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With this publication, the CD with all papers from the International Conference on Information Technology and Development of Education, ITRO 2016 is also published.

INTRODUCTION

This Proceedings of papers consists from full papers from the International conference "Information technology and development of education" - ITRO 2016, that was held at the Technical Faculty "Mihajlo Pupin" in Zrenjanin on June 10th 2016.

The International conference on Information technology and development of education has had a goal to contribute to the development of education in Serbia and the Region, as well as, to gather experts from natural and technical sciences' teaching fields.

The expected scientific-skilled analysis of the accomplishment in the field of the contemporary information and communication technologies, as well as analysis of state, needs and tendencies in education all around the world and in our country has been realized.

The authors and the participants of the Conference have dealt with the following thematic areas:

- Theoretical and methodological questions of contemporary pedagogy
- Personalization and learning styles
- Social networks and their influence on education
- Children security and safety on the Internet
- Curriculum of contemporary teaching
- Methodical questions of natural and technical sciences subject teaching
- Lifelong learning and teachers' professional training
- E-learning
- Education management
- Development and influence of IT on teaching
- Information communication infrastructure in teaching process

All submitted papers have been reviewed by at least two independent members of the Science Committee.

There were total of 163 authors that took part at the Conference from 15 countries, 4 continents: 96 from the Republic of Serbia and 67 from foreign countries such as: Macedonia, Bulgaria, Slovakia, Russia, Montenegro, Albania, Hungary, Italy, India, Rumania, Bosnia and Herzegovina, USA, Egypt and Nigeria. They were presented 82 scientific papers; 42 from Serbia and 40 from the above mentioned countries.

The papers presented at the Conference and published in Proceedings can be useful for teachers while learning and teaching in the fields of informatics, technics and other teaching subjects and activities. Contribution to the science and teaching development in this Region and wider has been achieved in this way.

The Organizing Committee of the Conference

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Introduction of Kanban Methodology and Its Usage in Software development

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Abstract – The purpose of this paper is to introduce Kanban methodology and present it as a tool for project management in software development. Kanban was originally invented as a tool of Lean Manufacturing, but its usage has proven to be useful in many other areas like software engineering. The usage of Kanban in software development is increasingly growing, as the traditional methods are replaced with new much more flexible methods. The implementation of Kanban in software development brings many advantages and benefits. Flexibility, increased productivity and efficiency are only a few benefits of its implementation. Kanban is a Japanese term meaning signboard or graphic and a way for teams and organizations to visualize their work, identify and eliminate bottlenecks and achieve operational improvements in terms of throughput and quality.

I. INTRODUCTION

If we want to understand Kanban and use it as a tool in software engineering we first need to understand its origin. Kanban gains its roots in the production system of Toyota. The main goal of Toyota was to overcome its competitors by producing cars for the same or lower price from the competition, but with better quality. Toyota production system (TPS) is also known as Just-in-time (JIT) manufacturing and the basic principle is to produce “only what is needed, when it is needed and in the amount needed”.

The Kanban system is also known as “Supermarket method” because the main idea is borrowed from the work of the supermarkets. The idea of using this method originally came from Kiichiro Toyoda the founder of Toyota Motor Company, but Taiichi Ohno, a former vice president of Toyota, was the responsible for developing the strategy and implementing it in the production. The supermarket stock has the items needed by its customers, in the quantity needed and they are available for sale at any time. By using Kanban they minimized the work in progress between processes and reduced the costs associated with holding an inventory.

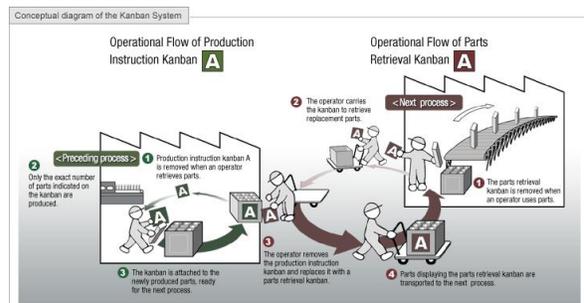


Figure 1. Conceptual diagram of the Kanban System

Fig. 1 shows two kind of Kanban system used for managing parts, the production instruction kanban and the parts retrieval kanban (Toyota Global, May 2016).

The term Kanban is also associated with the term Lean management. Lean management is an approach of running an organization that implements the concept of continuous improvements, a long term approach of work that systematically seeks to achieve small, incremental changes in processes in order to improve efficiency and quality. Lean management tries to eliminate any waste of time, work or money by identifying steps in a business process, revising them and cutting them if they do not create value. The term lean management in software engineering was first mentioned in the book “Lean Software

Development” by M. Poppendieck and T. Poppendieck, 2003. In this book they defined the main lean principles:

- Eliminate waste
- Amplify learning
- Decide as late as possible
- Deliver as fast as possible
- Empower the team
- Build integrity in
- See the whole

These same principles are emerged as agile software development.

This paper is going to explain the Kanban methodology, compare it with traditional methods, and show the implementation of Kanban in software development and its benefits.

II. COMPARISON OF TRADITIONAL DEVELOPMENT METHODS AND AGILE METHODS

Software systems are developed so they can perform complex tasks on the demand of a user. This process of building a software needs attention to details in order to meet the customer's needs. The traditional method is characterized as a series of steps like requirement, definition, implementation, testing, deployment et al. First, the customer's demands are carefully documented, the software visualization is made and then the actual coding has begun. After these steps there are various types of testing before the software meets final deployment. The main idea of traditional development methods is to have detailed visualization of the project before the building even starts.

While the traditional methods require the user to have detailed requirements of the software, agile methods are more flexible. The agile methods are based on adaptive software development methods, while traditional methods (e.g. waterfall model) are based on a predictive approach. The agile methods are incremental and iterative, and the actual users are always there to suggest improvements and review every phase of the project. The increased customer involvement in the development of the software makes changes to be easily made and keeps the customer satisfied. The adaptive approach of the agile methods has no detailed planning, but only future tasks defined by the characteristics that must be developed. The product that is developed is frequently tested and that minimizes the risk of major faults in the future tasks.

Some of the most used agile methodologies are: Extreme Programming (XP), Scrum, Kanban, Feature Driven Development (FDD), Dynamic System Development Methods (DSDM), Adaptive Software Development (ASD) etc.

In February 2001, seventeen representatives from different agile methods formed the Agile Alliance. The purpose of this alliance was to promote their views, so they grouped them together into a workable framework named Agile Manifesto. The result from this work was:

- Self-organization and motivation

- Working software is more useful than overall excessive documentation
- Continuous customer involvement
- Quick responses to change

III. KANBAN IN SOFTWARE DEVELOPMENT

In the Japanese Dictionary "kan" means "signal", while "ban" means "card" or "board". Kanban card is a signal that needs to initiate action and suggests manufacturing of parts in "pull" production system invented and developed as part of the production system of Toyota. Accordingly Kanban refers to "signal cards" which signals the need for a particular product. Taiichi Ohno had the idea for Kanban when he visited an American supermarket, where the shelves are amended when the amount is reduced to some extent (pull mechanism).

In the manufacturing industry, Kanban has spread worldwide as a tool of line production (Lean Manufacturing), and in agile development of software products is a way of visualizing the project presented on cards with problems on the board, which achieve "just in time" (just in time - JIT) strategy to develop a software product.

Kanban focuses more on work to be carried out on time instead of focusing on who did what. People work together, but they don't work at the same speed, do not have the same knowledge and skills and must be synchronized. In Kanban, the work is organized in tasks or processes and allows team members to self-detect the workflow in the most efficient way. Kanban rules are such that we don't need to consider the requests of the software product we don't need immediately. We no longer need to write specifications, but only what can be developed. We no longer need to develop more than can be tested, tested more than can be deployed.

Kanban system in software engineering looks like work waiting in line and it passes through the phases until it is completed. When the work phase is completed, then it goes into another phase.

Kanban method in software engineering was defined and enhanced by David Anderson. In his book, "Kanban: Successful Evolutionary Change for Your Technology Business", David Anderson identified five core properties in successful implementations of the Kanban method:

- Visualize the workflow
- Limit WIP (Work in progress)
- Manage flow
- Make Process Policies Explicit

- Improve Collaboratively

The most common way to visualize our workflow is to use a board on the wall with sticky notes and columns. Each column on the board represents a step in our workflow, and each sticky note a task. To show the work in progress of a project, D. Anderson uses a virtual Kanban board.

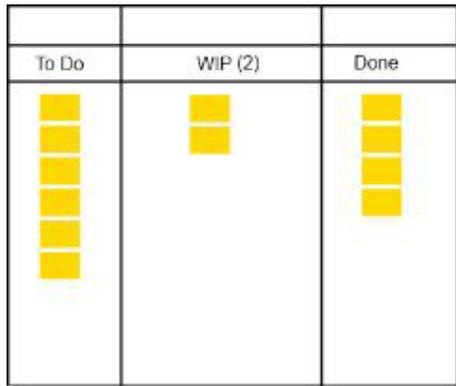


Figure 2. Simple Virtual Kanban Board

By creating a visual model of the workflow we can observe the flow of the work through the Kanban system. By limiting the unfinished work in progress we can reduce the time the task needs to move through the Kanban system. This can avoid problems like task switching and reduce prioritizing task.

By using work in progress limits, we can optimize the Kanban system to improve the smooth flow of work, collect metrics to analyze the flow, and even get indicators of future problems by analyzing the flow of work.

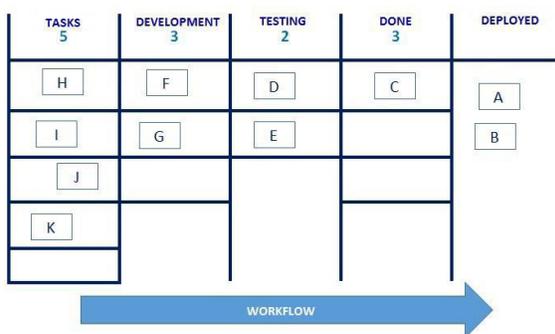


Figure 3. Kanban workflow board with limitations

IV. CONCLUSION

Each software development method has its own advantages and disadvantages. Each project has its needs and each different method can come with a different results. The traditional methods are often replaced with agile development methods mainly because of their flexibility and response time, but

agile methods can't guarantee success if the implemented method doesn't meet the needs of the environment.

Kanban is one of the agile methods that we can implement it successfully with the right effort and knowledge of our environment. During a development of a software product there are so many changes and sometimes it's hard for the development team to define the process. Some predefined set of steps may not lead to the desired result, since the software development process is a human activity that leads to problems with changing the customer requirements, changes in technology and developers etc. In other words, the variability of the process is very high. The one thing that is important to all methodologies is the importance of the people and their role in the process.

The focus of the Kanban method isn't to be agile methodology for software development which can lead to success, but Kanban focuses on the success of the software product and that process may result in that Kanban is an agile method. Kanban is highly flexible but at the same time there are clearly defined rules regulating the process.

The delivery of the software product with less possible errors and on time is the main goal of each methodology and therefore defines bandwidth that enables the prediction of future opportunities based on knowledge and experience. The bandwidth is the rate of delivery of the order to the customer in which Kanban determines two main variables: time cycle and limit the operation of the process. By the time cycle, limiting the work in process is also a variable that determines the bandwidth of the system. Through proper and smart defined limits in the columns, we avoid poor productivity that occurs because of too small restrictions.

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