A Survey of Key Challenges of Adopting Agile in Global Software Development: A Case Study with Malaysia Perspective

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Abstract—Agile methodology is the current most popular technique in software development projects. Agile methods in software development bring optimistic impact on software performances, quality and customer satisfaction. There are some organizations and small-medium enterprises adopting agile into their local software development projects as well as in distributed software development projects. Adopting agile methods in local software development projects is valuable. However, agile global software deployment needs an attention. There are different key challenges in agile global software development that need to resolve and enhance the global software development cycles. The proposed systematic literature review investigates all key challenges of agile in global software development. Moreover, a quantitative methodology (an actual survey) targeted to present a real case scenario of these particular key challenges faced by one of the software houses that is BestWeb Malaysia. The outcomes of systematic literature and the results of quantitative methodology are compared with each other to evaluate if the key challenges pointed out in systematic review still exist. The proposed research and its exploratory results can assist small medium enterprises to avoid these challenges by adopting the best practices in their global software development projects. Moreover, it is helpful for novice researchers to get valuable information altogether.

Keywords—Agile software development, ASD challenges, agile global software development. challenges in agile global software development.

I. INTRODUCTION

IN February 2001, 17 candidates who wanted to get an alternative and enhanced way of accomplishing software development created The Agile Manifesto [3]. Agile methodology is a method of fulfilling client satisfaction through iterative development cycles and therefore it is considered as an "iterative" and "incremental" development process [3]. Agile alliance represents an umbrella holding an agile family: SCRUM, Dynamic System Development Method, Crystal Method, Lean Development etc. [3].

A. Agile Software Development:

Software engineering is a discipline that provides engineering rigor to the profession. Agile development in software engineering industry is getting popularity and the three most successful factors of agile in software development industry are people, culture and communication [5]. Agile

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development is more about thinking mode than a pre-defined process [4]. There are different organizations adopting agile into their software development projects. In 2017, almost 87% software houses followed agile to accomplish their software development projects successfully. On the other hand, in 2018 the number raised by 10% (97%) [6]. Software houses follow the agile triangle consisting of three major factors; project scope, time and cost. Different team members handle the sub-projects of one major project in agile. The most significant tasks accomplished at first and the completely agile development team respond quickly to user demands [4].

B. Agile Global Software Development

The term Global Software Development presents the programmers from different parts of the world to accomplish the software development procedure successfully [10]. The completion of projects in global software development has become common to save the manufacturing cost and lessen the duration to publish the product in market [10]. Although, distribution/global software development is efficient; there are certain challenges the organizations are facing in Agile Global Software Development (AGSD) such as cultural differences, alternate time zones and procrastinating communication [12]. To reduce such issues, agile has started tightening its branches in software development [12].

AGSD has become popular and project managers with project engineers started creating quality software at less cost [10]. Agile methods serve best in huge dynamic business and IT environment. Different organizations have started surfing for talent available at lower rate to link the implementation tasks to these centres [12]. AGSD is beneficial for different software houses. However, there are number of key challenges in AGSD that need to resolve. This paper highlights key challenges in AGSD and answers the following research questions:

- Research Question 1: What are the key challenges of AGSD mentioned in systematic literature?
- Research Question 2: What are the current key challenges of AGSD faced by the software houses?

II. BACKGROUND

AGSD is popular in many software organizations to fulfill customer demands. However, some sets of challenges and problems in agile lead the projects to failure. Project accomplishment to time, scope, cost and quality cannot consider as the success factors of a successful project but the

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International Journal of Industrial and Manufacturing Engineering
Vol:13, No:10, 2019

project output, outcomes, and impacts are the true success factors of a successful project [7]. Although Agile provides quality software development, at the same time, it is not successful in delivering the exact project outputs/performance on time. Therefore, it is essential to point the main issues companies are facing in AGSD due to which the high performance projects are not delivering to the end user. The main reasons of agile project failure are [7]:

- Less understanding of the required wide organizational change.
- Organization culture or philosophy balanced with agile values.

Beside all these reasons, some challenges in agile distributed software development are lack of dedicated cross-functional teams, people's behavioural changes, and lack of skilled product owners from the business side [8]. Different agile challenges introduced after the agile transformation occur on large scale. In [9], the study revealed that number of agile development issues produced after the agile transformation occurs on large scale. A method for adaptation and implementation of agile projects is proposed in [11] to reduce communication and cost issues. Fig. 1 presents a communication model of all key challenges related with the communication in AGSD [13].
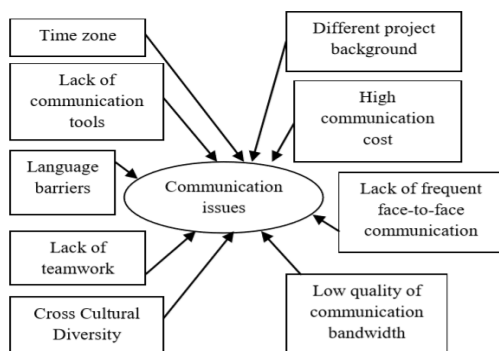

Fig. 1 A communication model

AGSD lacks the communication method. Moreover, the cross-cultural diversity, lack of teamwork, language barriers, high communication cost are some other communication challenges introduced in agile global distributed development [13]. By improving communication mode in global software development, benefits such as short meetings, short iterations, and incremental integrations can be attained by software development team [14]. In distributed software development, Ceremonies, Artifacts and Role are the three major problems of Scrum agile methodology during an accomplishment of distributed projects [15]. A possible explanation is given in [16] about a stressful working environment in AGSD in India. The researchers found that AGSD is more about high pressure, more time enforcement and stress. As because of time differences in India, there are huge conflictions of communication during different meetings. A vacation in India is a working day in Europe therefore; communicating effectively in AGSD is difficult and full of stress [16].

III. RESEARCH METHODOLOGY

A literature review that collects and evaluates different studies is termed as a systematic literature review. The validity of findings in systematic literature review is more noteworthy and it is very different from an ordinary literature review [10]. Fig. 2 illustrates the proposed research process based on three main steps. First, the possible sources are identified, and then the filtration of relevant sources is finished following by the analysis. The first stage that is identifying possible sources accomplished by using key words identification method.

A. Research Scenario

Research strategy followed in this research is the inclusion and exclusion criteria to complete the research scenario.

Research Resources

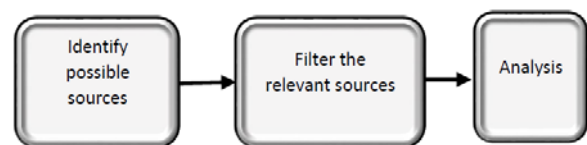The targeted resources are Springer, Google Scholar, IEEEXplore and Science Direct.

Fig. 2 Research Methodology

TABLE I
KEY WORD IDENTIFICATION

Search Category	Key words
AGSD	Agile methods in GSD, Global software development using Agile, SCRUM in Global software Development
Challenges in AGSD	Issues in Global Software Development, Communication issues in AGSD, Sprint problems in AGSD, Cultural issues in AGSD

Key Word Identification

The key words used to search the relevant data are presented in this section. Table I presents the key word identification scenario.

B. Research Selection Principle

It is essential to select the relevant papers. An inclusion and exclusion criteria is used to evaluate the relevancy of each paper.

Inclusion Criteria

The given rules are set in inclusion criteria to select the relevant papers and delete the irrelevant.

- Papers including the main challenges of adopting agile in global software development are considered.
- Papers related to the key challenges of AGSD with not less than published date of 2010 are selected.

Exclusion Criteria

The irrelevant papers are excluded based on given exclusion criteria:

- Papers that were not related to the issues/challenges of AGSD were excluded.
- Papers published before 2010 were deleted.

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Vol:13, No:10, 2019

C. Sources Selection Practice

All the relevant papers are selected based on an analysis stage. Table II presents the steps of analysis stage.

TABLE II
DATA SELECTION

Analysis Stage	Method
First Filtration	Review Title
Second Filtration	Read Abstract
Final Filtration	Explore the content

D. Data Compilation

Identified challenges of AGSD from systematic literature are enlisted in this section. Table III illustrates all the challenges explored from total number of papers listed with frequency that represents the number of papers highlighted the particular issue.

Research question 1 is answered in this section: What are the key challenges of AGSD mentioned in systematic literature?

TABLE III
DATA COMPILATION - CHALLENGES IN AGSD

Sr. No	Challenges	Paper	Frequency	Percentage N = 31
1	Communication	[1], [10], [12], [13], [17]-[22], [29]	11	36%
2	Language Barrier	[10], [13], [21], [23], [24], [31]	6	20%
3	Lack of Documentation	[1], [2], [10], [28], [30]	5	16%
4	Culture Diversity	[1], [10], [12], [13], [24], [26], [31].	8	26%
5	Time Difference	[10], [13], [21], [24], [26], [27]	6	20%
6	Geographical Distance	[10], [12], [21], [23]-[27]	8	26%
7	Temporal Distance	[10], [25], [27]	3	10%
8	Socio-cultural Distances	[10], [12], [13], [24], [26], [27]	6	20%
9	Technical Issues	[1], [10], [12], [29]	4	13%
10	Knowledge Management	[1], [10], [12], [29]	4	13%

IV. REAL WORLD CASE SCENARIO: BESTWEB MALAYSIA

A real world case scenario is analyzed to validate whether the challenges of AGSD explored in systematic literature still exist. A software house that is BestWeb in Malaysia answered a survey questionnaire about the challenges their organization is facing during AGSD Projects. Fig. 3 presents the answers from the organization-collected converts into the histogram.

Research question 2 is answered in this section. What are the current key challenges of AGSD faced by the software houses?

A. Evaluation

The results from the real survey present that there are some key challenges of AGSD software houses still face. Table IV presents the major challenges of AGSD the BestWeb is facing during AGSD Project deployment process.

B. Observation

The result shows that there are three major issues BestWeb is facing while the development of distributed software in agile environment. The three challenges are lack of motivation – 60%, lack of trained staff in agile – 70% and knowledge management – 70%.

TABLE IV
KEY CHALLENGES OF AGSD BESTWEB FACING

Key challenges of AGSD, BestWeb is facing	Percentage of the perspective key challenges
Lack of motivation	65%
Lack of trained staff in agile	70%
Knowledge management	70%

V. COMPARISON OF SYSTEMATIC LITERATURE RESULTS WITH THE REAL CASE OUTCOME

The systematic literature pointed out different key challenges in AGSD (Table III). Likewise, the BestWeb software house completed a survey and assisted the author in compiling the major key challenges still exist. It is critically analysed that the software house is still struggling with the key issue of AGSD "knowledge management" which is identified in systematic literature too. Although the systematic literature pointed out more challenges, the software house is encountering one of those challenges. There are some key issues of AGSD such as language barrier, culture diversity, temporal or geographical distances etc. from systematic review that are not faced by software house but it can be observed that two new key challenges of AGSD emerged in software house that is lack of motivation and lack of trained staff in agile. Table V presents an overview of comparison.

TABLE V
COMPARISON OUTCOME

Key challenges of AGSD	Systematic literature	Real case - Software House
Knowledge Management	Yes	Yes
Lack of motivation	No	Yes
Lack of trained staff in agile	No	Yes
Communication	Yes	No
Language Barrier	Yes	No
Lack of Documentation	Yes	No
Culture Diversity	Yes	No
Time Difference	Yes	No
Geographical Distance	Yes	No
Temporal Distance	Yes	No
Socio-cultural Distances	Yes	No
Technical Issues	Yes	No

VI. CONCLUSION

Agile in Global Software Development is beneficial in many ways but at the same time, there are different key challenges in AGSD presented in this paper. The results of preliminary studies and a real case scenario presented with a comparison of results in Section V of this paper. According to the result, the key challenge of AGSD that still exist is knowledge management. However, there are certain key challenges found in systematic review, which are may be

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resolved, but result shows that there are some challenges of AGSD that emerges newly that is lack of activation and lack of trained staff in agile in software houses AGSD project. It is essential to reduce these issues by deploying a platform where the companies can easily handle the AGSD. The data are finalized after performing research selection and filtration criteria. The risks/challenges highlighted in this paper help the software developers avoid the practices that create these issues in their software development and attain the best practices that enhance their Global Software Development.
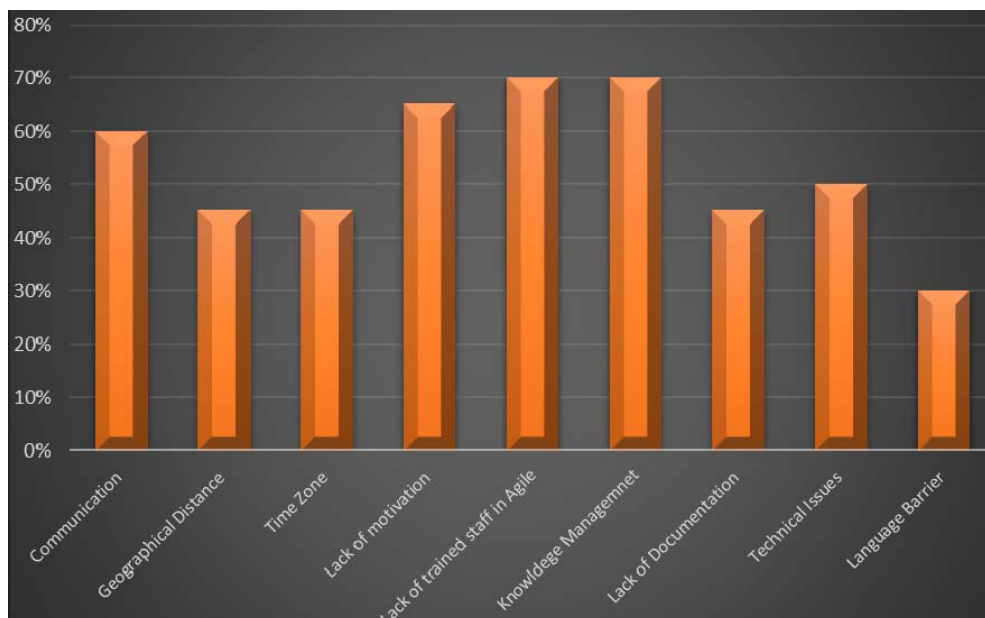

Fig. 3 Key challenges in AGSD - BestWeb Malaysia

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