Final Exam

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***Abstract*—The report involves the planning, execution, and experiences of developing a software process and applying it in the scenario of city building in the Lego workshops. The process is further evaluated, and software process improvement is applied to further develop the initial process and find issues when it was initiated. The report goes into detail regarding exploring SPI methods/techniques and much more.**

I. Introduction

In the world of software engineering, the aspect of software processes plays an essential part in the development of a product. Software process is the method and/or technique used to develop software products or systems [14]. To improve the process, software process improvement (SPI) can be put into place. SPI is a systematic approach to improve the software process quality to deliver better structural and functional quality [9]. The report aims to dwell deeper in the planning of software process and its effectiveness in the Lego workshops, further having SPI techniques to improve the initial process.

II. Process Defined for the Scrum Workshop

The process used during the first scrum Lego workshop involved elements from each process (scrum, user story practice, and incremental delivery). The process included all major aspects of scrum that included having sprints, scrum roles (Pos, scrum master, and development team), scrum artifacts including product and sprint backlog, and scrum ceremonies including sprint planning, review, retrospective and stand-up meetings.

In terms of user story practice, the adopted process included starting the development process with eliciting requirements and/ or user stories (mainly to create a MVP and most important items to be completed), in the form of user stories. This leads to making them more refined and concrete through developing an acceptance criterion for each to be implemented. While the incremental delivery part of process involved testing and integration of different sections of the city, so that errors are found earlier on in the design of the city. The combination of having broken down stories into acceptance criteria and having sprints where the product can be tracked, delivered, and integrated summarizes the process of the workshop.

To go further in depth regarding the process, the task definitions involved reviewing acceptance criteria every sprint, planning and reviewing sprints and having a retrospective. While the work product definitions included having a product backlog through an ordered list, having requirements and user stories (provided), and increment hence, the sprint result shall be deliverable for the product owners (POs). Furthermore, the role definitions include having POs, scrum master, and fellow scrum team. Finally, as a source of estimation techniques planning poker would be used for order of work and estimated time and effort [4].

As to instantiating the process, the tasks were to be prioritized according to the MVP decided through internal discussions while picking user stories, while being divided into sub-teams of 2 and having a sprint length as 45 minutes. To add on, the scrum meeting should involve a 10–15-minute discussion about the retrospective, checking-in with the POs, updating kanban board (for breaking down user stories into acceptance criteria), and having sprint review.

III. Experiences in the Scrum Workshop

The experience during the first scrum Lego workshop mostly followed the process defined. There were certain aspects of scrum and incremental delivery that were difficult to manage. Firstly, excluding the first sprint, there was minimal sprint retrospective occurrence discussing what went well, and what didn't. This was due to the sub-teams being more orientated towards the product completion rather than the process and possibly its vulnerabilities (that were not discussed). As seen in the corporate world, there tends to be a focus more towards technical problems for low maturity firms [1].

In contrast, the sprint retrospective wasn't too successful due to people retaining from involving themselves in discussions or lack of discussion. This challenge can be due to various reasons such as team size, communication difficulties, coordination, etc. [13]. Furthermore, to consider incremental delivery we saw delays in scrum meetings (as lack of resources (pieces) or not organized resources) due to being closer to finishing, which shows deviation from the process. In terms of, project level process, there was a major lack of integration with other groups as there was no communication and most of the integration was left to occur towards the end of the scrum workshop. The issues solution is known as scrums where various scrum teams take part in scrum

meetings. Though the issue still persists where there is no reporting or delay in communication at large-scale firms [12].

On the other hand, various positives can be taken from the process implemented such as, a backlog of how far certain user stories have been developed (for example, 15 flower planted out of 27 in sprint 1) in each sprint. Additionally, due to lack of access to planning poker we were able to adapt and replicate it. This was done through a thorough discussion during the sprint planning stage of initially prioritizing the 4 selected user stories (such as, town square should be built before a car). Moving on when the sub teams where made the user stories were broken down into acceptance criteria that were also prioritized by the sub team. For example, town centers fountain shall be built first before benches. Hence, replicating the planning poker process.

IV. SOFTWARE PROCESS IMPROVEMENT TECHNIQUES

To improve the scrum workshop outcome for the future SPI methods/models/techniques can be applied. Firstly, the software process improvement through the lean measurement (SPI-LEAM) method. The main goal is to achieve continuous production with maximum flexibility and minimum wasteful resources in the process. SPI-LEAM steps include [15]:

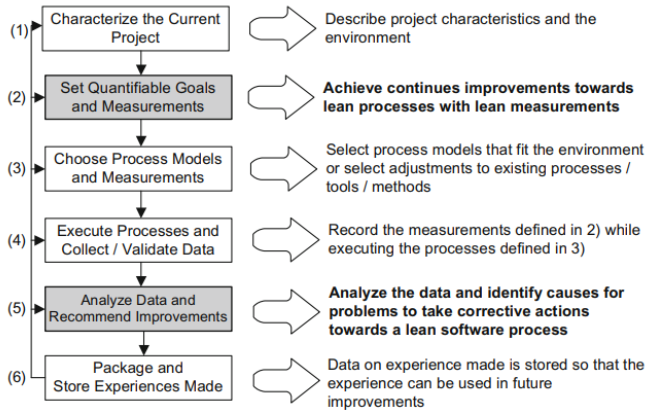

Fig. 1. SPI-LEAM [15]

The method can be adapted to suit the workshop improvement due to its adaptability advantage and the use of lean production which goes hand in hand with aspects of scrum. On the other hand, due to the limited research, practitioners are suggesting that the analysis and predictions for improvement are theoretical due to the methods used and might not work in practice [15].

Secondly, iFLAP is another inductive method that provides a combination of assessment and planning. It is established on three aspects [3]:

- Being lightweight, adaptable for the scale of the organization and the process areas to be assessed
- Cost-effectiveness, using some relevant projects and data sources for evaluation while still being relatively accurate
- Ability to prioritize and map dependencies, giving the firm the chance to choose between issues and place it into improvement packages that are the most suitable

The aspects stated above are achieved through three steps summarized as the diagram below, figure 3. Firstly, step 1: selection, involves selecting the project and roles for the assessment. Secondly, assessment takes place through interviews and document analysis. Finally, the improvement planning is in place, where prioritization of improvement issues is made, identify dependency between issues, provide data analysis, and package the improvement issues [3].

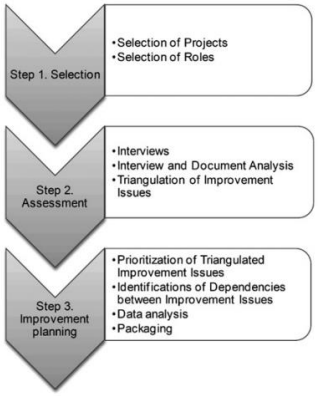

Fig. 3. iFLAP overview [3]

iFLAP can be a method that can be implemented for the improvement of the first workshop due to its main advantage is its flexibility though comes with the cost of accuracy due to the limited resources selected for assessment. On the other hand, the disadvantage isn't to relevant due to the small scale that the process and documentation can be addressed thoroughly.

While on the other hand, prescriptive methods can be seen through capability maturity model integration (CMMI). CMMI's objective is to reduce the cost of implementing improvements in the software process by removing inconsistencies and having guidelines throughout the process [5]. As of version 1.2, it compromises 22 process areas having 2 improvement paths (continuous representation measured through capability levels, and stage representation measured through maturity level.

Capability levels range from level 0 to 5, in the order: incomplete, performed, managed, defined, quantitively managed, and optimized. On the other hand, maturity level is from level 1 to 5 including: initial, managed, defined, quantitatively managed, and optimized [6]. Looking into the impacts of CMMI at organization level included success in meeting goals and having growth. The success came through better relationships with suppliers, improvement in work environments due to management support and integrated work across teams leading to reduced costs [5]. This came through due to having the process institutionalized across the organization. In contrast, negatives in organizations involve disagreement in teams, introducing or removing members was difficult and stressful due to the "resistance to change" factor CMMI entails [5].

To introduce CMMI as a SPI technique for our process, it can be an over complicated solution due to the small level of our team as seen in Ireland where various software SMES are rejecting CMMI [7]. The solution is aimed at large scale companies integrating and interacting with other clients of similar scale leading to the technique being successful.

V. SPI Proposal for future Scrum Development Efforts

Goal 1 [10]:

Have project level communication channel to have easier continuous integration between scrum teams.

Question	How easy is it to collaborate with other scrum teams?	
Metric	M1	Subjective evaluation by scrum masters
	M2	Subjective rating by scrum masters
Improvement	1) Create a dedicated timeslot where scrum of scrums takes place 2) Have a large kanban to track the project status easier to integrate when products are made	
Measurement plan	The success will be measured in combination of the rating and evaluation. Due to the qualitative and quantitative nature. The rating can provide general status of success, while evaluation can be used to track if issues arise.	

Goal 2 [10]:

Have a clear structure that is to be completed in sprint retrospective by the scrum master.

Question	What is the current template of sprint retrospective?	
Metrics	M1	Copy of sprint retrospective
	M2	Subjective evaluation of the current template by scrum team members and scrum masters
Improvement	1) Create a new template that will be a staple used in every sprint altered depending on the evaluation 2) Have team members create a sprint retrospective in the initialization sprint	
Measurement plan	The success can be seen through the evaluation of old and new sprint retrospective templates.	

Goal 3 [8], [10]:

Improve task efficiency of designated user stories in the internal subgroups.

Question	How long on average did it take to complete a user story in each split-group?	
Metric	M1	Average time per story: $\frac{Total\ time\ taken\ for\ all\ user\ stories\ (\text{mins})}{Total\ number\ of\ user\ stories\ (unit)}$
	M2	Standard deviation
	M3	% of sub-groups outside the upper range of the standard deviation
Improvement	1) Implement "pair-programming" through having other subgroups help if it is taking a larger amount of time 2) Perform shorter "daily" scrum meetings to discuss what will be done in a specific duration in between sprints so issues can be discovered prior to end of sprint	
Measurement plan	A quantitative way to see success is through the standard deviation decreasing meaning that the subgroups are taking similar times. Though, to measure efficiency the average time must also be tracked to see fair durations across the subgroups.	

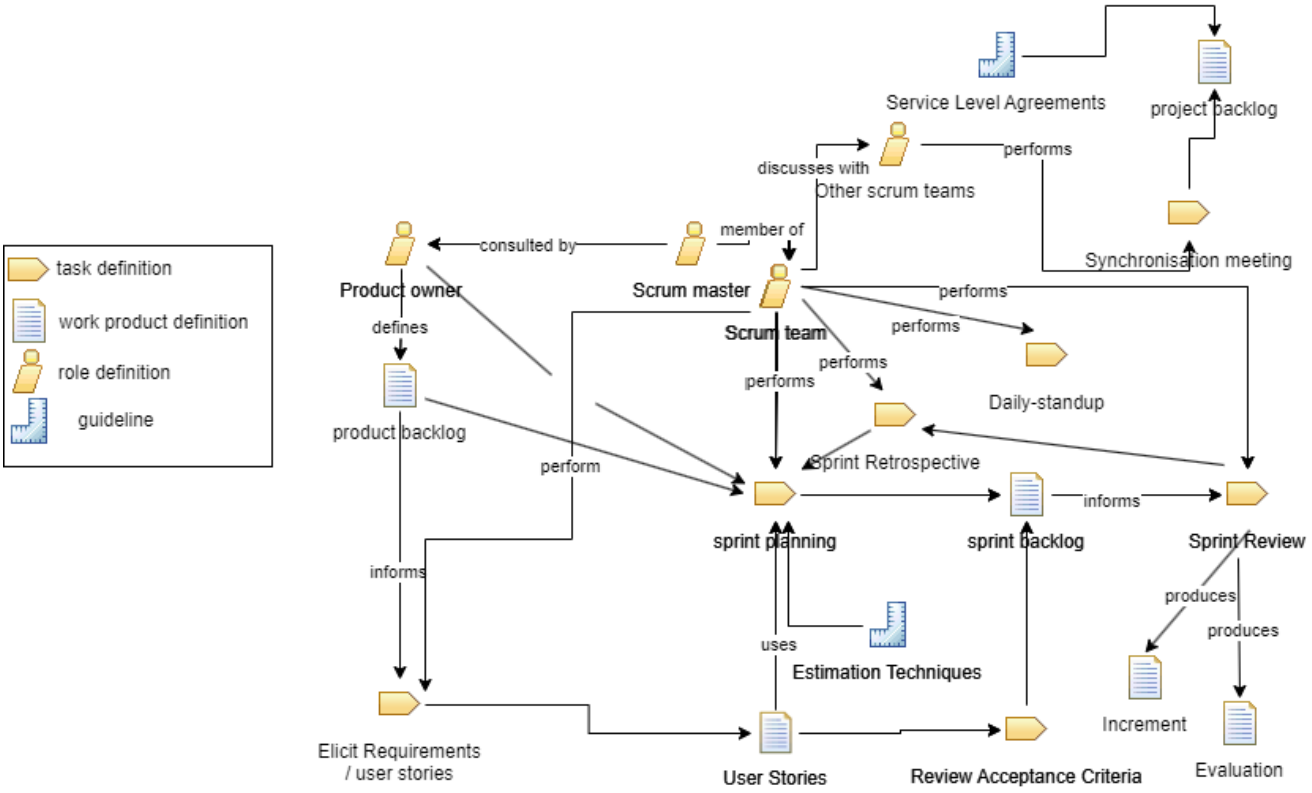

Fig. 2. Updated process [4]

VI. Implementation of an SPI Initiative (Alternate Task)

The challenges that occur in SPI projects can be seen instantly in the short run when it is implemented. Due to changes in management often leads to negative impact on the SPI programs [11]. This is due to management changes is due to changes in business goals and priority [11]. Furthermore, these changes can further stumble into more issues due to the lack of knowledge regarding the SPI of the new employees leading to more resources required to keep the project up and running. The solution can take place through having support groups that can help in easily transitioning and provide help whenever required [11]. On the other hand, this will require more resources initially though overall can be advantages due to the smaller time required in the transition. Hence, many companies, especially SMEs tend to move away from process oriented objectives due to the resources required.

Secondly, the issue of rigidness of methods such as CMMI lead to issues regarding unable to be adaptable depending on the organization [5]. The following nature also has had impacts in multinational corporations where there are differences in work culture impacting SPI projects [11]. These issues include problems such as different work ethics. This issue can even be presented on a smaller scale such as in our group. For example, due to the multicultural nature certain aspects need to be altered as certain individuals may have encountered doing daily-scrum meetings while others are completely new to the concept of scrum. Hence, require training and resources for individuals to adapt the method used in the specific organization .

VII. Redesign of the Software Process

See figure 2 for the SPEM 2.0 diagram for updated software process. Below are explanations for the changes made in the task, work product, and role definitions:

Task definitions:

Main changes include the inclusion of "daily-scrum" that occurs in between the sprint meetings. As well as synchronization, meetings can take place to make integration at project level easier with other relevant scrum teams.

Work product definitions:

There should be a project level backlog to be able to see the state of the complete project helping with the completion of the workshop. To add on, adding evaluation in the sprint review is added to help with the SPI.

Role definitions:

There is no changes in roles, it currently includes POs, scrum masters, and scrum teams. The various scrum teams is used for evaluation and illustrate more frequent integration with others.

IX. Summary and Lessons Learned

To conclude, the report was aimed at simulating the creation of a software process while implementing it in Lego building workshops and further enhancing it through the application of SPI techniques. The process was altered to incorporate the issues the process had showing possibility of incorporating changes incrementally while being able to meet goals.

References

[1] A. Cater-Steel, M. Toleman, and T. Rout, "Process improvement for small firms: An evaluation of the RAPID assessment-based method," *Information and Software Technology*, vol. 48, no. 5, pp. 323–334, 2006.

[2] P. Abrahamsson and K. Kautz, "Personal software process: Classroom experiences from finland," in *European conference on Software Quality*. Springer, 2002, pp. 175–185.

[3] F. Pettersson, M. Ivarsson, T. Gorschek, and P. Ohman, "A practitioner's¨ guide to light weight software process assessment and improvement planning," *Journal of Systems and Software*, vol. 81, no. 6, pp. 972–995, 2008.

[4] [Undisclosed Authors], "Assignment 1", Assignment 1 in course DIT348 H23, Software Engineering Program, University of Gothenburg, Sweden, 2023

[5] F. Selleri Silva, F. Santana Furtado Soares, A. Lima Peres, I. Monteiro de Azevedo, A. Paula L.F. Vasconcelos, F. Kenji Kamei, S. Romero de Lemos Meira, "Using CMMI together with agile software development: A systematic review," Information and Software Technology, vol. 58, pp. 20–43, Feb. 2015, [Online]. Available: https://doi.org/10.1016/j.infsof.2014.09.012.

[6] CMMI Product Team, "CMMI for Development, Version 1.2 Improving processes for better products," Aug. 2006, [Online].

[7] R. V.O'Connor, G. Coleman, "Ignoring "Best practice": Why Irish Software SMEs are Rejecting CMMI and ISO 9000," Vol. 16, number 1, Jun. 2009, [Online].

[8] [Undisclosed Authors], "GQM", Assignment 3 in course DIT348 H23, Software Engineering Program, University of Gothenburg, Sweden, 2023

[9] K. Wnuk, "DIT347 H23- Week 4- SPI.pdf", Lecture Slides, DIT348 H23 Software Development Methodologies, Software Engineering and Management Program, University of Gothenburg, 2023

[10] K. Wnuk, "DIT347 H23- Week 4- GQM.pdf", Lecture Slides, DIT348 H23 Software Development Methodologies, Software Engineering and Management Program, University of Gothenburg, 2023

[11] E. Rodenbach, F. van Latum, and R. van Solingen, "SPI- A Guarantee for Success? – A Reality Story from Industry," pp.216-231, 2000, [Online].

[12] Paasivaara, Maria et al. "Inter-team coordination in large-scale globally distributed scrum: Do Scrum-of-Scrums really work?" in Proceedings of the 2012 ACM-IEEE International Symposium on Empirical Software Engineering and Measurement (2012): 235-238.

[13] Yermolaieva, Sofiia. "Communication Challenges in Agile Teams from The Communication Theory Prospective." in Proceedings of the 2020 European Symposium on Software Engineering 2020 n. Pag.

[14] D. Olson, "Software process Simulation" Nov. 2004 [Online]: https://www.sciencedirect.com/science/article/abs/pii/B0122272404001635

[15] K. Pertersen, C. Wohlin, "Software process improvement through the Lean Measurement (SPI-LEAM) method" Feb. 2010