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A Framework for Software Engineering Metrics for Agile Software Development: A Sri Lankan Perspective

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Abstract - This paper focuses on Software Engineering Metrics for Agile Software Development in a Sri Lankan perspective. Software Metrics provide a quantitative and qualitative basis for the development and validation of models of the software development process, thus they are a valuable entity in the entire software life cycle. Metrics can be used to improve software productivity and quality. In this paper the researchers have come up with a framework that focus on the importance of software metrics and the efficiency of managing, quality, performances and to make accurate decisions for organizations that use agile methods and by using this framework how it can enhance the efficiency or the accuracy. This review emphasizes the importance in improving currently used metrics in Sri Lankan software firms and will analyze some of the key software metrics that go in hand with Agile Software development and deliver a considerable explanation to elucidate the underlying problems associated with software measurements.

Keywords— Agile Software Development, Efficiency, Framework, Metrics, Software metrics, Sprint, Quality

1. INTRODUCTION

Agile software development is a group of software development methods based on iterative and incremental development, where requirements and solutions evolve through collaboration between self-organizing, cross-functional teams. It promotes adaptive planning, evolutionary development and delivery, a time-boxed iterative approach, and encourages rapid and flexible responses to change. Actually it is referred not a methodology in itself but as an umbrella term that describes several agile methodologies [1]. Agile software development has had a huge impact on how software is developed worldwide. Sri Lankan companies use various approaches and strategies for software development and have understood the worth of using agile development methodologies in their projects. We can view agile methods such as Extreme Programming (XP), Crystal, FDD, DSDM and Scrum as a reaction to plan-based or traditional methods, which emphasize a "rationalized, engineering-based approach, incorporating extensive planning, codified processes and rigorous reuse".

In contrast, agile methods address the challenge of an unpredictable world, emphasizing the value competent people and their relationships bring to software development [2]. The aim of agile methods is to reduce overheads in the software process (e.g. by limiting documentation) and to be able to respond quickly to the changing requirements without excessive rework. The principles and values of agile software

development were formed as a way to help teams to break the cycle of process inflation and mainly focus on simple techniques for achieving their goals.

Most common challenges in software development industry are the delivery of products within an assigned time limit, the quality of these delivered software products, contract management, how to overcome hidden cost, etc. These challenges are frequently faced by practitioners as well as researchers. Software metrics play a vital role in providing solutions to these challenges. The use of software metrics aid early discovery and correction of technical and management problems, which may cost more time and money when they have to be resolved later. The frequently popping out question such as "is the software ready to be used?" Or "is the project on schedule?" too can be resolved with the aid of software metrics.

This research is focused on identifying how software practitioners in Sri Lanka can succeed in their software development projects with the use of matrices [3]. This will focus on developing a framework for software measurement and metrics that can be used in agile development to resolve the above mentioned issues to fabricate high quality products and yield tremendous benefits.

2. LITERATURE REVIEW

There are rather few references on software metrics used in agile development, especially product metrics. The existing

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quality standards applied in traditional software development, for example ISO 9126, are said to be incompatible with agile methods [4], with the metrics often being vague, irrelevant, or unusable [5], unfortunately the authors of these claims do not explain further why that is the case, how exactly traditional quality metrics have failed to serve their purpose.

Abrahamsson et al. [6] demonstrated how to collect metrics to measure productivity, quality and schedule estimation for an Agile Software Development project using XP. Williams et al. [7] investigated the usage of a subset of XP [8] practices at a group in IBM. The product developed at IBM using XP was found to have significantly better pre-release and post-release quality compared to an older release. The teams using XP reported an improvement in productivity and morale. In addition, customers were more satisfied with the product developed using XP because the teams delivered more than what the customers had originally asked for. Some key Agile Metrics include:

- Burn-downs
- Efforts
- Velocity Trend
- Counts and statuses of work items and defects
- Team Member Load/Effort
- Test Reports

When selecting a suitable metrics for an agile software development project the below mentioned factors can be considered and the following metrics can be taken as example: [9]

- Operational Excellence:
How does management measure development teams' effectiveness?
Velocity
Featured delivered vs. planned
- User orientation:
How effective is the team in meeting users' needs?
Post-iteration feedback /working demo
Surveys, Customer-filed defects
- Business value:
How do application development projects contribute (directly or indirectly) to quantitative business benefits?
Earned business value
- Future orientation:
How will change to development processes affect organization's ability to deliver value and quality in the future?
Agile Scorecard

3. OBJECTIVES

The main objective of this research paper is to develop a framework to be used for software development projects that focus on agile methodology in Sri Lankan software firms so that the companies or personnel using the suggested framework, Sri Lankan or other, can improve the quality of the products as well as the quality of the development process. This includes the current status of agile method applications in project developments and its description of benefits found, constraints, issues experienced and the alternative needs. Listed below are some of the specific objectives which the paper is based on:

- Identifying different measuring options and categories of agile methodology. With use of different studied software metrics.
- Importance of software metrics to understand the fulfilled requirements of a project
- Defining standard framework for software metric measures, motivate and support use of frameworks for software engineering metrics.
- Identify how metrics are used by Sri Lankan software developers in different phases of the development life cycle and understand how metrics effects to the output.
- Importance of software metrics to ensure the accuracy and maintainability of a project

4. METHODOLOGY

The aim of this research is to develop a framework for Software Engineering Metrics for Agile Software Development to improve the projects. This paper explores the current status and the use of agile methodology and the metrics that are in use by Sri Lankan Software development projects. The research question framed for this research is: "What metrics can be used to develop a framework to improve the projects which work with agile development methodology in Sri Lanka?"

In order to address this question an online survey using a simple questionnaire was carried out among a variety of people holding different positions involving in software development in various Software houses and other IT related individuals in Sri Lanka who mainly focus on agile methodology for development during the months of April to July 2014.

The method for gathering data was by an online questionnaire which consisted of around 10-12 questions where most questions were close-ended while only 1 or 2 being open ended. Furthermore, the authors used external journals, research papers and case studies to gain secondary data.

The assumptions such as the sample used, were clearly used to represent the Software developing population in Sri Lanka, the respondents having given truthful information without any hesitation, no invisible intervention for the respondents in providing trustworthy facts were used to support the research in order to get more precise results.

5. RESULTS AND DISCUSSION

As mentioned in Section IV the survey was successfully conducted and 11 different responses were gathered for further analysis as shown below.

A. Sample Categorized by Roles

1. The Position you hold in your company

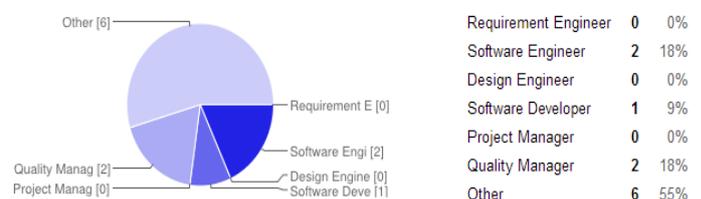


Fig.1 – Respondents according to their roles

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As shown in Fig-1, a variety of respondents who hold different positions have provided their opinion to the questionnaire.

B. Years of Experience

Years of Experience

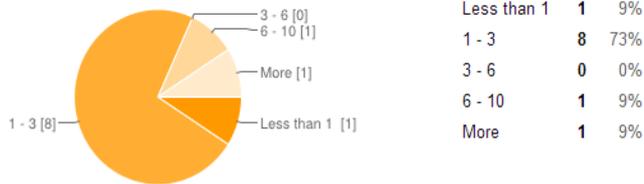


Fig.2- Experience level of respondents

As displayed in Fig-2 around 80% of the respondents have more than 2 years of experience in the field and the rest have a minimum experience of less than a year.

C. Advantages of software metrics

When asked if there were advantages of using software metrics for agile development 100% of the respondents said “yes” and the reasons are specified below:

Analyze product errors and defects [If “Yes”]

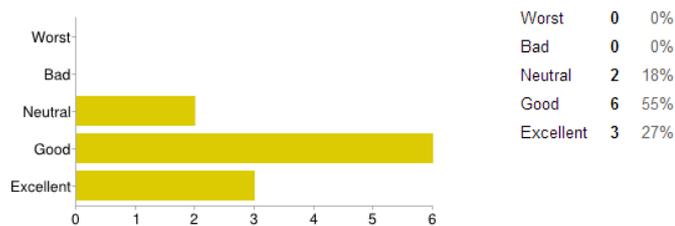


Fig.3- Respondents thoughts on Product Error & defect analysis

All respondents believe that metrics could be used to analyze the products defects and errors. Also as shown in Fig.4 they also believed it was a good way to measure the current status of the project.

Assess status [If “Yes”]

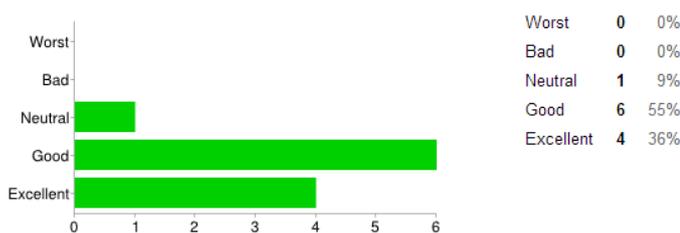


Fig.4- Respondents Assessment of Product Status

When considering matrices as a measure to derive a basis for estimates majority of the respondents were positive they were good or excellent while two respondents were neutral.

Derive a basis for estimates [If “Yes”]

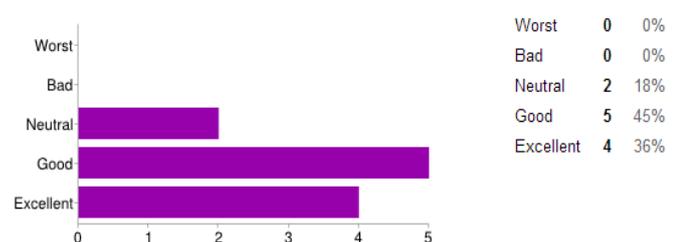


Fig.5- Metrics to derive a basis for estimates

Of the respondents 54% were also sure that metrics could be used to determine the product complexity of an agile project while the rest 46% were neutral.

Determine product complexity [If “Yes”]

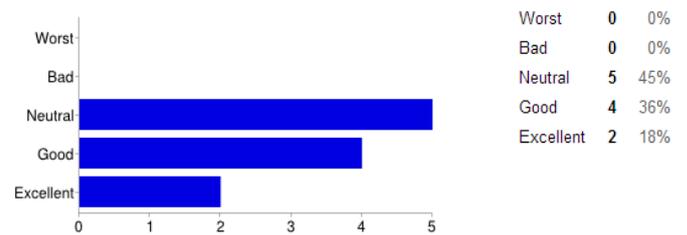


Fig.6- Metrics as a measure of complexity

While 18% of the respondents thought that metrics in agile development could not be used to establish baselines the remaining 82% thought it could be used as shown in Fig.7 below.

Establish baselines [If “Yes”]

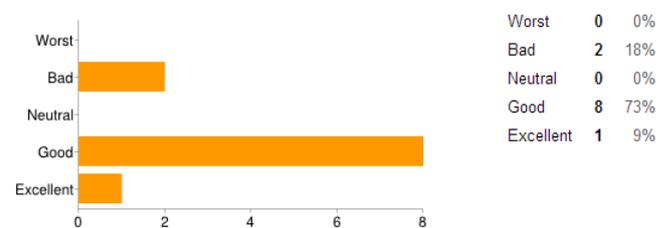


Fig.7- Metrics as a measure to establish Baselines

When asked of using metrics as a method to validate the so called “best practices” in agile development through experiments, the thoughts of the respondents were as shown in Fig.8 below.

Experimentally validate best practices [If “Yes”]

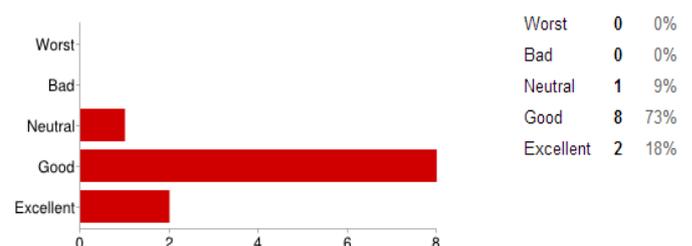


Fig.8- Metrics as a measure to validate best practices

Fig.9 below shows, of the respondents, 36% were neutral while the remaining 64% thought that metrics could be used as a measurement to evaluate the quality, schedule, effort and cost of an agile development project.

Predict quality, schedule, effort, and cost [If “Yes”]

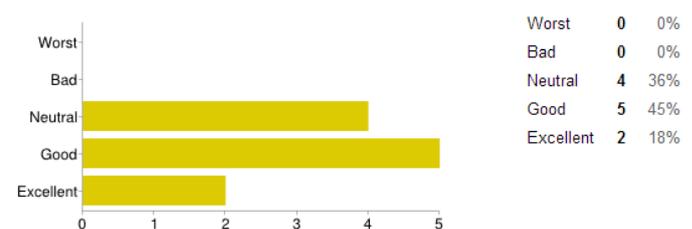


Fig.9- Metrics as a prediction model

At the same time 63% of the respondents thought that metrics were able to be used to track the progress of a development project while the rest were neutral or disagreed.

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Track project progress [If "Yes"]

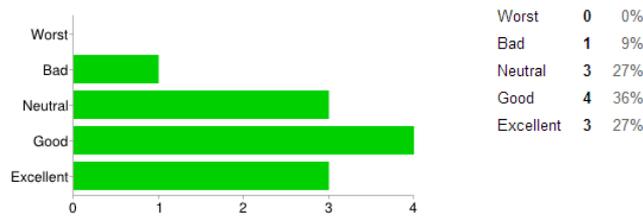


Fig.10- Metrics to track project progress

D. Metrics in Agile

When asked of what the best frequently used metrics in the development of agile projects the respondents provided their opinions as shown in Fig-11 below.

What are the Metrics frequently used in Agile Development

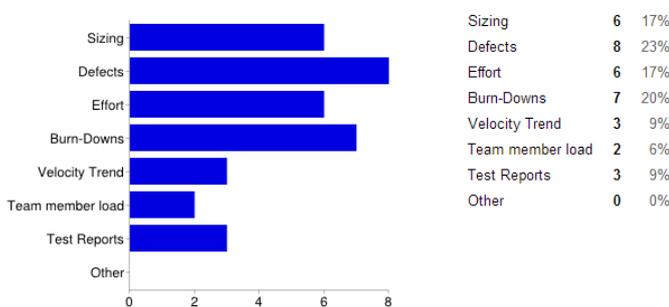


Fig.11- Frequently used Metrics in Agile

E. Need for advanced metrics

As the need for a more advanced and better metrics the reasons of the respective respondents were mentioned as such. 43% thought that through an advanced metrics we could overcome the issue of sometimes being unable to fulfill the limited objectives of a project whereas 36% thought that it could reduce the failures occurred due to the current metrics used.

Why do you think we need more advanced software metrics for agile

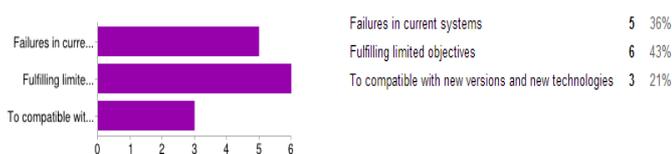


Fig.12 – Need for Advanced Metrics

When considering the above results we can clearly see that a better advanced metrics for agile will be accepted in the industry as it is bound to help developers and provide better quality to their software products.

Good metrics should enable the development of models that are efficient of predicting process or product spectrum. With the results obtained from the general sample of Sri Lankan developers the below mentioned metrics are suggested by the authors of this paper to be the ideal combination of metrics to develop the framework for agile development projects:

- Defects- Calculated by adding up all the defects occurred to measure the quality of the delivered code. Defect Cycle Time, Defect Spill-Over trends can be used to get a graphical view of the quality of the development process.
- Burn-Downs- A burn down chart is a graphical representation of work left to do versus time. The

outstanding work (or backlog) is often on the vertical axis, with time along the horizontal. That is, it is a chart of outstanding work. It is useful for predicting when all of the work will be completed.

- Sizing- Estimating the size of the project after each iteration or sprint to get the actual size of the project by using function points and such.
- Effort- Estimation of the development effort can be calculated in hours spent or in person-months.

Agile is the latest theory that is widespread maybe even replacing the waterfall approach when it comes to development. Since agile can track and control the outcome of each and every sprint which would make it much easier for the development team to manage and organize activities involved in the project very efficiently. Any deviation from the optimal practice of the development process can be identified in the early stages and can be neutralized in order to reduce the re-working effort, costs involved as well as customer expectation.

6. CONCLUSION

This thesis has contributed with an attempt to answer what type of performance and process optimization measurement should be conducted in an agile software development organization. Frameworks that consider the latest ideas in agile methodology and communicate measurement best practices have been developed. It holds awareness of dysfunction, consideration to agile principles and an economic perspective as fundamental for achieving success in agile measurement [10].

The thesis' result can be used in an agile software development organization to increase awareness among senior management, support mid management in the implementation and reduce resistance among developers as well as create better quality improved products. To give a complete solution to develop a framework for metrics in agile measurement, further research and empirical work are needed.

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REFERENCES

[1] Monjurul Habib, "Agile software development methodologies and how to apply them", 30 Dec 2013 [Online]. Accessed 23/03/2014

[2] Dyba, Tore; Dingsoyr, T., "What Do We Know about Agile Software Development?" *Software, IEEE*, vol.26, no.5, pp.6, 9, Sept.-Oct.2009 doi: 10.1109/MS.2009.145

[3] Fernando, W., Wijayarathne, D., Fernando, J., Mendis, M. and Manawadu, C. (2013). Emergence of Agile Software Development Methodologies: A Sri Lankan Software R & D Outlook, *International journal of scientific & technology research*, VOLUME 2 (ISSUE 11), pp.103-108.

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WINGS TO YOUR THOUGHTS.....

- [4] Martin Kunz, Reiner R. Dumke and Niko Zenker, Software metrics for agile software development. In: ASWEC '08: *Proceedings of the 19th Australian conference on software engineering*, IEEE computer Society, 2008, 6773-678
- [5] Beatrice M. Hwong, Gilberto Matos, Monica McKenna, Christopher Nelson, Gergana Nikolova, Arnold Rudorfer, Xiping Song, Grace Y. Tai, Rajinikath Tanikella and Bradley Weherwin, Quality improvements from using Agile Development methods: Lessons Learned. In: Ioannis G. Stamelos and Panagiotis Sfetsos (eds.) *Agile Software Development Quality Assurance*, Information science References, 2007, 221-235.
- [6] P. Abrahamsson, Koskela, J., "Extreme Programming: A Survey of Empirical Data from a Controlled Case Study", *Proceedings of International Symposium on Empirical Software Engineering*, pp. 73-82, 2004.
- [7] L. Williams, W. Krebs, L. Layman, A. Antón, and P. Abrahamsson, "Toward a Framework for Evaluating Extreme Programming", *Proceedings of Empirical Assessment in Software Eng. (EASE) 2004*, Edinburgh, Scot., pp. 11-20, 2004.
- [8] K. Beck, *Extreme Programming Explained: Embrace Change*. Reading, Mass.: Addison-Wesley, 2000.
- [9] Slideshare.net. 2014. *Agile Metrics*. [Online] Available at: http://www.slideshare.net/gmarwaha77/agile-metrics-3442832?qid=473868cc-e97e-4610-bbd7-3d9b29e9b3be&v=default&b=&from_search=9
- [10] Johan Gustafsson, "Model of Agile Software Measurement: A Case Study" *Master of Science Thesis in the Programme Software engineering and Technology*, Chalmers University of Technology University of Gothenburg, Department of Computer Science and Engineering Göteborg, Sweden, June 2011