International Journal of Current Science Research and Review

ISSN: 2581-8341

Volume 02 Issue 09 November 2019

IJCSRR @ 2019

Applying Scrum Methodology into the Production Processes of a Logistic Equipment Producer

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Abstract

The manufacturing is a competitive domain with a lot of challenges. Products need to be fabricated quickly, cost efficient and always responding to the changing demands of the market. Lifecycle of the products is decreasing, and the customization level of products is a basic need in order to survive on the market. Generally, lean manufacturing is a modern manufacturing principle that changed the traditional habits of production so that competitive advantage is held. But what comes after lean? Scrum is a generally software delivery methodology, but it's principles can be applied also into manufacturing in order to have a quick and agile response to the production challenges. The current paper is debating on the advantages of using scrum framework into the production processes of a logistic equipment manufacturing company.

Key Words: scrum framework, manufacturing optimization, agile methodology, scrum art effects, product owner.

INTRODUCTION

Manufacturing is a very complex and dynamic domain in which the main challenge is the costs reduction, increase of quality and have the flexibility to produce customized products in the same costs as series mass production. Most of the manufacturing companies produce series fabrication and can optimize processes based on historical data, identifying bottle necks and non-conformities. Modern production methodologies like lean manufacturing and just in time, have proven its advantages if they are well implemented and strictly respected. The purpose of the modern manufacturing methods is to eliminate waste and bottlenecks and work with low amount and value of stocks.

Scrum methodology is generally a software delivery model, part of the Agile Methodology mindset. Appeared the first time an article written by Hirotaka Takeuchi and Ikujiro Nonaka [1] as being a "new product development game" with the main purpose to reduce time to market and increase flexibility of the delivery process. According to the authors, their inspiration came also from the manufacturing industry, but also from photocopier and printer industry.

The regular manufacturing industry addresses projects waterfall. The scope is being planned, recourses assigned and during the fabrication processes, the end product is being built. During the process, the original plan is always maintained. The scrum framework addresses projects where the end product suffer a lot of changes compared to the planned one. But, as goods as the global trend is to have customized products, there are situations in which, after launching the product into production, it suffers changes because of the market needs, or the customer changes its preferences. Of course, such changes can be addressed and regulated in the contract, but companies that will be able to respond quickly and agile to these changes will have a competitive advantage and business increase.

The current research explains and compares the traditional manufacturing organization framework compared with a scrum framework with its advantages. The company in which the study was performed is world leading logistic equipment and material handling machines producer with customers and business all around the world. The goods that the equipment moves are the fast movement consumer goods. The production site consists of 300 workers organized like in the figure 1, below. Each department has around 20-50 manpower.

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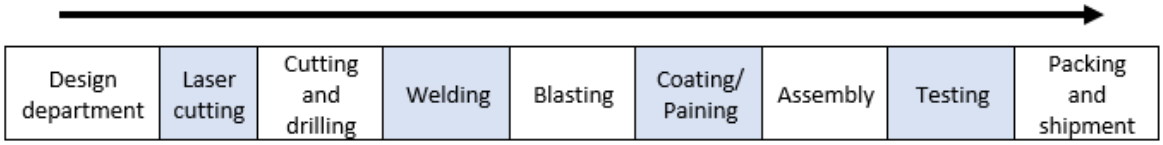

Figure 1 – Production flow of the manufacturing company

The current organization mode is waterfall, with just in time aspects. Products are generated using the 9 departments. After launching into production, from the design department, the product can't suffer any other changes. If the product suffers changes, all the new requirements need to be processed in the first department – design department and the product need to be relaunched into production. From this perspective, the flexibility to change is very low and the response to changes is late. Also the waste generation is at high level.

RESEARCH HYPOTHESIS AND METHODOLOGY

We will try to launch some hypothesis with the aim to observe the advantages while using the traditional production process vs. the scrum methodology. Big manufacturing processes generally exceed budget and time and deliver products that are not according to the market needs.

Scrum framework, as part of the Agile methodologies have some specific characteristics[2]:

- Iterative work cycles;
- Self-organizing team members;
- Ceremonies: daily stand-up, planning, review, retrospective, grooming;
- Artefacts: backlog, tasks, epics, definition of ready and definition of done;
- Roles: scrum master, product owner, team members.

1. One research hypothesis is that the scrum framework can bring competitive advantage into the researched company through decreasing delivery time and increasing the flexibility of the manufacturing process and product.
2. The total costs of the process is higher using the traditional production method compared with the scrum methodology.
3. The quality of the product is higher using scrum organizational rules because of the quick response of changes and irregularities that appear during the manufacturing process.

ITERATIVE WORK CYCLES

The iterative work cycles into the software delivery helps to prove the intermediate result and to adjust if there are new requirements or if the scope has changed. In the production, this way of working can be also applied, and in the current research, the following actions were taken.

There were organized weekly sprints, in which an increment of the products had to be produced. Since the products of the factory are project-based products, each project is unique. This is also an extra aspect that led to a good adoption of the scrum framework in the production. Generally, the production cycle of a project is around 3 months, that means 12 weeks/sprints.

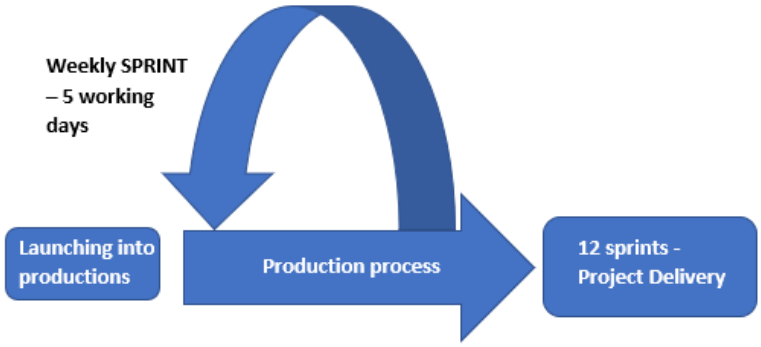

Figure 2 – Applying sprints – 5 working days [3]

International Journal of Current Science Research and Review

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After each sprint, each scrum member presents the realized work. Since the production flow is successive, there is the situation in which some departments didn't have any result about a specific project (since their task was later planned), but were involved in other projects – in another backlog, in the meaning of scrum.

The scrum work cycle allows the product owner to come up with changes regarding the product after each end of the sprint. Of course, in the manufacturing industry, such changes do not have a big impact over the end of the product, but changes like colors, small additional features or minor mechanical changes.

SCRUM ROLES AND TEAM MEMBERS

The change that was implemented according to the scrum framework, was the assignation of a product owner, that is the project manager of each product. The assigned product owner follows the product though the production process and makes sure that it is delivered on time and in the desired quality.

Regarding the scrum master, the production manager was assigned to be the scrum master since he must deblock and prioritize resources in order to finish the product on time.

All the other team members were explained that they are owners on their tasks during the production flow and must care that each sprint the objective of the sprint (increment) is achieved. The results of the new roles defined is a positive one, since the product owner was always in contact with all the production and logistics departments and could easily prioritize and clarify specification if there were some blocking points. Also, his presence in all the ceremonies was a good opportunity to inform al the scrum team members regarding the changes and specifications of the product because of internal or external factors.

CEREMONIES INTO THE PRODUCTION

The scrum framework consists also in a set of ceremonies that tracks the changes in the process and with the purpose of creating alignment to the changes that appear in the scope of the project but also to prepare the new sprint, so that questions appear before the actual work, not during the sprint. Cost of changes are much lower during the planning phase compared with the production phase (the 10 rule for the manufacturing industry). There is a strong debate regarding the number of meetings that recommends the framework, because around 10% of the time during a sprint, consists in meetings. Since in the manufacturing process, the changes are not so often, and the delivery time of a complete product is small (12 sprints), we tried to limit the meetings to the real necessary ones, that bring value.

- **Daily status meetings** with all the involved production partners: logistics representative, production manager (scrum master) and representatives of each production department (including quality control) and the new assigned product owner.
    - Thanks to these meetings, a quick daily status is taken so that all the involved people have a short status regarding the launched and produced projects. If one of the departments/process is blocked, quick measurements can be taken and deblock the situation.
    - Before implementing these daily meeting, the company took the information out of the ERP system and had no real time information regarding the status of the production process.
    - The status meeting was held weekly, only with the involved production department.

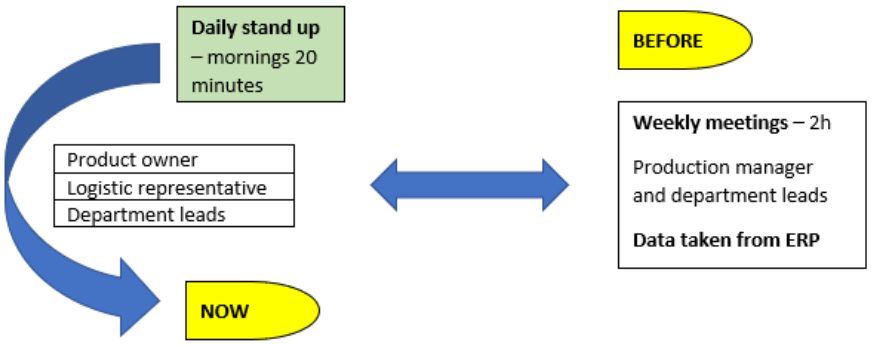

Figure 3 – Implementing daily stand-up meeting compared with the old meeting format

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- **The demo/review meeting** is a ceremony that we cancelled since the result of each sprint is the input of another department, and, if it doesn't happen, the team members and their departments that they represent don't have what to work on. There was a demo held only when the entire product was finished, so after the approximatively 12 sprints of production. This meeting helped all the scrum team members to see the result and the transformations suffered from the initial plan.
- **Retrospective** is a very useful ceremony, full of value for the scrum team and for learning form changes that happened during the sprint. The product owner had the task to note the lessons learned, action points and feedback and to make sure that next time, when a similar project is launched into production, the changes needed to be made in order to reduce waste and costs and to get a higher quality at the delivery. Retrospective meeting indicates also what to "stop doing" and what went wrong and what went good in the previous iteration.
- **Planning/grooming** meeting consists in a weekly alignment meeting for describing the future tasks of the new sprint, clarify the past challenges and all the specifications and characteristics of the scope, according to the priorities and changes indicated by the product owner. If a sprint could not be filled with tasks because of not having the necessary materials, the product owner reprioritizes some other parts, so that the machines don't wait unused until the sprint is ended.

All the new implemented ceremonies helped the involved scrum team members to have a better overview over the scope of each sprint and all the changes that appeared between the launch into production and the finishing of the product. The agility of the production process increased.

SCRUM ARTEFACTS APPLIED TO MANUFACTURING PROCESS

According to the scrum manifesto, while using this framework some new artefacts were defined with the scope of supporting the framework and facilitating the agility of the methodology:

- **Backlog:** There was used a physical backlog on a wall with post-it notes that was checked daily, in the stand-up meeting. Department managers could move the sticky notes form a state to another according to the completion level. This helped them a lot to visualize the progress of the pieces that later create the product.

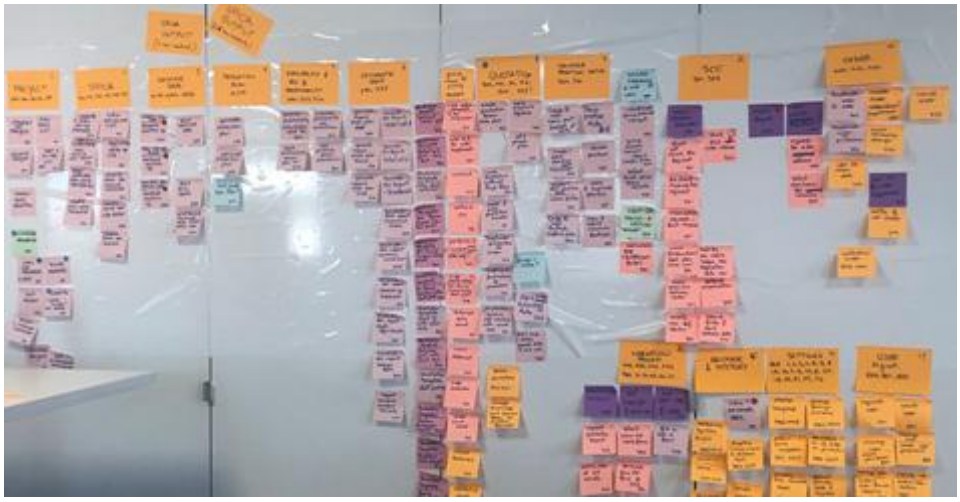

Figure 4. – The wall backlog of a production project

- The backlog was populated with **tasks** that were estimated in hours, according to the planning from ERP. The tasks were limited to the duration of a sprint, this means 5 days. It is important that a task is ended in a sprint so that the recommendation of the scrum process is fulfilled, to have a tangible increment after each iteration. More tasks build an epic, that consists in a larger part of the product. Generally, 2-3 sprints delivered an epic.
- **Definition of ready** was defined as the minimum required information and materials that needed to be present in order to start the task. The product owner had to make sure that the bill of materials and the capacity of the machines can cover the production of the specific task. If one of this condition weren't met, the task did not move in the next sprint, and the

production of the specific part did not start. Generally, the products are not entering the sprint, if the components provided by external suppliers didn't arrive in the factory.

- Also, one of the scrum artefacts is that, during the sprint, the tasks are not changed or abandoned, so that the capacity of each resources is fully used. This is probably well managed in IT projects, but in manufacturing projects, there are also a lot of urgencies for pieces that have nonconformities or are forgotten. Therefore, each sprint, the production manager (scrum master) reserved 15% capacity for urgent changes or products that needed immediate attention but weren't planned in the sprint.

CONCLUSIONS

After explaining the scrum process and rules, all the involved team members had a 2 weeks training for explaining the "rules of the game". After the way of working was clear, the first pilot project was started with a small 5 sprints project with a 5 team scrum team. The first result was a positive one, work was more predictable, communication more efficient a therefore no useless time spent. Ceremonies had the impact of having clear goal and no blocking situations that could delay the deadline. Therefore, we admit that the first research hypothesis is confirmed, we had a decrease of delivery time, while the flexibility of the process increased.

Regarding the costs, the scrum process brought more feedback, communication and decreased delivery time. There couldn't be calculated a real saving in costs, only after a longer period of using the framework. In the researched time period (6 months), the most savings were in not having delayed products and having a better quality of the products. Therefore, the second hypothesis can be partially confirmed. After at least 1-year implementation of the new methodology, there can be made a comparison of the number of products delivered in the past years and the generated costs.

The third hypothesis, regarding the quality of the product can be confirmed because the strong communication between the scrum members helped to have aligned expectation, no compromise in blocking situations and support from all members and product owner when a problem occurred.

As a general conclusion, the scrum framework that is a good option for IT projects, where the results are intangible is a good option for being agile and adapting to the frequent changes of the customer. In the production process, a tailored scrum process can be also applied and generates value, decreased production time and leads to increase of product quality. This happens because this framework facilitates a close and frequent communication between the involved roles of the manufacturing process. This way, projects and task don't get blocked and the response to changes, while they appear, is easy to adopt. The company where the research was made adopted for all the projects the scrum framework that works already since 10 months.

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