

Implementing Scrum and Kanban Approaches for E-Commerce Web Application: An Agile Framework

P. Sahithi¹ M. Pradeep Kumar²

¹B. Tech Student ²Assistant Professor

¹Department of Electronics and Communication Engineering ²Department of Mechanical Engineering

^{1,2}Kamala Institute of Technology and Science – Karimnagar, Telangana, India

Abstract— Now a days, software sector plays an important role in development process as it is ruling the world. Generally, for any proper input, proper and quality output is expected which adds value to the product or process that satisfies the clients and customers. So, to get a quality-based output proper methodologies and tools should be utilized. In software development approach, Agile is one of the most demanding models which can handle requirement changes in the future stages, flexible, time and cost effective and has a good scope. Agile is not only cost and time effective but also results in quality output by maintaining constant pace throughout the process by reviewing the tasks at regular intervals of time. This adds customer satisfaction which enhances the customer satisfaction levels that increases the reputation of the companies. In this paper, two main methods of agile, scrum and Kanban, have been reviewed critically, discussed principles and roles of scrum and explained the Kanban process.

Keywords: Agile, Scrum, Kanban

I. INTRODUCTION

In the present scenario, ups and downs in software industries are most common due to many reasons. In order to avoid the process deviations or downs in the organizations, some changes should be followed. As advancement in the technology is rapidly increasing day by day, some new advanced technologies that suit the process or project can be considered to avoid deviations. In the similar pace, agile model is one of the modern software development approaches which can be implemented to lead a smooth and comfortable process and which results in the improvement of the processes it is customized and adopts frequent changes.

Start to end of any task or process can be done through the phases of software development life cycle (SDLC). The development approach can be implemented from design to deployment of a product or a process with the help of different phases. The various phases involved in SDLC are requirement analysis, design specifications, implementation, testing, deployment and maintenance. The different methods used to implement SDLC are Waterfall model, V-model, Agile model, Big Bang model, Spiral model, Rapid application development model etc. In those different models, the model which is modernly used due to its flexibility, welcome change ability, transparency is Agile.

Agile is the demanding methodology due to its flexibility, adopts changes in the features or requirements in future process and can handle cost, time and scope with respect to the needs of the customer. Implementing Agile can be done using Scrum, Kanban, extreme programming (XP), feature driven development, Dynamic Systems Development Method (DSDM), Crystal family and Lean development. Among all Agile methodologies, Scrum and Kanban are most

commonly used methods because of their flexibility, customized and transparency.

II. LITERATURE

- 1) Sylvia Ilieva et al. [1] discussed about the agile approach in software development process for e-business applications. A case study was conducted on eXPERT approach implementation at Rila solutions and developed eXPERT metrics by collecting data during the experiment at company. They stated that metrics developed can be used in integration in XP-EF framework. The main intention of authors in implementing this eXPERT approach is to deliver quality software with less amounts of defects in very less time. Finally, they concluded that it can be implemented in small teams in organizations for delivering quality software.
- 2) Apoorva Srivastava et al. [2] stated agile is one of the customized product development approaches in which scrum is an easy method to implement agile model. The workflow of scrum, advantages over other methods and compared scrum with other methodologies like waterfall are discussed. The pictorial representation of organizations was shown indicating that use of other methodologies is getting reduced. The future enhancement of scrum has been explained along with proposed scrum model. At the end, authors mentioned that this methodology can be used in different fields like research, finance etc., apart from software industries as it is customized.
- 3) Sikender Mohsienuddin Mohammad [3] explained why organizations are moving to DevOps even many development processes are available. Author explained agile methodology process, DevOps continuous delivery life cycle and compared DevOps and Agile. He discussed the culture of both Agile and DevOps processes and discussed challenges of Agile. It was concluded that Agile and DevOps makes work easier in the same space.
- 4) Faizal Hayat et al. [4] conducted a survey on various software companies and believed most of the organizations use Agile (Scrum) process which has a positive impact on the development process. Scrum model along with different phases and methodologies has been explained. Based on the conducted survey, a pictorial diagram has been represented showing the influence of scrum process in project fields and analyzed estimated time and cost of the project. It was concluded that scrum has good impact on software project management, takes less time, cost and has good scope. The conducted survey shows this scrum not only reduces risk but also saves cost and enhances quality.

- 5) Krunal Bhavsar et al. [5] analyzed how long scrumban which is an integration of scrum and Kanban can resolve the challenges of scrum. The authors explained the workflow of scrum, Kanban and scrumban. Finally concluded the limitations of scrumban and discussed future enhancements of scrumban.
- 6) H. Frank Cervone [6] discussed scrum as an effective method in managing and completing projects in agile project management. The main objective of the paper is to fill the gap in digital library project management by providing a description of agile project management methods. Finally, the author concluded that by managing the process, productivity can be enhanced.
- 7) Adrialdo et al. [7] conducted a case study in a pharmaceutical company by applying Scrum framework. The principles, applications, phases and impact of agile project management has been discussed and compared agile and traditional model. Generic medicine manufacturing process was explained and concluded that time and cost by implementing agile is less compared to traditional model.
- 8) Wael Zayat et al. [8] compared scrum and Kanban methodologies of agile. The authors discussed Waterfall

model, Scrum and Kanban agile methodologies, explained scrum and Kanban framework, lifecycle of scrum and Kanban. The similarities and differences between scrum and Kanban were also discussed. At the end, authors mentioned that results observed are flexible in which scrum focus on cooperation of customer and development team and Kanban can operate in continuous flow environments which leads to system improvement.

III. WATERFALL VS AGILE

A. Waterfall Model Design

In the year 1970, Winston Royce introduced waterfall model which is a sequential software development process. When the customer requirements are constant and not changed frequently it is a suitable model to implement. It is a simple model in which starting and ending points in each phase are fixed. This model consists of various phases which include requirement analysis and specification, design, implementation, integration and system testing and deployment and maintenance as shown in figure 1.



Fig. 1: Waterfall model

B. Agile Methodology

Agile is one of the most demanding and transparent methodologies used in software development process. It is mostly used because it can handle requirement changes and it involves continuous iterations in the form of sprints. The phases involved in software development process or software development life cycle are requirement analysis, design specifications, implementation, testing, deployment and maintenance.

In agile model, all epics or requirements or user stories are divided in the form of sprints. Sprint is the time duration to execute the requirements available in that particular duration. Every sprint includes different activities like plan, design, build, test and review. Sprint duration is normally 1 to 4 weeks, based on the complexity of the project sprint duration may vary. Everyday 10 to 15 minutes call is conducted to track the status of the work and to know any further information. A project may contain any number of sprints based on the epics given by the clients or customer. Every sprint consists of different phases like plan, Design, Build, Test and Review as shown in figure 2 and agile model may contain various sprint based upon the project scale, different sprints in agile model are shown in figure 3.

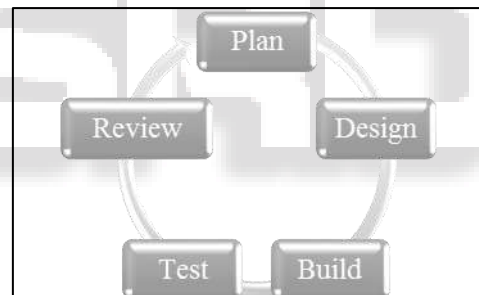


Fig. 2: Sprint cycle

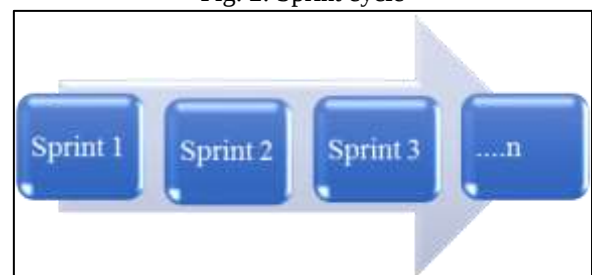


Fig. 3: Different sprints in agile model

C. History of Agile

With requests to add new features, technology is rapidly enhancing day by day. Even our daily used applications are getting new features very quickly. Software industries should be in a way to adopt the changes quickly and response in a short span of time. So, to adopt those changes in an easy manner Agile methodology has come into the picture.

Agile is developed not for a specific approach but it is flexible to adopt any requirement changes and uses best practices and tools which adds value and quality for the

process and said be a effective process with minimum defects. Agile can be implemented by using Scrum, Kanban, Lean, Crystal, extreme programming (XP) etc.

D. Agile Manifesto

In 2001, Agile manifesto has come from a meeting of 17 people who has attended to discuss the development approaches and process that was developed and used. A group was formed for Agile named as Agile Alliance group. The main aim of that group is to promote the development of Agile apart from sequential approach like Waterfall model.

After conducting a debate, group of practitioners came to an agreement and created "Manifesto for Agile software development". In the year 2003, according to Williams and Cockburn and practitioners Agile is a process of developing software that gives value to the individuals and interactions apart from processes and tools used in the development approach.

E. Agile applications

The agile model can be applied for the following situations:

- 1) When rapid changes need to be implemented in the process, agile methodology can be used.
 - 2) It can be used when developer and clients are in the same line to interact.
 - 3) When there is a flexibility in the process and work should be managed according to the tasks to perform.
 - 4) It can be implemented when transparency in the work is required.
 - 5) Twelve principles of Agile
- The principles of agile are:
- 1) Welcome change: In most of the software development life cycles, requirement changes are not allowed in the middle of the development. But in agile, it accepts the changes in requirements even at any stage.
 - 2) Customer satisfaction: Agile model provides high priority to satisfy customer by continuous improvement and quality delivery.
 - 3) Deliver the working software: By considering the shortest time duration, agile delivers the working software.
 - 4) Collaboration: Every individual should cooperate and work together to add value to customers and collaborate entire life of the project.
 - 5) Motivation: Environment should be in a way to support every team member and project should be build around motivated team members to achieve a fruitful result.
 - 6) Face to Face conversation: There should be transparency in communication between scrum master and development team, customer for conveying the proper information or data to the development team.

- 7) Measure the progress as per working software: Working software is the main and important measure of progress.
- 8) Maintain constant pace: Users, all the members of the project and businesses should maintain a constant and stable pace.
- 9) Monitoring: Every individual should pay attention to get a good design.
- 10) Simplicity: It's better to use simple terminology and methods of the work that should be done.
- 11) Self-organized teams: Teams should be self-organized without depending much on other members or teams for collecting data regarding the requirements, design etc.
- 12) Review the work regularly: Reviewing should be carried out at regular intervals of time to achieve productivity.

IV. AGILE METHODS AND PRACTICES (DIFFERENT METHODS OF AGILE)

The various agile implementation methods are shown in table 1. In those different methods, Scrum and Kanban are most popular processes used.

Agile methodology	Founder(s)	Emphasis
Extreme Programming (XP)	Kent Beck	Efficiency, customer focus and feedback, and quality
Scrum	Jeff Sutherland, and Ken Schwaber	Teaming, organizing work
Feature-Driven Development	Jeff De Luca	Iterative development of user focused features
Dynamic System Development Method (DSDM)	DSDM Consortium	Structured approach to rapid development, collection of best practices
Lean Software Development	Mary and Tom Poppendieck	Eliminate work that doesnot create customer value
Kanban Method	David J. Anderson	Visualize and manage workflow, just-in-time development
Crystal Family	Alistair Cockburn	People, Communication, process rigor maps to product organizational dynamics

Table 1: Different implementation methods of Agile

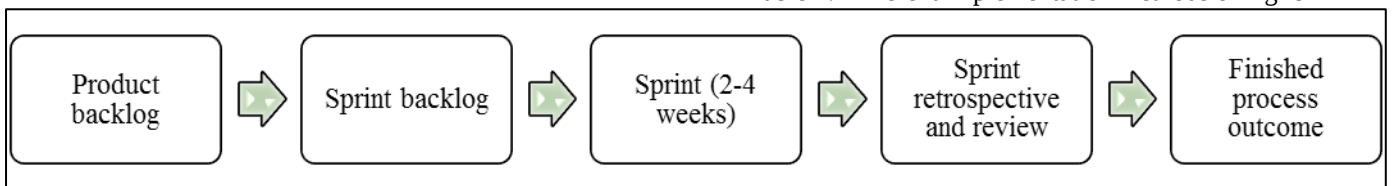


Fig. 4: Workflow of Scrum process

V. IMPLEMENTATION OF AGILE MODEL

A. Scrum

Scrum is one of the agile implementation model used in software development process. It is flexible, fast, adaptable framework to deliver value or quality to the customer throughout the entire process. The main intention of scrum is to satisfy and fulfill the customers through transparent communication. Scrum is executed in periodic and short blocks called sprints.

1) Flow in Scrum project

The workflow of scrum consists of product backlog, sprint backlog, sprint in which daily scrum call is carried out, sprint retrospective and review and final outcome of the process as represented in figure 4.

2) Roles in Scrum

- Scrum master: Scrum master is the lead of the complete team to guide them with proper guidelines.
- Product Owner (PO): The person who is the representative of customers is the product owner. They translate the vision of the project or process to team to execute their ideas and transfer them into reality.
- Team: Group of members with technical knowledge executes the tasks based on the user stories committed at the start of each sprint and responsible for delivering the quality outcome.

3) Rules in Scrum [12]

- 1) Sprint duration should be two to four weeks (may slightly vary based on the size of the project).
- 2) Every sprint should be of same time duration.
- 3) Proper planning should be done in every sprint.
- 4) Daily scrum call is carried out every day for 10 to 15 minutes.
- 5) There should be any break points in between the sprints.
- 6) To inspect the process, sprint review and retrospective takes place.
- 7) There should be any breaks between sprint retrospective and review meetings.
- 8) The main objective of each and every sprint is “Potentially shippable/ deliverable” software or product.

B. Kanban

Kanban is a transparent model after scrum. It is a transparent communication model among team members which consists of a Kanban board. Kanban board consists of tasks to do, tasks done and tasks doing. It is used to know the status of every task at any point of time. In this way, it helps to visualize the status of work.

Kanban contains product backlog but not the sprint backlog. In this model, sprints are not available in Kanban which is the only difference between scrum and Kanban.

One of the most important quality of Kanban is “Limit” option. If there are ten tasks in product backlog, five tasks are set to do then limit is five. After tasks done, then few more tasks will come to do state from product backlog state.

1) Four Key principles of Kanban

a) Start with what you do now

This principle helps to identify the issues that should be noticed and helps to plan accordingly so that the process implementation goes well. As the work is started according to the knowledge known there may not be any disturbances during the process implementation of workflow.

b) Agree to Pursue Incremental, Evolutionary change
Kanban is capable to balance evolutionary changes as per the ongoing process. The existing process can be improved by making small changes to avoid fluctuations in the process and its respective output.

c) Respect the current process, Roles and Responsibilities

Kanban process appreciates that current process has its own importance and has value. Mainly Kanban is used to promote and encourage incremental changes.

d) Encourage Acts of Leadership at all levels

This is the latest and modern principle of Kanban process. It tells how leadership evolves from day to day tasks from team members. Everyone is responsible for continuous improvement which leads to good performance on the organization level.

2) Core practices of Kanban

a) Visualize the workflow

Kanban is implemented on Kanban board. The complete work process can be visualized by viewing the Kanban board which develops transparency in the work among all the team members. It helps the members to know the work completed, work in progress and work that has to be completed.

b) Limit work in progress (WIP)

All the requirements are divided into the particular columns as Work done, Work in progress and Work to do. It helps us to finish the requirements of work in progress and then it moves to work done column. It clearly says the work that is going on is limited.

c) Manage flow

Kanban manages the flow of work and tasks carried out and it tells the members of the team to plan according to the work and should be implemented accordingly.

d) Leadership at every level

Every individual is responsible to finish the task which leads to enhance the overall performance of the process. Leadership should be carried out at every stage and implement the tasks assigned.

e) Improve collaboratively, Evolve Experimentally

The quality work is delivered only when there is an effective cooperation. Individual interactions play an important role in any team. If collaboration is good then it shows the effective work change. Evolving experimentally speaks how the changes are implemented practically. As Kanban method is problem solving method, it used PDCA cycle which is known as Deming cycle (Plan-Do-Check-Act cycle). The changes should be implemented according to the procedures to be carried out to get a quality outcome.

VI. SCRUM AND KANBAN RELATION

Some of the major differences between Scrum and Kanban processes are listed in table 2.

SCRUM	KANBAN
Proper planning is carried out in the entire process.	No proper planning is done as tasks are not estimated.
Sprint concept and planning is done.	Sprints are not involved in Kanban.
Every sprint contains particular time duration.	As no sprint is involved in Kanban, it does not have any time duration.
In Scrum, scrum master takes the responsibility of the entire team.	Scrum master is not present in Kanban.
The constant changes are accepted in scrum.	If any major changes are to be done, Kanban fails.
As fixed number of tasks are involved in each sprint, the cost of the project is minimal.	As tasks are not estimated, the cost is not accurate.
After every sprint, small release takes place.	Kanban provides continuous delivery.

Table 2: Differences between Scrum and Kanban

A. Scrum board Vs Kanban board

Scrum and Kanban processes are used for implementing agile. In scrum, the complete process is carried out in the form of sprints where as in Kanban, the progress of the project is displayed in board known as Kanban board. In Kanban board, the cards are displayed on the board. The only difference between scrum and Kanban board is the time limit which is followed in scrum but not in Kanban.

1) Scrum board

Scrum board consists of different sprints as shown in figure 5.

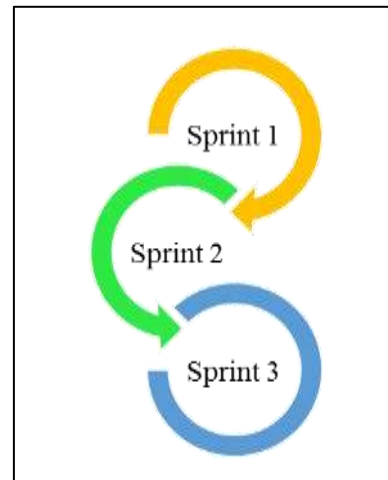


Fig. 5: Sample Scrum board

2) Kanban board

The sample Kanban board is shown in figure 6.

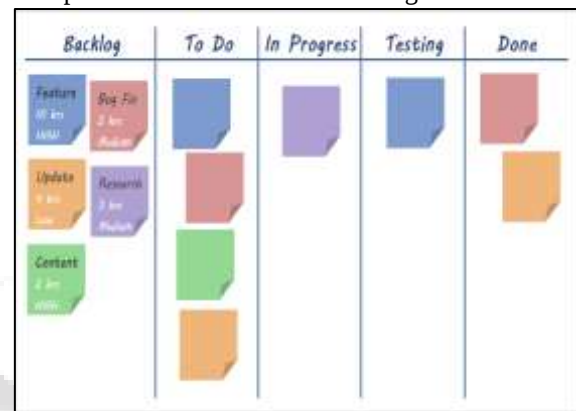


Figure 6: Sample Kanban board [13]

VII. PRACTICAL EXAMPLES OF SCRUM AND KANBAN

Figure no. 7 shows the test scenarios and test cases of the respective scenarios created based on the customer requirements. The lines that are pointing from e-commerce website are the test scenarios and the lines from test scenarios are the test cases of the respective scenarios of the web application. Let us assume that based on the web application designed, the above scenarios are developed to test the functionality of the application.



Fig. 7: Test scenarios and test cases of an e-commerce website

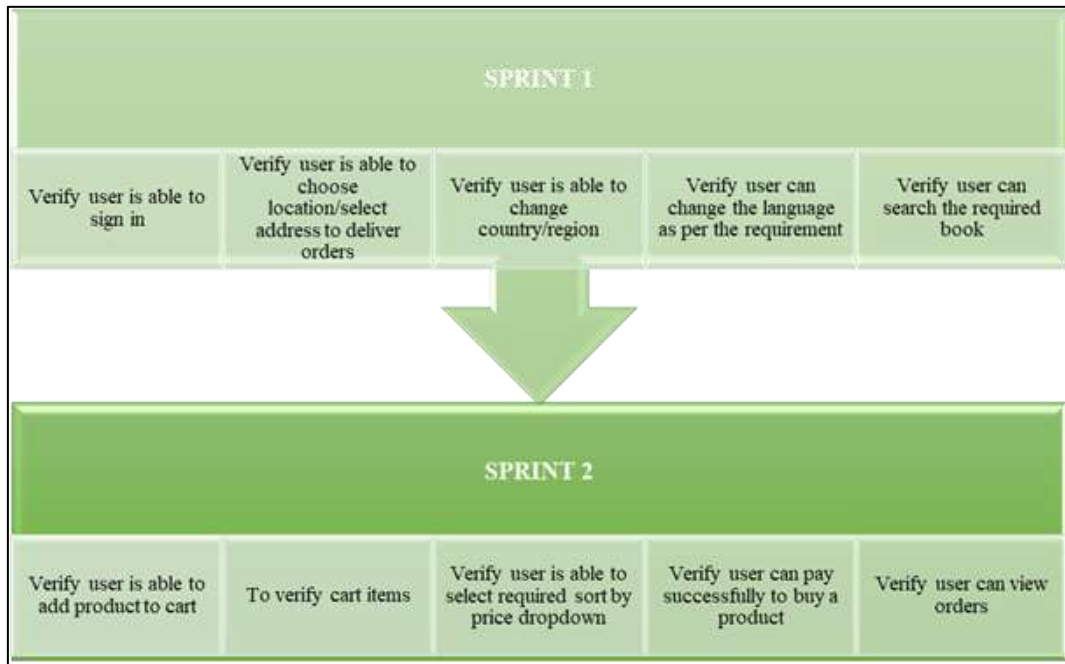


Fig. 8: Sprints consisting of different scenarios

A. Practical example of Scrum process

Scrum process works in the form of sprints and scenarios developed are divided into sprints as shown in figure 8. Generally, a sprint duration is 2 to 4 weeks, in that particular sprint part of the process should be done and released. From ten scenarios developed for an e-commerce web application, let us assume that there are two sprints each of five scenarios. In sprint1, five scenarios are considered to test the behavior

of the application and in sprint2, the remaining scenarios along with sprint1 scenarios are tested. At the output of sprint2, the entire scenarios based on the needs of the customer are tested and deployed into production for the usage. In the similar way, any number of requirements can be considered according to the customer and divided them in the form of sprints in scrum and process is carried out in the same manner.

B. Practical example of Kanban process

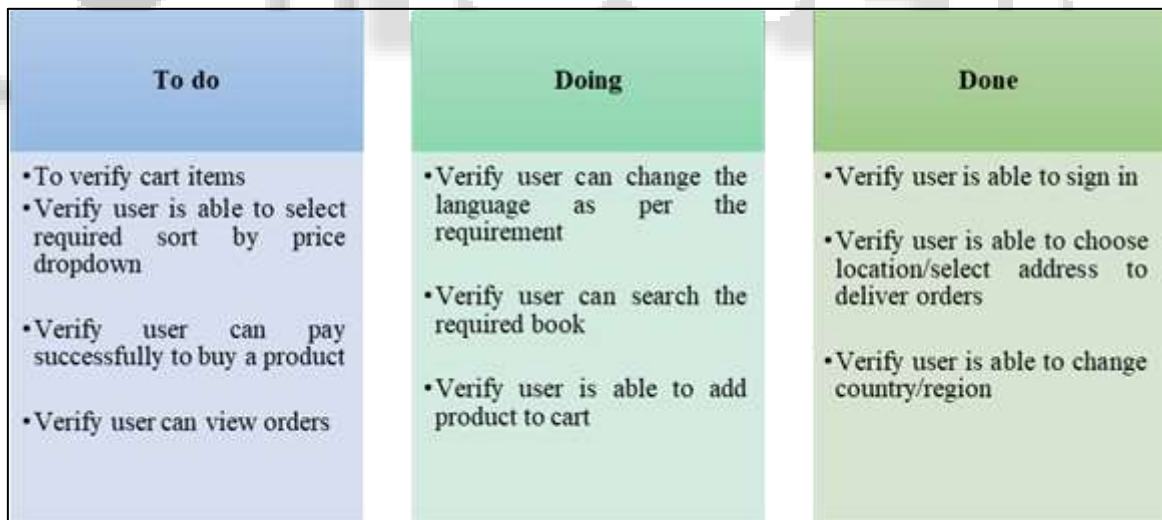


Fig. 9: Scenarios divided into tasks “To do”, “Doing” and “Done” states in Kanban process

Three scenarios have moved to done state, three scenarios are in doing state and four scenarios are in to do state and there no pending tasks so it means there are no scenarios in backlog state and assuming that all scenarios are designed based on the customer needs as represented in figure 9. In Kanban, the scenarios from “Backlog” state moves to “To do”, “To do” to “Doing”, “Doing” to “Done” states and after all the scenarios gets verified then it comes to done state then the entire process gets released into the market.

VIII. CONCLUSION

For every objective there should be a proper plan and while implementing the plan any changes or modifications can be done if any deviations take place to get a proper output. In the similar way, agile can handle the requirement changes even in the ongoing process, this is the reason behind why agile is most demanding methodology in any software industry. Among agile implementation techniques, scrum and Kanban

are popular due to their flexibility and transparency in communication. The only difference between the scrum and Kanban is the time limit which is followed in scrum but not in Kanban. By implementing those scrum and Kanban models using proper selection of tools, time and cost taken for completion of process is less compared to other. In this paper, some sample test scenarios along with test cases are developed for an e-commerce web application and explained scrum and Kanban process with the help of those sample scenarios.

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