Modern Project Management: Essential Skills and Techniques

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Abstract

Modern project management is a well-understood discipline that can produce predictable, repeatable results. The methodologies of modern project management are highly analytical, usually requiring automated tools to support them on large projects. Like most other disciplines, it is learned through both practice and past experience. Project management encompasses many different skills, such as understanding the interdependencies among people, technologies, budgets, and expectations; planning the project to maximise productivity; motivating others to execute the plan; analysing the actual results; and reworking and tuning the plan to deal with the realities of what really happens as the project is executed. In order to manage a project and bring it to a successful completion, its project manager must have a complete understanding of the methodologies being used for the management of different parts of the project. Managers prefer specific project methodology, while resist and face difficulties for an opportunity to manage another project with different methodology as they do not know how much commonality exists between the preferred and the new required methodology. This paper discusses the issues involved in modern project management and compares the differences between traditional and modern project management skills and techniques.

1. Introduction

Many project management methodologies being used today, are either the wrong methodologies or are not applied fully [1]. Some project managers see methodologies as impractical and bureaucratic, relying on their gut instinct when it comes to managing projects. If project management methodologies come across as too complex to use in real-world projects, project managers will look for their own shortcuts. Given enough time, anyone can be trained to adhere to a project methodology. Projects are usually split into phases often along the lines of initiation, control (Planning, Execution) and closure. During each phase, a number of documents are produced as part of the project control process. All IT projects, regardless of their size, complexity or industry, require a set of defined rules and principles to be managed effectively and come to a successful conclusion. This area of managing projects is called project management. This idea of project management has been around for a long time. Today, project management has emerged as its own field, supported by bodies of knowledge and researches across many discipline. Although still relatively new, the field of Software Engineering has its own Bodies of Knowledge that include various methodologies, frameworks, tools and techniques supported by a continuous growing base of research.

2. What is a Methodology?

A methodology is a set of guidelines or principles that can be tailored and applied to a specific situation [1]. In a project environment, these guidelines might be a list of things to do. A methodology could also be a specific approach, templates, forms, and even checklists used over the project life cycle. A methodology can also be defined in other ways, for example [2, 3, 4]:

- A process that documents a series of steps and procedures to bring about the successful completion of a project.
- A defined process for accomplishing an end.
- A series of steps through which the project progresses.
- A collection of methods, procedures, and standards that define a synthesis of engineering and management approaches designed to deliver a product, service, or solution.
- An integrated assembly of tasks, techniques, tools, roles and responsibilities, and milestones used for delivering the project.

A formal project methodology should lead the work of all team members throughout the life cycle of a project. All members of a team should be familiar with and use the chosen methodology throughout their projects. Many project management methodologies address the management of a single project, without appreciating that many other projects in a company compete for the very same resources

and attention. The project management methodology should also provide project managers with the perspective that there is a project management framework and associated methodologies present in the company. In Fig. 1, we see that Project A has no methodology and is filled with process issues as well as problems that actually increase as the project moves along [5]. Additionally, Project B, which has a structured methodology with defined and operational project processes, minimises the number of problems that may occur on the project [5].
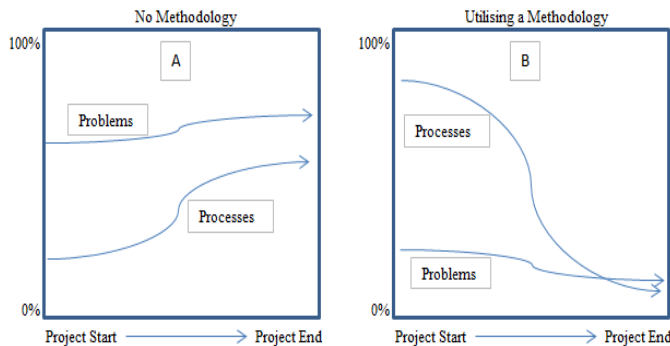

Fig. 1: Difference in using a methodology.

2.1 Strategy with Methodologies

For any company to be world class, the strategy is clear, survey the entire landscape and then put the objectives. In negative economic times, always remember that what comes down must come up [3]. In other words, after identifying and selecting the correct methodology, it may be the best defense if you want to:

- Avoid mistakes
- Reduce cost
- Reduce risk
- Meet project schedules

- Identify and correct errors early
- Avoid excessive documentation

2.2 Review on Project Methodologies

Project management has grown from the early initiatives in the U.S. defense and aerospace sectors in the late 1950s and 1960s [3]. The U.S. Department of Defense and NASA achieved early project management successes, mainly promulgated through their internal policies, procedures, and lessons learned. Many articles, seminars, and training programs that expanded the project management genre, although much of the theory centered on the use of tools and techniques, such as [3]:

- PERT/Gantt charts.
- Critical path.
- Scheduling techniques.
- Organisational issues.
- Conflict management and others.

Most projects share a common life cycle. This is not to say that these projects are all designed and executed the same way, but they remain universal, as they pass similar phases during the life cycle of the project.

3. How Many Development Methodologies are there?

There are no similar development methodologies. Some companies have their own unique customised methodology for developing products or services; others simply use standard commercial off-the-shelf methodologies. With the incorrect methodology, discovering, designing, building, testing, and deploying projects can be chaotic [6]. At least 20 different methodologies are competing to be the best methodology, and this list of methodologies keeps on growing. Some of the assessing project development methodologies are shown in Table 1.

Table 1: Assessing project development methodologies.

Methodology /Life Cycle	Risk	Easy to Implement	Frequent Changes	Easy to Manage	Scope Creep	Reliability	Document Oriented	Project Approach
Open Source	Low	Easy	√	√	√	√	×	Iterative
XP-Extreme	Med	High	√	√	√	√	×	Iterative
Pharma	Med	Average	√	×	√	√	×	Phased
Object Oriented	High	Difficult	√	×	√	√	×	Iterative
Spiral / MBASE	High	Difficult	×	√	√	√	√	Phased
RAD	Low	Easy	√	√	×	√	×	Phased
Crystal	Med	Easy	√	√	√	√	×	Iterative
Incremental	Med	Average	×	√	×	√	√	Phased
Prototyping	Low	Easy	√	×	√	√	√	Phased
UniCycle Model	Low	Easy	×	√	√	√	×	Phased

The project methodology that is chosen represents merely the framework for the real work to be done and indicates where creativity is needed. Many times, project managers simply select the available methodology and continue to develop their projects with that same methodology. When unpredictable results occur on a project, they raise issues and risks and try to manage reactively [3]. Project managers often lack the controls to measure and respond to the unpredictable. Therefore, they must first determine that the methodology is the correct one.

Many project managers find it difficult to give up control as provided in traditional development. There is no guarantee that the team will deliver if it just follow a chosen methodology. Clients seldom complete requirement specifications because their requirements are constantly changing. The most logical solution is to simply evolve the product as the client's needs change along the project development process. This shows the need for a methodology to be more flexible than a formal waterfall approach. In fact, the trend is shifting to the more iterative or incremental style of methodologies [3, 7].

Most project developments are wrongly approached with the assumption that the methodology used is well-understood, and the project can be easily planned and estimated. When a project begins to fail, the development process is immediately provided with more resources and attention to get it back on track. Thus, cost and schedule overruns start occurring. These step-by-step approaches do not work because they do not cope with human and technical unpredictability. Inflexible processes are often too constraining and fall short of delivering a project to operations or production [7].

4. Requirements for Selecting a Methodology

The essential decisions that a project manager must make when selecting a methodology are below [1, 3].

- *Budget*
  Budgets play a big role in any project, and the type of methodology to be used is important. Formulated fairly early in the project's planning stage, the budget estimate is most often based on analogous estimating. With the budget estimate, we start at the top and work our way down into the project details.

- *Team size*
  Methodologies are directly proportional to the team size. Use light methodologies for smaller teams and heavy methodologies for larger teams. The choice of light or heavy methodologies discussed in section 4.1.

- *Technology used*
  The technology used on a project affects the direction and type of methodology selected. Unfamiliar technology slows progress. On many projects today, simulation and testing of new technologies is actually considered a phase of the methodology.

- *Tools and techniques*
  Some project methodologies require more tools and techniques than others. For example, some projects need databases, visual modeling tools, and project management tools; while others require hardly anything. If a project manager must manage multiple design changes, he or she will need a configuration management tool and technique.

- *Project criticality*
  Any critical project with a "must-deliver" target date needs to have the correct choice of methodology. The project might require additional resources to finish by the required date. If the methodology is too small, the project manager loses control; too large and formal, he or she slows the project down. A project manager's experience and skills will help in choosing the best approach.

- *Existing processes*
  In any company, the maturity and ease of use of existing project processes largely influence the methodology. Some company processes may be totally unreliable and ad hoc, slowing down completion of tasks.

4.1 Light or heavy methodology

The choice between using a light or heavy methodology determines the success of the project [3].

4.1.1. Light Methodologies

Ever-increasing technological complexities, project delays, and changing client requirements, brought about a small revolution in the world of development methodologies. A totally new breed of methodology, which is agile, adaptive, and involves the client, every part of the way, is starting to emerge. Many of the heavyweight methodologists were resistant to the introduction of these "light weight" or "agile methodologies". These methodologies use an informal communication style. Unlike heavyweight methodologies, lightweight projects have only a few rules, practices, and documents. Projects are designed and built on face-to-face discussions, meetings, and the flow of information to the clients.

The immediate difference of using light methodologies is that they are much less document-oriented, usually emphasising a smaller amount of documentation for the project. The great thing about light methodologies is that they are learning methodologies. After each build or iteration, the team learns to correct issues on the project and improvement cycles form throughout the project. Additionally, with light methodologies, the project teams are smaller and rely on working more closely, fostering knowledge sharing, and having almost instantaneous feedback. The project manager does not need to develop heavy project documentation, but should instead focus on the absolute necessary documentation [3].

4.1.2. Heavy Methodologies

The traditional project methodologies are considered bureaucratic or "predictive" in nature and have resulted in many unsuccessful projects. These heavy methodologies are becoming less popular. These methodologies are so laborious that the whole pace of design, development, and deployment actually slows down, and nothing gets done. Project managers tend to predict every project milestone because they want to foresee every technical detail. This leads managers to start demanding many types of specifications, plans, reports, checkpoints, and schedules [3]. Heavy methodologies attempt to plan a large part of a project in great detail over a long span of time. This works well until things start changing, and project managers inherently try to resist change.

If the project manager does not obtain a complete list of user requirements from clients for the heavy weight project, it is very likely that the heavy methodology will not work effectively because the project will be racked with change, slippages, and rework on the project documentation. A heavy weight methodology works on the assumption that the more rules and coordination there are, the better the project result will be. A complex project requires sufficient documentation just to jog the memory of the many team members on the project. However, excess methodology is very costly and inept, there are more updates to reports, plans, and schedules. Alternatively, there are times when a heavyweight methodology may be appropriate for super projects where it is necessary to gain stricter control and coordination between phases, and to improve the lines of communication between team members [3].

4.2. Importance of methodology and life cycles

Successful implementation of any project methodology is a project itself. The hard part is to roll it out and make it part of the company's everyday culture. Although managers can manage projects without a formal methodology, having one can be a big help. Project management methodologies have been around for decades, but first started to become popular in Information System (IS) in the early 1970s [2]. These methodologies usually have two components. The first is an overall process for doing things, while the second consists of templates or forms required at specific portions of that process. While the process itself is the true methodology, most project managers consider the templates and forms to be part and parcel of the methodology.

Project management methodologies are important for two reasons. First, they standardise the way in which an organisation manages its projects. This allows people from anywhere in the organisation to talk with one another using the same terms and the same definitions for those terms. Presenting a consistent approach to project management via standards also allows project managers to cover for one another when the need arises. The second reason that methodologies are important is that they provide novice project managers with the tools to manage projects, without requiring a long learning curve.

Project life cycles generally go hand in hand with project methodologies. Such life cycles break a project's life into a series of phases or stages. The end of each phase provides a convenient project review point for senior management to institute go or no-go decisions, and also allows project managers to plan the next phases in more detail. While project life cycles can have many phases, the majority have three to five. They include some type of project start-up or initiation, a project construction or implementation stage, and, finally, a project evaluation or post-implementation review [2, 8]. The Project Management Life Cycle has four phases: Initiation, Planning, Execution and Closure as shown in Fig. 3 [9].

Fig. 3: The Project Management Life Cycle

4.3. Selecting project management methodologies
First, an exploration of the benefits and drawback of vendor methodologies is in order. The greatest benefit of a vendor methodology is that the work is already done, which can save an organisation literally years of developing an internal methodology. The vendor methodology has also been tested and proven to work, saving both the time and headaches involved in smoothing out process wrinkles. On the downside, however, purchased methodologies require an organisation to change its existing practices to match those of the methodology [2, 10].

If it does not, then the organisation must customise at least some of the methodology. These customizations can vary from minor tweaks of the process, to customisations so severe that the original purchased methodology is virtually obliterated. Another drawback of purchased methodologies is their price. Some of the more popular methodologies for IS projects include Dynamic Systems Development Method (DSDM) from Computer Associates and PRIDE from Computacenter [2].

4.4. Implementation of project management methodologies
Once an organisation has either selected a vendor methodology or developed one in-house, it is ready to start the long, often tedious process of creating project standards. While some of the purchased methodologies come with standards for various project components, organisations will need to develop standards for those that do not have them. One of the first steps in implementing a project methodology is good planning. The only thing that really distinguishes projects from non-projects is the project life cycle. To develop a broad understanding of the generic discipline of the management of

projects, both project managers and executives should address the broad range of issues affecting all stages of the life cycle in all kinds of projects [2]. This is certainly a tough challenge as it requires a substantial breadth of analysis and understanding. Maintaining a coherent conceptual view of the discipline at this broader level is generally difficult. We can, however, create a simple structure comprising project methodology; project team; tools and templates; business processes and development techniques in three separate levels to show this relationship (Fig. 4).
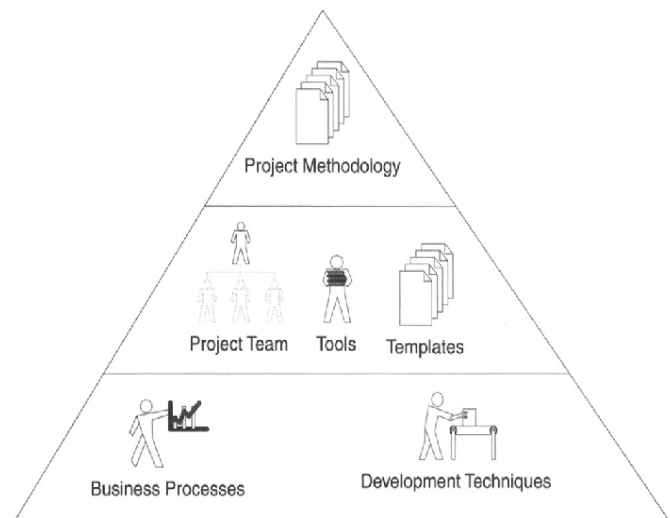

Fig. 4: Project structure and composition.

4.4.1. Creating WBS, Estimating, and Tracking Standards
The first standard to be established is how project WBSs will be created. Many organisations develop project templates for the most common types of projects developed in the organisation, and then specify that project managers work from these templates. The advantage of this is that project managers are not "reinventing the wheel" on each project [2, 10]. In turn, this speeds up planning, and allows better project tracking. After WBS standards are established, the organisation must decide how estimates will be created. Estimates can be determined from expert opinions, weighted averages, statistics from previous projects, or from techniques such as function point analysis [10].

If organisations track their projects accurately and religiously, they can use statistics from previous projects to provide the most accurate estimates. This highlights the need for standards in tracking projects. Most organisations use some type of automated time, keeping package to track time against projects. Time

tracking has three project-related purposes. The most critical is to accurately judge where a current project stands. However, other reasons that are almost as important are the uses of time tracking for project cost accounting, and for data collection, in order to better estimate the next project. To provide the best database for estimating future projects, these packages should allow tracking against each task in the WBS, reinforcing the desirability of standard WBSs [10].

4.4.2. Change Control, Quality Control, and Communications Standards

Standards for change control, quality control, and communications are equally important to project success. Change control in this context does not refer to changes in functioning production systems, but rather to changes in the project itself. The most common modifications to be managed are scope changes, generally expressed as a need for increased or different functionality. Because estimates are based on functionality as originally conceived, changes to initial functionality will obviously impact the project's cost and schedule [2].

To minimise this effect, change control policies outline the project manager's range of discretion for approving changes, and spell out escalation levels and procedures. While these two standards can be negotiated at the beginning of each project, general guidelines can prove helpful. Quality standards in an IS department tend to address how the department handles testing and production turnover. Some examples include how unit testing, system testing, and user acceptance testing will be performed. Communications standards are also important to successful projects.

The main reason that projects change as often as they do is that someone misunderstood a communication, be it the systems person or the client [2]. The organisation can significantly reduce the number of changes to a project in its later stages by setting clear communication guidelines during planning, and then constantly updating everyone involved in the project as it progresses, and doing so in a standard manner.

5.   Methodology Training

While it is attractive to start training employees on the new methodology as soon as it is selected, this 'jumping the gun' can be hazardous to the ultimate success of methodology implementation. Certainly, the methodology will evolve as employees start using it, but there should be a base of standards in place prior to training, lest employees, at a minimum, require retraining. In some organisations, employees

have actually revolted and chosen not to use the methodology at all, until standards have been established [2, 10]. With at least tentative project tracking, estimating, change control, quality control, and project communication standards in place, the organisation is ready to conduct IS departmental and client training. This training can be performed in three ways [2, 10]:

- Using outside consultants, who often develop the training as well; via internal employees; or using a combination of consultants and employees. If the organisation chooses the combination approach, external consultants often develop the training, whereupon they train the internal employees regarding how to deliver the training.

- Since both project managers and project participants must understand the new methodology, it often makes sense to have two separate classes. The more in-depth class, for project managers and project leaders, ideally provides case studies, so they can actually practice the critical portions of the methodology. Although this type of training initially takes longer, the learning curve is less steep when project managers and leaders start following the methodology on "real" projects.

- The training for project participants can be less detailed, focusing on their roles in the new methodology. It need not specifically train them to use all the pieces of the methodology.

5.1.   The Agile Methodologies

Project or development managers are still facing controversy between the agile and heavyweight methodologies. Currently, many companies favour the agile methodologies. Agile methodologies present new, nontraditional ways of building complex products and systems. Projects that use agile methodologies are now starting to report improved time line and cost savings, compared to those in the heavyweight family [3].

Additionally, project teams are hailing the agile family of methodologies as remarkable because, at last, a series of methodologies contributes directly to the business. Many managers tend to stick with the heavyweight methodology because they want to predict the entire project until the last man-hour, whereas the project teams tend to stick with dynamic shorter cycles [3, 7, 11]. Industries that use agile methodologies include financial, IT, telecom, utilities, and many more service industries. Furthermore, this trend is starting to emerge worldwide [7]. The following are the most commonly used agile methodologies [3, 7, 11]:

- Extreme Programming (XP)
- Scrum
- Crystal methodology
- Dynamic Systems Development Methodology (DSDM)
- Rapid Application Development (RAD)
- Adaptive software development
- Lean development
- Feature-driven development

Agile methodologies better suit small projects where smaller project teams are involved. With larger team size and the complexity and duration of the project, the choice of a heavyweight methodology is purely from a command and control perspective. Many smaller companies do not use heavyweight methodologies and prefer the more agile approach to building solutions [7].

6. Differences between traditional and modern project management

Comparisons between traditional project management and modern project management from the four perspectives of planning, leading, organisation and controlling are explained below.

6.1. Planning
i. Traditional planning

Planning for an operational environment consists primarily of establishing the schedules people work, assigning individual tasks, scheduling vacations and adjusting for expected and unexpected time away. Plans for Continuous Efforts may assume highly stable end-products, a well-defined process and task-based workers. This yields plans that are very predictable early on and highly stable over time. Many of the project management techniques and current day expectations were based on these assumptions. Staff planning for a Single-Time Effort is complicated by dynamic teams comprising of people who typically do not report administratively to the Project Manager. Matters become seriously complicated when these people are available on a limited, unpredictable basis [5].

ii. Modern planning

Project planning focuses on breaking down the total effort into assignable units, estimating this work, defining the most efficient order in which the work should be performed, and then deploying available staff to specific work packets for specific windows of time. Perhaps the most significant influence of modern project management is on project plans and the planning

process. Because Single-Time Effort projects are only performed once, and in many cases, have never been done before [5]. It is impossible to create final, stable plans early in the life of the project.

While preliminary and highly speculative projections may and should be produced, these early plans must be repeatedly "re-base lined" as new information becomes available. A complete discovery process is typically required before stable plans are feasible. Because of their experience with the early, stable plans of Continuing Effort, many organisations falsely assume they may simply "command" early planning data for Single-Time Effort. This often dooms a project to failure as it is operating with totally invalid set of expectations and strategies [5].

6.2. Leading
i. Traditional Leading

Leading any human organisation requires managers, working in a benevolent manner with their subordinates, helping them learn how to accomplish assigned work. In Repeating Effort and Continuing Effort, the manager is often the task expert and is fully qualified to perform any work within their managerial domain. If not, they can easily retain an advisor or consultant who fills this role. These traditional supervisors and managers are expected to make the hard decisions, even when others do not agree with their conclusions [5].

ii. Modern Leading

Due to the complexity and diversity of skills needed to perform Single-Time Effort, it is impractical for the project manager to be the task expert of all work that must be done. When these managers attempt to blindly dictate direction, they are quickly exposed by their impractical or unreasonable edits. Instead, modern managers work to solicit individual contributions, create consensus within the project team, facilitate group decisions and create an environment where it is possible for people on the project to accomplish their work with a minimum of distractions. The modern Project Manager plans, organises and controls the project with the team and not for the team [5].

6.3. Organisation
i. Traditional Organisation

The operational manager is primarily concerned with creating a structure within his or her control

that monitors the work flow. They must insure the proper number and alignment of employees to accomplish the work in a consistent manner. Well-defined career paths are established with the promise of a "in-line" promotion for length of service. A manager's personal ranking in an organisation is often directly related to the number of people in their employ. In this setting, the traditional manager often has both administrative and functional authority over their employees. Administrative duties include the "care and feeding" of their employees such as salary administration, training plans and employee evaluations. Functional authority is the right to assign work to an individual and have that work be accountable back to the boss. When this view dominates an organisation, it creates serious conflicts for managers of Single-Time Efforts [5].

ii. Modern Organisation
A modern Project Manager must establish clear roles and responsibilities needed for the success of their project. A project staff often includes many people who do not report administratively to this manager and may even be at a higher corporate level. Organising a project structure begins with defining what is expected of the Project Owner along with each member of the Project Team. The Project Manager must also define and explain the responsibilities they will have to the project. Further, these managers typically have only functional authority over their team.

This "authority" is often compromised by the priorities, views and occasional interference of the actual administrative managers. It becomes illogical and unfair to hold a Project Manager responsible for deliverables and dates when they have such limited and tainted authority over their team. Even more vexing is the tendency of out-of-control organisations to improve the "look" of productivity by deploying the same people to multiple simultaneous projects. Organisations must address this condition with well-defined roles, clearly stated responsibilities, full release of people to a project and a corporate resource management process that insures team members are never over-deployed to multiple projects [5].

6.4. Controlling
i. Traditional Controlling
Controlling an operational organisation includes establishing organisational performance goals and then determining what each individual's contributions should be. Individual goals are assigned and measure to insure the employee is meeting their goals. Control is usually established around target performance over a standard period of time, such as a quota measured within an hour, day or week [5].

ii. Modern Controlling
Single-Time Efforts are measured based on creating quality, not quantity. It is critical to first verify the completion of promised deliverables. Objective criteria for completeness and quality must be met before a deliverable is considered "done." Performance and productivity may then be measured by comparing planned hours, durations, start dates and finished dates against the actuals. However, instead of comparing performance against the original plans created during the first days of a project, measurements must be against revised and relevant baseline plans [5].

7. Conclusion

Selecting a Project Management methodology can be one of the most difficult parts and can have real impact on the fate of the project. Normally the Project Managers' criterion for choosing a methodology for any project is mainly based on an expert's opinion, past working experience, government rules and regulations, organisation, senior management, stakeholder's preferences and client location. All of these can have positive or negative impact on the underdevelopment projects. However, all of the above mentioned criterion have inbuilt quality of rigidness. None of these provide any opportunity to analyse the nature of project and then decide the future course of action related to the selection of project management methodology. Decisions in which a methodology is chosen or used based on a single criteria can have serious negative impacts on the project especially if the project manager, development teams do not have the knowledge or the pros and cons of the selected methodology. No project management methodology is meant to be taken verbatim. It must be customised in the context in which it is being applied in order to increase the rate of adoption and the opportunity for success. It has been observed and evident from the above text, that all the methodologies discussed have some common tools and procedures. There are points where one methodology has some powerful tool and procedure than the others. In that case and in order to make the most of these established methodologies, a combine, mixed approach is required to get the best possible results.

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