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Assessment method for Scrum culture within the Development team

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***Abstract*— Agile methods have become the most adopted within the software industry as they offer a faster return on investment, better software quality, and higher customer satisfaction in comparison with the traditional approaches. However, the agile method is regarded as a cultural shift where values need to be institutionalized within the development team prior methodology implementation. Many organization adopting agile method without considering its values which lead to undesired outcomes. Despite this, the current literature lacks attempts in assessing agile team culture readiness. Therefore, this research develops the Value, Goal, Question, and metric (VGQM) assessment method to assess agile team culture readiness within the development team. The VGQM includes metrics that selected purposely to evaluate agile team values. The VGQM is based on the Goal, Question, and Metric (GQM) paradigm concept. The VGQM was applied in a software company as a case study for evaluation purposes. The outcome of the case study shows the VGQM capability to assess agile values and identify gaps as areas for improvement.**

Keywords*— *agile methodology, scrum values, agile team values, agile culture assessment, team culture assessment.

I. INTRODUCTION

Nowadays, agile methodology is the better-adapted software development methodology to deal with the complex market environment because it offers numerous benefits to the organization include faster return on investment, better software quality, and higher customer satisfaction [1-2].

Since the 1990s, agile development methods have developed popular methods such as eXtreme Programming (XP) [3], Scrum [4], Lean [5], Feature- Driven Development (FDD) [6], and Adaptive Software Development (ASD) [7] have become popular in comparison with traditional software development processes. This is mainly due to agile methods describe how things to be done while traditional processes focus on what things to be done. Moreover, all agile methods share a common philosophy in the form of values and principles that representing agile culture [8]. Therefore, agile methods can be seen as a cultural shift and social change to organizational culture [9-10]. And according to P. Ingalls and T. Frever, probably, the values are considered as the main drive for cultural orientation [11]. Typical Scrum values are [12]: Commitment, Focus, Openness, Respect, and Courage. A typical XP values are [3]: communication, simplicity, feedback, and courage.

Recently, Scrum is the most used method within the software industry as its focus on software project management which is recognized as the most challenging area in the software business [13][4].

Several researchers such as H. B. E. N. Othman et al. and P. J. Ågerfalk stated that to apply the agile method within an organization, priory, its values must be taken into consideration by agile practitioners or/and the development team [14-15].

Moreover, adapting to the new agile culture is not always an easy task, since it is required to change the attitude and values of all members of the organization [16]. Currently, several industries are struggling to reach the optimum utility of the agile methods due to several reasons such as the failure to adapt to the agile culture and the fact that the organizations don't assess the team member's readiness to embrace this new culture [17-18].

According to our comprehensive literature investigations, there is still no direct method to assess Scrum values within the organization yet.

Thus, the motivation behind this research is to assess the existence of the agile culture i.e. values. This assessment helps then organizations to identify agile cultural gaps or areas of improvement. The scope of this research is limit to Scrum values and it has been selected as the most used method.

This research is set up to design an assessment method to evaluate the agile culture within an organization hence identifying gaps or areas for improvement. The contribution of this study is to design an assessment method that is tailored to agile values.

II. BACKGROUND

A. Scrum method

Scrum mainly is an agile framework that offers practices such as a daily meeting of all scrum team developer, define

project lifecycle and identify project risks [19-20], artifacts in the form of the product backlog, sprint backlog, and increment [21], and three roles which are product owner, development team and Scrum master to manage software project [21]. Scrum provides numerous benefits for the development which increases the speed and quality of the development by providing a strong performance between the individual and the organization at all levels. Whereas, these steps do not have specific procedures to follow but it's flexible in its criteria for selecting the sprint [4].

B. Scrum Values

The Scrum values help to build a cohesive and cross-functional approach. Although, providing a common set of values for those who participate in the Scrum team plays a critical role. This helps to unify everyone in the team when people work from shared values, eliminate possible tension and provides a good basis for guiding the team. These values stated and categorized into five main types, and also noted that scrum values are the same values of agile team values [22], which are [12] [13]:

1) Commitment: is the ability to commit to a task and to do the best to achieve it within the assigned time-box. It also means you have to show commitment to each team member, product, and sprint goals at the end of the iteration.

2) Focus: it means that instead of being distracted and diverted, the Scrum team must focus on and be responsible for doing and completing the tasks that have been agreed on during the sprint. This means that nothing should be allowed to alter the team's concentration during the sprint.

3) Openness: Being willingly open to others is a sign of emotional maturity, high-performance, and the team's ability to work together. Besides, the team members must hear and collaborate with customers, and stakeholders.

4) Respect: this means the team members are all equally and important, and they must respect each other's diverse, backgrounds, experiences, skills. Also, the team must show respect to the customer's feedback.

5) Courage: Courage is a critical value to an agile team's success, the team must feel completely safe to refuse unnecessary requests and to start asking questions when the potential of success is hindered. Courage is also about being unafraid when it comes to removing impediments that may cause an obstacle for team development [23].

C. The Scrum Team

The Scrum Team consists of three main members: the product owner, the development team, and the scrum master [13]. However, the team members are cross-functional and work together in the entire product backlog iteratively and incrementally to checking the updates. Accordingly, the Scrum team must comprise the five scrum values to ensure the success of Scrum practices because the Scrum team is the main aspect of the process of building the product [24].

Consequently, the scrum team must pay more attention to fit the organizational culture with the values of Scrum to guarantee the effectiveness of the Scrum process [25].

III. RELATED WORK

In the past few years, the study (Quantitatively measuring a large-scale agile transformation) presents a metrics model to measure the impact of agile transformations and their application in the context of a large-scale company. This study aims to compare the state of the organization before and after an agile and lean transformation. They used the methodology that begun to explore the quantitative metric model approach as an alternative to the qualitative studies; this metrics model was elicited with the use of the Goal Question Matrix (GQM) approach, which consisted of four questions, for each of these questions there were two metrics established. These metrics were meant to evaluate the result of the transformation from the traditional way of working. However, this contribution provides a preliminary insight into the quantitative approaches by analyzing the existing model metrics in an attempt to tailor specific direct measuring metrics oriented to Scrum values to assess the agility degree and the acceptance of the cultural shift from the traditional mindset in an organization by considering the team member's functionality and effectiveness.

IV. METHODOLOGY

The research methodology is designed in two parts, part 1 is tackling the solution rationale and the second part is about evaluating this solution.

A. Part 1

In this part, a form of a conceptual process model to achieve this research aim is illustrated in Figure 1. The consequence subsections show the detail of each activity of the process in Figure 1, as follow:

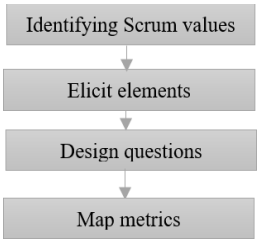

Fig. 1. The Value, Goal, Questions, and Metrics (VGQM).

A1. Identify Scrum Values

As been identified in the background section, scrum values are the major factors in the success of the Scrum methods implementation because they guide the Scrum team to obtain the desired goals [24]. These values and their descriptions have been mentioned in Table 1 from which elements were elicited for each value.

A2. Elicit Elements

These elements have been derived from the Scrum values description as the core value indicators that tend to be measured later.

A3. Design Questions

To measure these elements, we designed questions that address the values indicators. For example, commit to a task's time is the indicator that elicits from commitment values, to measure this indicator we established this question "How to measure the processing interval?". The following table shows

the different values, the elicited elements, and questions that address each element.

TABLE I. THE SCRUM VALUES, ELICIT ELEMENTS, AND THE DESIGNED QUESTIONS

values	Elements	Questions
1. Commitment	Commit to task's time.	Question 1: how to measure the processing interval?
2. Focus	Customer satisfaction	Question 2: how to measure the response time to the customer's request?
	Focus on the teamwork	Question 3: how to measure the degree of uncovered function?
3. openness	Customer feedback	Question 4: how to measure the openness to customer feedback?
	Team collaboration	Question 5: how to measure the degree of the organization's openness with the team members?
4. respect	Respect the customer	Question 6: how to measure the degree of respecting the customer?
	Respect among members team	Question 7: How to measure the degree of respect among the agile team members?
5. courage	Courageous to decisions make	Question 8: How to measure the degree of ability to say no to unnecessary tasks?
	Manager ability to remove inactive members	Question 9: How to measure the degree of courage inside the team?

A4. Map Metrics

Furthermore, relying on the previous sections, we reached the last level (Map Metrics) which represents the list of metrics; these metrics used by organizations to assess agile team members. The answers to these metrics give a measurement result to what extent the team has agile team values and that shows the level of the value in the agile team. We automated these metrics and answers in Excel to get the percentage of each metric.

A5. Metrics thresholds interpretation

The percentages from these metrics represent the level of each value within the organization. However, If the percentage is more than or equal to 50% that means this value is embedded in the organization and vice versa, except for metric 3 and metric 7 if the percentage is less than 50%, this indicates that the organization is embracing this value and vice versa.

TABLE II. ILLUSTRATES THE LIST OF METRICS AND ITS DESCRIPTIONS

Question	Metric	Description	Source
Question 1	Metric 1: LdTime = Tdel – Tdev	This metric calculates the lead time of the task by subtracting the time of delivery from the time of development. If the lead time is greater than the time box that indicates the team is not committed to the task's time.	[26]
Question 2	Metric 2: D = $\sum_{i=0}^{n} \frac{Sreqi - Creqi}{n}$	This metric is conducted to evaluate customer satisfaction by measuring the time that the team takes to solve the customer's request.	
Question 3	Metric 3: SDR=(nuf /tnf)∗ 100%	This metric evaluates The degree of the team's focus on work by measuring the number of uncovered functions by the end of product iteration.	[27]
Question 4	Metric 4: Collected directly from objective sources of data (for example logs, databases, etc.)	This metric measures the organization's ability to get the customer's feedback.	[26]
Question 5	Metric 5: Collected directly from objective sources of data (for example logs, databases, etc.)	This metric measures the degree of how much the organization is open with its employees	[26]
Question 6	Metric 6: LdTime =Tdel – Tdev	This metric assesses the degree of respect to customer's time by delivering the product at the end of the assigned time box	[26]
Question 7	Metric 7: Cross rate = (Croimp / TotTask) ∗ 100%	This metric measures the respect level inside the team by calculating the number of cross implementation that occurred by overstepping without regarding the permission of other teammates	[28]
Question 8	Metric 8: CourC = (RejUn / TotUn) ∗ 100%	This metric measures the level of courage with the customer by refusing unnecessary requests that may hinder the work process	[29]
Question 9	Metric 9: CourT= ActiveMember/totalMember)∗ 100%	This metric evaluates the manager's courage to remove inactive members from the team. The assessment of getting the number of inactive members is calculated by dividing the number of active members by the total number of members.	[30]

B. Part 2

B1. Case Study

In the last part of the methodology, several software companies were targeted to test the proposed method in Figure 1. These companies were the target based on their adoption of the Scrum method or they have the desire to do so. However, and due to recent COVID 19 outbreaks causes business disturbances, only one company named here as company X was able to communicate with us and implement the proposed method.

In the beginning, the company has been approached by the authors, and a PowerPoint presentation was presented to describe briefly the project aim and method. Soon the

presentation ends and approval was gained to carry on implementation.

B2. Project Setup

The study has implemented these methods on the software development team of company X. Company X has three internal units or departments. The first department is the software department, the second department is the infrastructure and the last one is the call center.

The software department has five teams, the first team-where the study has taken a place in-is called the enterprise solution team; this team consists of the team manager and three other employees. The other teams are the web development team and the consumer application team.

B3. Evaluation Interview

Finally, an interview was conducted to obtain overall feedback about the research whether the proposed were helpful to identify gaps concerning Scrum values hence aid improvement or not. A "face to face" interview was conducted with the scrum master and team to interpret expressions and reactions that help to better understanding and analysis.

B4. Ethical issues

In this research ethical issues were considered due to the data sensitivity of the company, which may affect its reputation [31]. Accordingly, to preserve the company's confidentiality a contract was signed with the company to guarantee the collected data only used for scientific purposes. Also, the company identity and employees are not comprised. Therefore, company X is used instead of the company's real name, and employees are referred to them by their roles.

V. RESULT AND DISCUSSION

A. Analysis

The data analysis was performed after the data collection. First, data were collected and recorded by the use of notes and tape recording. However, more than 80% of this data is documented and reported in the company database and the rest of the data collected were estimated by the software manager. The data is collected for all the company's projects which are three projects, two projects (P1 and P2) are finished and one project (P3) was still ongoing until the time of the data collection. Afterward, from the obtained data, the result was delivered by conducting a simple analysis using the EXCEL sheet.

The analysis for metric 1 requests the time of delivering the project and the start time of the development to get the lead time, then we compared it by the time-box of the project. The results show roughly 41,48%, which is low since the percentage in organizations should be above 50% due to the importance of high commitment in agile projects. However, the company should establish more policies to embed this value and to be more restricted regarding the project's time box to deliver the products and achieve all goals at the end of the iteration.

Metric 2, customer satisfaction, required the time when the request was solved (sreqi), the time when the request was created (Creqi), and the total number of requests (n). In conclusion, we couldn't get the result of this metric because the requests in the second project and the third project were under process until the day we collected the data on 16/7/2020.

While metric 3 the second metric on focus value, which measures the degree of the team's focus on the work by calculating the uncovered functions after delivering the product required the number of uncovered functions (nuf), and the total number of functions (tnf). The result from this metric is 4% on average, which means the company is efficient at solving almost all functions (96%), and the team who is responsible to implement the operation is fully functional, effective, and practically focused on their given work.

Metric 4, assess the degree of openness with customers by getting the data from an objective source considering the rate of regular meetings with customers. The result of metric 4 is 47% on average. However, this result declares that the company needs to be transparent with the customer by involving them more in the project innovation, and they need to put on more work to achieve this goal.

Metric 5 assesses the openness among the team members by getting the data from an objective source considering the rate of regular meetings with customers and if they are involved in the planning process. The result is 90% on average, this means the team members are fully integrated into the project development, and they're accepting the changes, alternatives, and new ideas from each other. In conclusion, the company has achieved success in embedding this goal.

Metric 6 shows the degree of respect with the customers, and this is identified by delivering the product on time and not delaying it. From this metric, we get the result of 41, 48% on average, and accordingly, this is considered as a low degree. Therefore, this poor percentage may have occurred as a result of a delay in the project schedule. In conclusion, there must be stricter policies to ensure that the schedule is going as planned.

Metric 7, the level of respect among the team members, required the number of cross implementation tasks and the total number of tasks (TotTask). The result is 1.72%. However, it is a good percentage that indicates the team members in the company are respecting each other independence and capability in terms of knowledge and experience.

Metric 8, the courage with the customer, requests the number of rejected unnecessary requests (RejUn) and the total number of unnecessary requests (TotUn). In this metric, we get 100%. However, standing up to customers takes confidence from both managers and team members, so this result means that the company has succeeded to form a constant and solid culture to deploy this value.

Metric 9, courage inside the team, requests data about the number of active members (ActiveMember) and the total number of the team members (totalMember). Form this metric we get the result of 88,89% on average, this result shows the capability of the manager to remove any kinds of impediments that may slow the team down, which indicates that this agile value is fulfilled successfully in the company.

The following table shows the projects results and the overall result of the metric:

TABLE III. SUMMARY OF THE METRICS RESULTS

Value	Metric	Result per project	Metric overall result
Commitment	Metric 1: LdTime = Tdel – Tdev	P1:100% P2: 20.39% P3: 4.03%	41.48%
Focus	Metric 2: D = $\sum_{i=0}^{n} \frac{Sreqi-Creqi}{n}$	P1: 3% P2: inapplicable P3: inapplicable	inapplicable
	Metric 3: SDR = (nuf /tnf) ∗ 100%	P1:6% P2: 5% P3:1%	4%
Openness	Metric4: Collected directly from objective sources of data (for example logs, databases, etc.)	P1: 100% P2:10% P3:30%	47%
	Metric5: Collected directly from objective sources of data (for example logs, databases, etc.)	P1:90% P2: 90% P3: 90%	90%
Respect	Metric 6: LdTime = Tdel– Tdev	P1:100% P2:20.39% P3:4.03%	41.48%
	Metric 7: Cross rate = (Croimp/ TotTask) ∗ 100%	P1:3% P2:2% P1:1%	1.72%
Courage	Metric 8: CourC = (RejUn / TotUn) ∗ 100%	P1:100% P2: - P3: -	100%
	*Metric 9: CourT = (ActiveMember /totalMember) *100%*	*P1:100% P2:66.67% P3:100%*	*88.89%*

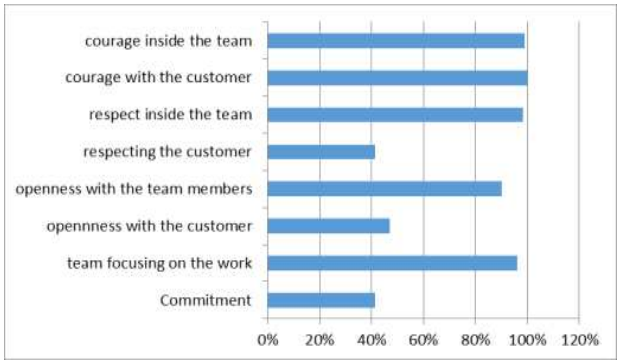

Fig. 2. Represents the Scrum values percentages in the company.

B. Evaluation Interview

To evaluate this assessment, we arranged for a focus group interview with the Scrum team who is the subject of our case study, we applied the interview on the entire scrum team including the scrum master (software manager) and the assigned development team.

We asked the software manager and the development team three open-ended questions to get their feedback:

Q1: What is your opinion about this research?

The scrum master answered: "I think it's a very useful study, and I benefited from it because it drew my attention to the importance of the agile team values in embedding the agile and in implementing it in the right way. Also, this assessment method came at the right time to our company because we observed that our agile implementation becoming more restricted and more difficult to follow with each project to the next one".

The team answered:" The research idea is excellent and outstanding, it sheds the light on the importance of agile culture and how these values are essential to implementagile methodology efficiently within the organization"

Q2: What is your opinion about the way of assessing Scrum values?

The scrum master said: "they are very good metrics, especially the metrics that evaluate the commitment, respect, and courage values, because before I had a different perspective of what these metrics actually mean and now I think I understand them right".

The team added: "The metrics are really good. But when it comes to measuring the commitment value, other external factors should be considered, such as the lack of resources and the postponement that occurred regularly from the partnership with other companies which may hinder the aspect of committing to the project's time"

Q3: What is your opinion about the assessment outcomes?

The scrum master answer was: "I think the outcomes of the commitment, respect, and courage are fair and true, but on the other hand the focus on the work must include a quality assessment for the end product because sometimes we send the project on the assigned time-box but the quality is always noticed to be less than the customer's expectations". He added that: "the openness with the team percentage is higher than the reality, because I actually believe we don't make sure that every team member attends meeting regularly, and we also don't make sure that they always give their feedback".

Most of the team said: "the metrics results are reasonable and the interpretations are sufficient. But, one of them saw that some results of the metrics that related to customer evaluation in M2, M4, and M6 may be underestimated, and on the other hand, results from which its metrics measure the development team in M3, M5 and M7 may be overestimated."

C. Discussion

This research should answer the research questions based on its results, which is:

RQ1: How to assess the Scrum team culture?

This question is answered in section methodology three, which used Goal Question Metrics (GQM) approach that developed an assessment method that contains different metrics, each metric is used to assess specific Scrum team value and some values contain more than one metric to measure it.

RQ2: How to evaluate this assessment?

This question was answered in the previous section, to evaluate the assessment method we applied an interview with the software manager and the development team of company X to get thier feedback about the research, metrics, and outcomes.

VI. CONCLUSION AND FUTURE WORK

A. Conclusion

Agile methodology has become the most adopted approach which helps the industry in developing software by delivering better outcomes than plan-driven processes. However, the cultural shift and adopting more policies to establish the agile culture is essential for agile success within the organization, therefore scrum is the most adopted approach for its ability to ensure the transition success of the new culture and its values.

So this research comes in place to help industries to implement agile in the right way by measuring the Scrum values on the team according to an agile cultural point of view.

The research methodology shows the conceptual model which is containing the steps to develop the Goal Question Metric (GQM) approach. The GQM approach created the research assessment method to investigate the Scrum team values in organizations. The developed assessment method was implemented in a company X in Sudan as a case study to measure the Scrum team values, then provide interpretation about each value assessment result. After that, the assessment method was evaluated by getting feedback from the organization if it helped them ornot.

B. Limitations

- In the second metric of focus (measures customer satisfaction), the requests were still being processed and that's the reason the data were inapplicable in the second and third projects, and that why we were unable to obtain the metric result.
- In our assessment method, we did not take into account developing a metric that assesses the quality of the function which may have affected the result of the metric (focusing on the work). However, the obtained results were good, but it did not contain a measurement process to evaluate the quality of the delivered work.
- The assessment method did not consider the other external factors which may hinder the aspect of committing to the project's time.

C. Future work

- The research should contain more than one case study to validate the research current outcomes.
- As has been mentioned in the limitations section, there should be an additional assessment metric to verify values in more depth.

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