CHAPTER 2

REVIEW OF LITERATURE

Research towards ensuring efficient software development methodologies in project management have been conducted for more than a decade. The current study proposes to investigate frequently used development methodologies, e.g., Agile, Lean Principles, Six Sigma, etc. Therefore, this chapter discusses some of the significant literature available till date related to the effectiveness of these software development methodologies.

2.1. Agile Software Development

Kupiainen, Mika, and Itkonen (2014) presented preliminary results from a systematic literature review. According to their study, metrics are focused on the following areas: Iteration Planning, Iteration Tracking, Motivating and Improving, Identifying Process Problems, Pre-Release Quality, Post-Release Quality, and Changes in Processes or Tools. When Agile principles were compared or mapped with the findings, it was found that the metrics supported the principles with some deviations. Surprisingly, little evidence was found of the use of code metrics whereas there is much evidence on the use of planning and tracking metrics. It was also noted that the use of metrics to motivate and enforce process improvements, as well as applicable quality metrics, can be interesting topics for future research. In this paper, they covered the following research questions:

- Why are metrics used?
- What actions do the use of metrics trigger?
- Which metrics to use?
Fitzgerald, Stol, O'Sullivan, and O'Brien (2013) identified the essential characteristics of Agile approaches and illustrated through a detailed case study how an Agile approach was implemented successfully in a regulated environment. Among the interesting concepts that emerged from the research were the notions of continuous compliance and living traceability. The reason for this can be traced to the Agile Manifesto, which identifies the four fundamental value propositions for Agile to be (http://agilemanifesto.org/):

- Individuals and their connections are valued in excess over tools and processes.
- Functioning software is preferred over complete documentation.
- Collaboration with the customer is more important than getting a contract negotiated.
- Reacting to change rather than rigidly following a plan.

Harish, Madhu, and Lokesha (2012) performed a complete study using the procedure for Agile software testing. The procedure for Agile software automation testing and the best practices to be followed to deliver an optimal working product to the customer were discussed. The paper includes the best practices to consider before implementing automated software testing. These best practices are strategic and are applicable regardless of the automation tool used and provide a clear path to test the software product in the Agile development process.

Melo, Cruzes, Kon, and Conradi (2013) conducted a multiple-case study for six months in three large Brazilian companies that had been using Agile methods for over two years. They focused on the main productivity factors perceived by team members through interviews, documentation from retrospectives, and non-participant observation. A conceptual framework was developed using thematic analysis to understand the probable processes behind such productivity factors. Agile team management was found to be the most influential factor in achieving Agile team productivity. At the intra-team level,
the main productivity factors were team design (structure and work allocation) and team member turnover. At the inter-team level, the main productivity factors were how well teams could be effectively coordinated by proper interfaces and other dependencies thus avoiding delays in providing promised software to dependent teams.

Moniruzzaman and Hossain (2013) significantly identified and described the major factors to prove that the Agile development approach improves software development process to meet the rapidly changing business environments. They also provided a brief comparison of Agile development methodologies with traditional systems development methodologies, and discussed the current state of adopting Agile methodologies. They speculated that Agile software development has emerged as an alternative to traditional plan-based software development methods from the need of satisfying the customer all the way through early and incessant delivery of the precious software. The purpose of this paper was to provide an in-depth understanding of the major benefits of the Agile development approach to the software development industry, and also provide a comparison of Agile software development methodologies over traditional software development methodologies (TSDM).

Pathak and Saha (2013) described a new type of model for software development, i.e., Agile software development. In this paper, they presented their analysis of three Agile software processes. They also described the problems faced during the implementation of Agile software development. Their objective was to help software engineers understand the key characteristics of these processes and therefore select the most suitable process with respect to the type of software projects developed by them. As a future exercise, there is a need to review other Agile processes not covered in this paper such as Lean Software Development (LSD) and Dynamic Systems Development Method (DSDM).
“In what ways does the implementation of Agile Software Development Methodology impacts quality within Information Technology (IT) organizations?” is the query that Imreh and Raisinghani (2011) attempted to answer in their work. Agile software development, the pioneering "development", has a significant effect on companies which focus on software development and also represents a few obstacles that ultimately affect quality within IT companies. This study investigates the effect of Agile software development on quality inside the authoritative, precise, and social structures of IT companies and provides industry standard suggestions to mitigate such effects.

Singh and Chana (2012) created standards that have their place in business, for example, Agile software development, reuse based development, and component based development. On the other hand, diverse programming advancement models neglect to fulfill the various needs of the product business. All methodology models aim at accomplishing item quality, reducing time for development, increasing profits, and decreasing expenses, yet no solitary procedure exists that is complete. The programming industry is moving towards Agile software development. Coordinated advancement does not clearly fit well for building reusable artifacts. Then again, with cautious consideration, and vital alterations made to Agile techniques, it might be conceivable to adapt effectively and put on Agile methods for the development of reusable objects. The model proposed here unites the attributes of Agile software development and reusability.

Qwaider (2012) focused on Agile in software development methods and practices. However, effective methods for use received less attention. This paper discusses the adoption and level of experience of the use of Agile practices in three software development companies in Jordan.

Zhang and Dorn (2012) studied Agile practices in a small-scale, time-intensive web development project at a college-level IT competition.
Based on the observation of the development process, interviews of the project teams, and the study of relevant documents, they describe how Agile practices, such as daily scrums, backlogs, and sprints, were successfully adopted to project development. They also describe several supporting activities that the team employed, including cross-leveling of knowledge, socialization, and multiple communication modes. Finally, they discuss the benefits and challenges of implementing Agile practices in the case project reported, as well as contributions and limitations of their findings.

Agarwal and Majumder (2011) described Agile project management, a critical factor that comes while implementing Agile methodology, real Agile environment, and Agile project planning. Mere knowledge of the development process is not sufficient for effective software development. Knowing additionally how to manage the process will ensure that the process is carried out effectively. For example, while planning a vacation, merely having a detailed itinerary of places to visit is not sufficient.

Sousa and Almeida (2011) focused on the academic setting: the Laboratory SAPO/UA, specifically in the SAPO Campus project. The working of this context, currently reduced in management formalities, was analyzed to further develop an Agile project management model. The design model was implemented among the project team and subsequently validated. As a result, they expect a real improvement of the project and a gathering of arguments that strengthen a clear perspective on the adaptation of Agile project management to the context of multimedia production.

Gandomani, Zulzalil, Ghani, and Sultan (2013) talked about measurement of the Agile change process from a more extensive point of view. They demonstrated that concentrating on Agile adoption is not the only key for achievements in the Agile transformation process; an Agile change management system also requires to be defined. This scheme has to consider
all parts of the changing methodology and is the foundation of accomplishment in Agile change transform through essential transformation incidents.

Harichandan Panda, and Acharya (2014) performed testing in a Scrum environment. Test strategies such as unit and regression testing method were adopted in the process. Management of user requirements through product backlog and sprint backlog is discussed with suitable examples. A different methodology of backlog estimation i.e., initial estimation technique and planning poker method is discussed in this paper.

Kennedy, Ahmad, and Koch (2011) presented the DBToaster project, which is an ongoing effort to develop a prototype Dynamic Data Management System (DDMS) system. They described its architecture design, techniques for high-frequency incremental view maintenance, storage, scaling up by parallelization, and the various key challenges to overcome to make DDMS a reality.

Khurana and Sohal (2011) proved Agile to be excellent in case of overtime and to keep a check on the performance of the workers. In this model, one of the limitations is that workers should be permanent till the assignment is over. The future work in this case can be to run this model where the workers are not permanent. This model can be studied and the effectiveness of Performance Evaluation and Overtime Reduction (PEOR) model in this situation can also be determined. This model is still being implemented in this organization.

Lalsing, Kishnah, and Pudaruth (2012) aimed at identifying the underlying people factors to consider when adopting Agile for a team to be effective. The method used is the study of three different sized Agile teams developing products based on the same technologies and using Scrum. Both objective and subjective measures were used, and the results were supported by a survey. The results clearly show that for Agile methodologies to work well, it is crucial to select the right people for the right team.
Morien (2014) suggested that computer software is now so ubiquitous in everyday private and commercial life that no discussion on business, business strategies, etc. can ignore matters pertaining to software. Especially in this day and age, when creativity of thought and artistic action, and imperative of agility in system development and system operations has been brought about by the influence of cloud computing, SaaS, IaaS and OaaS, HaaS and Paas, a change in how system development and project management is perceived is essential, and almost a survival strategy.

Petrasch (2014) focused on the specifics of interactive media software projects in order to give a concrete example. This is done by defining extension points to the role model and the artifacts so that the customization of a Scrum based project management approach is easier.

Pozgaj, Vlahovic, and Bosilj-Vuksic (2014) presented the notion of creating a teaching model based on the principles of Agile management. The model developed and described here is based on Scrum, one of the most widespread Agile methods. Since Scrum is primarily a framework for managing software projects and software applications development, during the development of the model it was crucial to negotiate the differences between Scrum and the teaching process. The teaching model in this paper covers the whole teaching process from first lessons to the final exam.

Soria, Campo, and Rodríguez (2012) presented a model by focusing on Scrum and Agile coaching. This creative model, which has been diverged from RUP (Rational Unified Process) and evaluated by utilizing CMMI (Capability Maturity Model Integration) as a source of perspective, is the effect of an evolutionary process in which a few upgrades were led amid the scholastic period 2008-10. Results demonstrate that this Agile methodology permits understudies to create programming accomplishing large amounts of CMMI development.
2.2. Lean Principles

Staats and Upton (2009) started the investigation of the Lean productive system by considering the Indian software service. The work provides a detailed study of the internal process of Lean. The case study found that Lean projects are more effective than non-Lean projects in some but not all cases. From the survey result they found that the techniques have an influence on some problems such as coordination, problem solving, and work standardization thus improving productivity. Their investigation provides insights into how companies can build an advantage based on operations.

Salman, van der Krogt, Little, and Geraghty (2007) presented a study in two parts. The first was concerned with the adoption of Lean in an appropriate manner, i.e., not attempting to imitate other organizations or tracing their footsteps, as this has shown to be a common explanation for companies failing to realize or achieve Lean success. Second, Lean can venture beyond its automobile industry origins, known to be Toyota in Japan, to benefit other industries and market sectors. Here the concept of applying Lean to production scheduling is investigated in more detail. Lean tools that can be adapted to scheduling are explained and analyzed to help highlight the agenda. This is further emphasized by presenting two case studies, where Lean tools and techniques are implemented to enhance scheduling effectiveness. The first case study shows the impact of “leaning” (particularly, buffer reduction) on the scheduling process and how quantitative modeling can be used to examine this. The second case study investigates the support of day-to-day operations in a Lean-centric cellular manufacturing environment.

Marzouk, Bakry, and El-Said (2011) demonstrated how computer simulation can be used as a tool for assessing the impact of applying Lean principles to the design process in construction consultancy firms. The design process was divided into three main consecutive phases including project initiation, core design, and finalizing and closing phase. A generic simulation
model was designed to represent the design process, which can be utilized by consultancy firms of different sizes to represent their design process closely. Different blocks and various functions of the used software were utilized to depict the different components of the design process and their interconnectivity. Subsequently, the model was optimized to take into consideration Lean principles in the design process including specifying value, identifying the value stream, achieving flow, applying pull and achieving perfection.

Glover, Van Aken, and Creehan (2009) described a process improvement team in a hospital operating room department. This team planned to address issues by reducing the turnaround time between surgical cases and improving the number of first cases commencing as per schedule. These two performance metrics were chosen for improvement through the use of Lean work system principles executed by a cross-functional team composed of the OR employees and external consultants. This method resulted in considerable improvement on the number of first cases starting on time and minor progress in turnaround time. In this work the author summarizes the overall methods used by the team members, tools used, findings associated with tool use, outcomes for performance metrics and probable prospective improvements.

Staats, Brunner, and Upton (2011) carried out an analysis on the relevance of Lean generation to knowledge work by exploring the execution of a Lean creation framework on the services of the Indian software. They first examined particular facets of knowledge work (task uncertainty, process invisibility, and architectural ambiguity) that cause the reinvestigation of the importance of Lean production in this setting. Merging an empirical analysis and observational examination, they found that Lean software projects perform better than non-Lean software projects in the organization for most performance outcomes. They recorded the impact of the Lean activity on internal processes and inspected how these influence learning by enhancing
both problem identification and resolution. Finally, they broaden the Lean production structure by emphasizing the need to (1) recognize issues ahead of schedule and (2) keep issues and resolutions together in person, time, and space.

Prakash and Kumar (2011) carried out a study describing a quantity of learning from USA, UK, and Indian literature and actual practices. Endeavors are made to present the gaps between the standards and practices. Some correlated suggestions are proposed to enhance the information base of experts to make the processes of implementation more logical and powerful over the long haul and for the facilitation of exact research by academic researchers.

Widman, Hua, and Ross (2010) described Lean thinking concepts and the process of applying Lean in the technical coding at IMVU—a virtual worlds company. They also summarized lessons learned in the implementation of Lean for software development processes.

Radnor (2011) draws on the findings of three evaluations, two Hospitals and a Mental Health Trust in England, on the implementation of Lean within Health Care. The paper analyzes the case studies not only to assess if the approach taken was process or continuous improvement, but also to evaluate the degree to which conditions of readiness related to Lean were present. Organizational readiness factors include understanding of the process/system view, customer view, data, and engaging the staff to ensure that Lean is not just about making weak processes more efficient by focusing on the tools. The paper introduces a typology of Lean implementation which could be used to position organizations to understand their association between the approach taken and, the state of the conditions of readiness thus the level of sustainability which could be achieved.

Puvanasvaran, Tian, Suresh, and Muhamad (2012) compared the ISO 14001 certification received by organizations with Lean creation practices
and estimated the positive and critical relationship of Lean standards with the necessity of ISO 14001. The results demonstrate that all ISO 14001 organizations do embrace no less than one practice of Lean generation. Principally, the fundamental discoveries demonstrate that Lean standards have a positive and exceptionally critical association with the requirements of ISO 14001.

Hook and Stehn (2008) demonstrated the necessity of clear top management strategies, and secondly the importance of changed work practices as facilitators of a change in culture. Thus it is argued that to move towards a Lean culture, from a long-term perspective in industrialized housing production, there is a need for a simultaneous top-down and bottom-up approach diffused to workers. The bottom-up approach specifically means that tools and techniques motivate workers towards a Lean behavior and mind. Hence, the proposed approach has a system view because the Lean tools show the direction for worker towards a Lean culture. A Lean culture cannot merely be obtained by management that proposes a strategy. Instead, a culture is achieved when people find a strategy (or principles, practices and tools) to be working.

Moori, Pescarmona, and Kimura (2013) examined the relationship among Lean manufacturing management, competitive skills, and business performance from the perspective of managers of companies doing business in Brazil. They conducted a survey of 68 Brazilian companies that use Lean manufacturing and analyzed data using structural equation modeling based on partial least squares method. Results showed, considering competitive skills as mediating variable, a positive relationship between Lean manufacturing and business performance. Results also suggested that managers lack awareness about the importance of the competitive skills to enhance business performance.
Pettersen (2009) aimed to investigate the definition of Lean Production and the methods and goals associated with the concept as well as how it differs from other popular management concepts.

2.3. **Six Sigma Principles**

Oguz, Kim, Hutchison, and Han (2012) drew attention to the adoption of Lean Six Sigma in the construction industry with a case study. The combination of Lean tools and Six Sigma methodology was used on projects to improve the process by eliminating variations and creating a workflow in the process. Despite its relatively new introduction to the construction industry, it has been popularized by several organizations and adopted as the primary improvement process.

Han, Chae, Im, and Ryu (2008) proposed a model which gives an extra reliable workflow by decreasing the variability of the process to improve the whole performance, through measuring the level of quality, of the current construction operation. The authors presented two case studies to test the model, Furthermore, process simulations were performed to find the performance changes based on Six Sigma principles. The authors also discussed quality control for rising sigma levels.

Chow and Downing (2014) presented a case of using Six Sigma methodology for improving the retention of first-year college students in an academic institution. Communicating the factors involved in student retention research, improvement strategies, and results attributed to selected courses of action with both internal and external audiences can be daunting. The standard Six Sigma methodology offers a comprehensive five-phase framework for organizing information, examining factors and presenting operational results.

Ansari, Lockwood, Thies, Modarress, and Nino, (2009) presented a review for the application of the Six Sigma methodology in a finance department. The authors chose a case related to the reconciliation of accounts
in the finance department of a major US defense contractor. The main aim of the project was to achieve better standards in cost maintenance and planning of the business activities in the current financial management process. The implementation of Six Sigma provided good results with reduction in cycle time and cost per activity unit required to produce the necessary financial reports.

Nakhai and Neves (2009) concentrated on the improvement of services using Six Sigma methodology. From the 1980s Six Sigma has been applied in manufacturing settings. The authors try to explore the challenges of widening the application of Six Sigma methodology.

Dumitrescu and Dumitrache (2011) focused their study on the implementation of Lean Six Sigma approach on industries to gain benefits. Lean Six Sigma aims at improving quality, reducing cost and lead time, stressing on the elimination of waste. The authors also investigated the requirements for Lean Six Sigma implementation within a company and conducted a comparison with other methods of total quality management to evaluate why Lean Six Sigma is a more advantageous approach.

Raghunath and Jayathirtha (2013) presented a literature review on the implementation of Six Sigma by manufacturing and service companies considering findings related to various interrelated factors such as: benefits of implementation; barriers for implementation; critical success factors; metrics for measurement of breakthrough performance; customer satisfaction; change in organization culture; leadership behavior; change management; etc.

Nooramin, Ahouei, and Sayareh (2012) reported findings related to the implementation of Six Sigma in the offshore side of marine container stations to reduce the average number of vehicles in queues and the average waiting times of vehicles in both entry and departure gates. Risk Priority Numbers (RPNs) obtained from the FMEA (Failur Mode Effect Analysis) analysis implied that further control procedures and related inspections were required to
monitor the working time and activity of weighbridge operators and vehicle drivers. Additionally, grave deliberation should be provided to evaluation of operators job performance and the improving of administrative systems.

Hayen (2008) examined the application of the Six Sigma methodology in providing an IT solution to a business issue. Six Sigma was applied to the attendance/leave system of employees in the business. The author explained that Six Sigma requires organizing a team around the owner of the process and is conducted with the support of a Six Sigma black belt. Following Six Sigma’s data driven approach, the IT solution resulted in an improved process which reduced the business problem.

Valles, Sanchez, Noriega, and Nuñez (2009) presented a Six Sigma project conducted at a semiconductor devices company which manufactures circuit cartridges for inkjet printers. The circuit cartridges are electrically tested in a process to measure their electrical characteristics, and then accepted or rejected. It was found that electrical failure caused about 50% of all the defects. Therefore, it was critical to determine the chief issues, causes and actions to reduce the defect level. Six Sigma implementation helped ascertain key factors, recognize ideal levels or tolerances, and opportunities for improvement. The major factors found through a design of experiments of 3 factors and 2 levels were tool height, abrasive pressure, and cycle time. Electrical failures were reduced by around 50% as a result.

Lloréns-Montes and Molina (2006) presented an analysis of the relation between the Six Sigma approach and general and specific topics of management. This study led them to suggest that there is a significant similarity between the recommendations of Six Sigma and management theory. Furthermore, they analyzed various Six Sigma processes and practices that lead to improvement in organizational effectiveness. The inference from this research is that Six Sigma programs need to change employee work behavior to be successful.
Parast (2011) developed a theoretical base for the influence of Six Sigma projects on innovation and firm performance. It has been suggested that Six Sigma projects improve the technological innovation of firms. However, this has not been proven beneficial for firms in unstable environments. This is due to the fact that Six Sigma programs focus on decreasing variance and increasing efficiency and thus can be of use in improving incremental innovation. However, as a result they are not very successful in dynamic environments. Additionally, Six Sigma projects focus on current customers, i.e., they may hinder innovation for new customers. Accordingly, the implementation of Six Sigma projects in dynamic environments with high levels of innovation and change may be a challenge, and consequently may not provide the anticipated results.

Hsia, Hsia, Huang, and Chen (2014) adopted the Six Sigma Process improvement method known as DMAIC (Define, Measure, Analyze, Improve and Control). The readability of statements written in maintenance technical orders is called the readability index while the significance of aviation safety obtained through composting maintenance technical orders is termed the importance index. These indices estimate quality and vigilance in writing maintenance technical orders. DMAIC concurrently measures and examines maintenance of technical orders with a high satisfactory value on the importance index, but low on readability. It recommends a way to improve writing quality while developing a management mechanism for maintenance technicians to ensure quality technical procedures to increase aviation safety.

2.4. Other Software Development Methodologies

Petersen, Wohlin, and Baca (2009) investigated issues related to the waterfall model as applied in the context of large-scale software development at Ericsson AB (Sweden) and compared the findings with literature. The results showed that the most critical issues in waterfall development were related to
requirements and verification. In consequence, the waterfall model is not suitable for use in large-scale development. Therefore, the company moved to an incremental and Agile development model in 2005. A comparison of the case study findings with literature revealed that all the issues found in the literature were also found in the case study.

Norbjerg (2002) raised the question of how a development project may address the problems inherent in the waterfall approaches to software development without losing project control and jeopardizing the quality. The Monitor project is one example of how this may be done. The approach adopted in the project is similar to recommendations and descriptions from other (current) development models, such as XP, RAD, and MS development framework. The experiences have been adopted from “internet development” with a focus on rapid production of an executable and potentially marketable – if not quite stable – product with relatively short construction cycles, and flexible/evolving requirements. The experiences reported in this paper provide more insight into how such development approaches work out in the “trenches”, how they can be managed, and the potential risks involved.

Farr (2005) reexamined the performance capabilities of a specific combination of Space Shuttle external tanks and various liquid engines in an in-line configuration, two-stage core vehicle with multiple redesigned solid rocket motor strap-ons. This concept proposed the use of available assets, hardware, and capabilities that are already rated by crews, certified for flight, manufactured under current contracts, component and system ground tested, and have been flown for over 20 years. This paper is not limited to describing the probable performance capacity of particular components or to discussing the feasibility of the overall system, but also explains the fundamental cost benefits of the Spiral Development concept, which develops on existing abilities and assets, as against building a “fresh sheet” heavy-lift launch vehicle program from scratch.
Paasivaara and Lassenius (2004) recognized practices such as, delivery synchronization, feature-based development, frequent deliveries, behavioral patterns, plan and code reviews. They likewise displayed the advantages that the utilization of these practices brought, for example, such as precision of development, the escaping of “big bang” incorporation, amplified developer inspiration owing to quick feedback, early engagement of subcontractors, suppleness concerning changes, and ensure joint understanding of necessities. It appears that the benefits of utilizing the practices override the additional correspondence and coordination costs incurred.

Munassar and Govardhan (2010) presented five of the development models namely, waterfall, Iteration, V-shaped, spiral, and Extreme programming. These models have both advantages and disadvantages. Therefore, the main objective of this research was to present the different models of software development and compare them to show the features and defects of each model.

Awad (2005) provided a brief description on the characteristics of several traditional methods and the Agile technology that are widely used in software development. The author has also discussed the strengths and weakness between the two opposing methodologies and gives an idea of challenges connected with the processes of implementing Agile in the software industry. This subjective proof is increasing with regard to the efficiency of Agile methods in particular environments. However, there has not been much collection and analysis of empirical evidence for Agile projects. The author conducted a survey inviting the feedback from the practitioners of the software industry to estimate which method is more successful across the different sizes of software development. According to the findings, Agile methodologies can provide good benefits for medium and small-scale projects but the traditional methods seemed to be dominant for large-scale projects.
Farrell (2007) demonstrated an overview of both software development methodologies and organizational structures and provided guidance on how to select a software development methodology for a project based on the characteristics of the organization’s structure. Selecting the correct software development methodology for a project can help projects to be released successfully, on time, and within budget. Once an organization has determined which methodologies will work best for its projects it can ensure that there is a repeatable process established that will ensure successful projects.

Sabale and Dani (2012) focused on comparative analysis of the SDLC (Software Development Lifecycle) models. With the growth of operations in organizations it has become increasingly necessary to automate activities. Hence it is very important to standardize the methods and structure in the industry thus making it easy to transition from manual to automated systems.

Lima, de Castro Freire, and Costa, (2012) illustrated how Scrum Agile software project management methodology has been deployed and adapted to the software project management of a research and development laboratory. As a result of this deployment, experiences and lessons learned in seven real projects developed by the authors are reported.

Parsons and Lal (2006) explored both Agile development methods and their potential use with hybrid development approaches alongside more prescriptive, high ceremony methods. Previous research indicates that test based practices are perhaps the most easily accepted and immediately useful of Agile practices that can be integrated into existing formal approaches.

Greer (2005) reviewed some of the techniques available for prioritization of requirements for incremental and iterative development of software systems. A category called relative comparison techniques can be formed. These are the methods that require the requirements to be compared to
achieve a prioritization. Once a prioritization is achieved, a greedy algorithm taking into account the dependencies in the requirements could be applied to assign requirements to increments for release planning. This method should work well for small numbers of requirements but is impractical with larger sets of requirements. A further method as illustrated by the SERUM method could be classified as absolute comparison method.

Munassar and Govardhan (2011) proposed a Machine learning technique based on hybrid software development process model called prototype centric (PC). The proposed hybrid model works by considering any one or more traditional models as source models. They also conduct an empirical study to analyze the performance of PC over other traditional models that are most frequently quoted in literature.

Mitchell and Seaman (2009) presented evidence for software project managers to improve development approaches. These were given in terms of the two approaches, namely waterfall and iterative incremental development (IID), which are compared on development cost and product quality.

Mishra and Dubey (2013) compared the different software development life cycle models on the basis of certain features such as Requirement specifications, Risk involvement, User involvement, Cost, etc. On the basis of these features, one can decide which of these software development life cycle models should be chosen for a particular software project. Selecting the correct life cycle model is extremely important in the software industry as the software has to be delivered within the deadline and should also have the desired quality. This study claims to make the process of selecting the SDLC model easy and hence will prove to be very effective for the software industry.
2.5. Study of Related Work

After investigating the Agile improvement strategies, it was observed that researchers mean to help early and rapid advancement of working code that addresses the needs of the client. Agile supporters assert that the code is the main deliverable that matters. However, Agile supporters also found the stress on code will prompt memory misfortune owing to the inadequate display of documentation.

There are some disadvantages in the application of Agile methodologies which were not found in the past. Agile methodologies are not suitable for the maintenance and greenfield engineering and hence there will not be any documentation of the systems. Agile technology depends on the relationships of the user. Hence, the success of the project will depend on the communication and co-operation of the user.

Another limitation in the Agile method is that it focuses on the work quality or the abilities and practices of the designers as the outline of the modules and the sub-modules are made basically by a single designer. This is on account of the concentration on building frameworks that take care of only particular issues, and not general ones. Agile technologies work best for groups with few members, and hence, they will not function well for groups with large number of members.

In order to obtain advantages using the Agile methods requires a current set of suppositions that are thought to be valid. For instance, collaboration and up close and personal connection between clients and the improvement group; developing and changing prerequisites of the undertaking; designers having great individual abilities and encounters; etc. In the event that it is not able to satisfy these essential suppositions in a product advancement venture, then it is better not to use Agile technologies irrespective of the strategies for improvement.

The main goal of the Agile software is to convey what is required when it is required. The Agile scheme includes a group of advanced software
approaches. They are a few differences between these but require the same essential ideas. The fundamental Agile methodologies being utilized are the incorporation of Scrum, XP, and Agile Modeling. XP is the coding of what the client points out, and the testing of that code. Agile Modeling characterizes a gathering of qualities, standards, and practices which portray how to streamline demonstrating and documentation activities. Scrum also helps support the software development.

The Agile methodology is not suitable for many projects where the communication between the customer and the developer is problematic, or where there are beginners’ in the development team. These approaches show ideal results when there is a solid correspondence between the customer and the developer, and the improvement in work requires good and skilled team members. At a point when there is a huge chance for misunderstanding the precise requirements of the client, or when the due dates and plan are tight, then Agile approaches are among the best Agile advancement methodologies can apply.

Six Sigma approach since its inception has been usually associated with large companies. Small and midsize companies have also gradually started reaping financial benefits from the program. They are achieving enhanced savings from Six Sigma projects and better growth. Lack of knowledge, training and some of the misconceptions has made Small and Medium Enterprise (SME) to be skeptical about the adoptability of Six Sigma. Apart from these there are some genuine technological, organizational and financial limitations of SMEs that act as barriers for Six Sigma implementation. The major factors that affect the Six Sigma implementation are as below:

- Lack of resources
- Internal resistance
- Lack of leadership from top executives
• Lack of knowledge about Six Sigma
• Insufficient organizational alignment
• Cultural barriers
• Poor training and coaching
• False notion that Six Sigma is too complex to use
• Wrong identification of the process parameters
• Lacunae in data collection
• Poor Six Sigma project selection

Hence, very few studies are found to prove the cost effective adoptability of Six Sigma principles for SMEs. Hence, this is obviously an open issues as well as research gap, where theories contradict with practicalities.