan: define how the new process should be monitored.

The Metric

Sigma is a measure of process performance and uses the parameter "Defects per million opportunities" which is expressed as a deviation from the statistical normal distribution. Six sigma equates to 3.4 defects per million opportunities.

Example: Airlines mishandle 42 million items of luggage per year [Telegraph on-line: 30/6/09] from 2.75 billion passenger flights. A six sigma accuracy (99.9997%) in baggage handling (assuming that there is 1 item of luggage for each passenger flight) would mean that only 825,000 items of luggage would be mishandled rather than 42 million.

APPENDIX 3: Techniques

There are two techniques specifically described and unique to PRINCE2™ covering Product Based Planning and Quality Review Techniques. The rationale for including the Product Based Planning technique is that it has a specific PRINCE2™ approach and without it application of the method would be significantly weakened. The rationale for including the Quality Review Technique is not so clear – it is kept from older versions of the method, and any robust review technique would work. PRINCE2™ also references many techniques from other sources.

- The Product Based Planning technique leads to a comprehensive plan based on the creation and delivery of required outputs. The technique considers prerequisite products, quality requirements and the dependencies between products. The technique contains the following steps:
  - Write the Project Product Description: this defines the "final" output of the project
  - Create the Product Breakdown Structure: this produces a decomposition of the final output as a set of products to be delivered by the project
  - Write the Product Descriptions: this describes each product to be delivered
  - Create the Product Flow Diagram: this shows the order in which products can be delivered.

- The Quality Review technique is a quality inspection technique with defined roles and a specific structure. It is designed to assess whether a product that takes the form of a document (or similar, e.g. a presentation) is complete, adheres to standards and meets the quality criteria agreed for it in the relevant Product Description. The participants are drawn from those with the necessary competence to evaluate its fitness for purpose. The objectives of this technique are:
  - To assess the conformity of a product which takes the form of a document (or similar item, e.g. a presentation or test results) against set criteria
  - To involve key interested parties in checking the product's quality and in promoting wider acceptance of the product
  - To provide confirmation that the product is complete and ready for approval
  - To baseline the products for change control purposes.

Six Sigma uses a very rich set of techniques and tools, and there are many texts available on each of these, both in books and on-line. Some of the techniques are listed below, along with their primary use, and they are grouped specifically relating to the most appropriate process phase in which they should be used:

- Define: Pareto Chart, Kano Analysis, SIPOC Process Map Functional Deployment Map
- Measure Phase: Cause/Effect Diagram, Quality Function Deployment [specifically for DMADV]
- Analyze: Root Cause Analysis, 5 Whys, Statistical Data Plots e.g. histograms, box-plots, etc, Hypothesis Testing, CTQ Flow-down
- Improve/Design: Six Thinking Hats Mind Map, Pairwise Ranking, Field-force Analysis, Stakeholder Analysis, Field-force Analysis, Variance Allocation

- Control/Verify: Control Charts, Out-of-control Action Plan, Capability Flow-up.

Many of the techniques used on Six Sigma projects will be useful when conducting PRINCE2™ projects, however, in the author's opinion, most PRINCE2™ practitioners are quite naive when it comes to selecting the most appropriate tools and techniques.

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