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Test automation maturity assessment

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***Abstract*—Test automation is becoming critical in software development process. Though it has been widely applied, many are not surprised to find there is the long journey to a mature test automation process. To get continues improvement and achieve or sustain test automation benefits, organizations need to know what factors can lead to mature test automation and how to assess the current maturity level of test automation in order to identify improvement steps. However, the contemporary test maturity models are likely to emphasize more on general testing but fewer details for test automation, and also lack empirical evidence from the industry to validate the statements that indicate maturity levels. To address the above issues, this study aims to examine what factors lead to a mature test automation process and how to assess the maturity level against them.**

Keywords—test automation; test maturity; measurement ; assessment

I. INTRODUCTION

Software development teams test their products in order to produce high quality products and meet client's requirements better. When products is becoming more complicated and need to be developed in more agile development process, tedious and labor-intensive manual tests gradually cannot meet the all expectations [1]. To increase test efficiency, test coverage, and test effectiveness, organizations start to automate tests [4]. Automated tests can be run repeatedly with comparably lower costs and faster speed, and currently is becoming the critical in more agile software development process [2].

Though test automation has been widely applied, many are not surprised to find there is still a long journey to a mature test automation process. To get continues improvement and achieve or sustain test automation benefits, organizations need to know what factors can result in mature test automation and how to assess the current maturity level of test automation for improvement steps. Researchers have developed many test maturity models, like Test maturity model (TMM) and Test Maturity Model integration (TMMI). However, despite there is an increasing focus on test maturity, the inadequate attention to test automation maturity seems to be the norm in many studies [5]. The exiting test maturity models are likely to emphasize more on general testing but fewer details for test automation process, and also lack of empirical evidence from the industry to validate the statements that indicate maturity levels. Furthermore, few formal measurement instruments provided to assess the maturity level of test automation and identify improvement steps.

To address the above issues, the objectives of our research were defined. Firstly, we intend to investigate what factors should be considered for the journey to a mature test automation process. Secondly, we intend to develop the formal measurement instruments, which can be used by the most of organizations to assess the maturity level of test automation and also identify improvement steps. Thirdly, we intend to collect empirical evidence from software industry to complement our research results.

II. RELATED WORKS

This research is the part of Testomat project, which intends to propose a Test Automation Improvement Model (TAIM). According to the previous study [2], TAIM defines ten key improvement areas (KIAs) for test automation: Test Management, Test Requirements, Test Specifications, Test code, Test Automation process, Test execution, Test Verdicts, Measurements, Test Environment, and Test Tools. Each KIA defines the measurements for the stepwise improvement.

III. METHODOLOGY

The research process was designed in accordance with the defined objectives, and consists of two stages: the reviewing, the designing and piloting stage, and the formulation stages. In the first stage, we plan to review the contemporary test maturity and test process improvement models, in order to derive the factors that can result in a mature test automation process. The derived factors will reviewed by test automation experts for the revision. In the second stage, we plan to design a survey, which can be used by the most of organization to assess their maturity level of test automation. The designed survey will be piloted several times in the industry for the revision. In the third stage, we plan to come up with the metrics to measure test automation and its efficacy.

IV. CURRENT STAGE AND EARLY RESULTS

The reviewing stage was completed. We reviewed 42 contemporary test maturity and test process improvement models. Garousi et al. [3] have done the multivocal literature review to identify the exiting test maturity and test process improvement models. By using the identified models form their study as the base, we sort the models further against to our inclusion and exclusion criteria. The inclusion criteria is applied, when the models have relevant statements indicating test automation maturity and were developed during 2005 and 2014. The exclusion criteria applied, when the models not related to test automation or were developed before 2005. This

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has resulted in 21 models left for further reading. We used NVivo to code the statements that indicating test automation maturity in those models. The factors that can lead to test automation maturity were derived and then categorized by KIAs of TAIM.

We identified different factors in each KIA of TAIM. Several factors were identified in each KIA of TAIM. Table I presents two example factors identified in Test Management KIA, and the detailed contents are also described. For instance, the factor "extent of the strategy work on test automation", examines whether the test automation strategy are created to define 'the reasons for test automation', 'the goals for test automation', and other contents. As for the factor 'resources of test automation', it investigates the availability of resources such as skilled people, time & efforts, test tools, and others assigned for test automation.

TABLE I. THE FACTORS OF MATURE TEST AUTOMATION

Factors	**The contents**
Extent of the strategy work on test automation	The reasons for test automation The goals for test automation Product risks analysis Products/project to be tested test scope to be automated Test efforts estimation …
The resources of test automation	Skilled people Time & efforts Physical facilities Test tools Test data/test environment Hardware …

We have sent identified factors to experts with academic or industry background, and currently are waiting for their comments and feedbacks. The purpose is to validate the identified factors and also probably found new ones.

V. FUTURE PLANS AND EXPECTATIONS

This chapter presents our ideas to plan future works. However, the detailed designing approaches and methods still need further studies to decide.

A. Survey

We plan to design a survey based on identified factors, and structure will be like a "tree" as the whole. This means survey questions will be formed into the levels from low to high. The higher levels may contain more concrete questions. As questions reach the highest level of accuracy we can later also consider metrics. For example, the first level may contain board questions, like "Do you think you have enough resources available for test automation?" The second level checks the availability of different resources such as skilled people, test tools, and physical facilities. The third level checks the numbers of skills people in test teams, test tools in use, and physical facilities assigned to test automation. The answers of respondents in each level may provide the reference to assess the maturity level of test automation. Concrete methods and approaches will come out later.

In piloting stage, we plan to run our survey in the industry, to examine if this could really help organizations to assess the current maturity level of test automation for improvement steps. In addition to the goal of constructing TAIM, Testomat project also aims to provide organization with test automation solutions towards the advanced levels of maturity. We expect our survey could be used as a measurement instrument to assess the maturity level of test automation for organizations in the project before and after applying Testomat solutions

B. Metrics

In the formation stage, we plan to identify test automation metrics using GQM approach. The Goals of test automation can be derived from the factors, which lead to mature test automation. Survey questions can be used to come up with a set of Questions to achieve the goals and therefore lead to Metrics, which will be used as the critical component of TAIM to access the maturity levels.

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