Exploring the Use of Software Metrics in Saudi Enterprises: A Case Study

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Abstract: This study was aimed to evaluate the application of software metrics used by the software enterprises present in Saudi Arabia. Extensive literature reviews were conducted to comprehend the current body of knowledge on the use of software metrics in Saudi enterprises. These literature review and studies elapsed approximately two decades. Based on the drawbacks, shortcomings, and fallacies of the existing studies a series of interview questionnaires were developed. Interviews were conducted for collection of real-time and actual data. Around seven Saudi enterprises were selected, and each enterprise was considered and regarded as a unit, and the manager of the enterprise was acting as a unit for our case study. 40 managers were interviewed, and their responses were analyzed. Respondents' responses indicate that the software is useful enough to support business processes. In an attempt to assess the complexity of implementing this software, effective feedback was received, suggesting that there is a lack of communication between the developers and managements' intent. Moreover, the findings of this study showed that the organization need to give more attention to quality and productivity management. In addition, the results indicate that when agile development is undertaken through software effectiveness, the enterprise's services are implemented appropriately.

Keywords: Agile Approach; ISO 9000; Saudi Enterprises; Software Metrics, Software Processes

1 INTRODUCTION

Software metrics are the measurement of measurable or numerical properties of software. The studies by Psomas et al. [2] and Fenton and Bieman (2019), stated that Software metrics are an essential part of the software engineering situation. More and more customers are quoting software reports or quality metrics as part of their contractual requirements [38, 39]. Measurement standards include industry standards such as ISO 9000 and industry models such as the Integration of the Functional Maturity Model (CMMI®) of the Institute of Software Engineering (SEI). Enterprises use metrics to understand better, monitor, manage, and forecast software projects, processes, and products. Measuring software metrics can provide engineers with the information they need to make technical decisions and manage them. If metrics are intended to convey useful information, its definition and purpose should be understood by all those involved in the selection, design, implementation, collection, and use of the scale. Sometimes one metrics can become a management problem, overestimated at the expense of other signals, and eventually disrupt behavior [40]. In recent years, examples from many of the agency's user departments have focused too much on the number of services per client. Software metrics are useful: the willingness of customers to purchase several services can be a sign of an enterprise's health. In this case, however, the first is an important issue, and there is no right balance in customer care. In some cases, frontline workers have tried to improve cross-selling, but have harmed the enterprise and customers at the expense of trust and relationship. Moreover, many enterprises were facing issues that which software metrics they should go for in terms of reliability; software quality forecasting is another area where software units can play an important role [41]. Again, some special models on the market can help with this problem, but the debate over their accuracy continues. Whether the customer or developer's point of view needs to control the cost of testing and certification, this need exists [40]. Various

technologies are currently available, and this area will become more critical in the future [2]. The software measurements are all related to the measures, and the measurements contain numbers. Use numbers to improve things, improve the software development process, and improve all aspects of managing that process. Software metrics are valid throughout the development lifecycle, from the initial phase (the price should be assessed) to monitoring the reliability of the final product in this area and how the product is continuously being improved over time [5, 42, [43]. According to Aba and Badar [4], the software metric is explained as "Continue to implement the software development process and measurement technology for its products to provide relevant and timely management information and use these methods to improve the process and its products."

Software metrics are essential for several reasons, including measuring software performance, scheduling tasks, measuring productivity, and more [1]. Some measurements reflect only a portion of an enterprise's performance, but no other significant factors. The study by Begosso et al. [3] stated that call centers that can track the average waiting time for customers are great. Still, there may be more important information in calculating the percentage of issues resolved during the first call. Another example is that click revenue analysis is a popular part of "performance marketing". Compared to metrics such as brand value, how marketing costs affect the value of enterprises and revenues that can be directly related to marketing, these figures make more sense. Although they are more challenging to measure than to click, these measurements are precious [3]. Measuring sales performance can be challenging. It is easy to inflate the income of each sales representative (joint action) with marketing costs and discounts, but the problem is that not all income is of equal value. Like most enterprises, enterprises that sell a variety of ROI products must recognize that some of the revenue is more profitable. At the same time, an enterprise may want to encourage sales from new regions or customers who are more challenging to get than upgrading

existing accounts, but love is helpful. Software enterprises share all revenues equally for several years when calculating the price of sales quotas. Thus, there is no difference between the software's income (high margin) and the professional service that the enterprise provides for software management (very low or even negative margins). Finally, the enterprise solved the problem by carefully assessing the margin of each product and resorting to quotas limited to these numbers. Today, more sophisticated enterprises use digital escape to test their metrics [40]. For example, you can use your email traffic and calendar analysis to determine how often your sales channel interacts with critical customers. In the weeks leading up to the end of the quarter, if this use does not show significant interaction with customers, it is best to reduce the likelihood of sales to that customer carefully. Many business organizations and measures have taken the opportunity to introduce improved hygiene measurements, which may change their performance in the future. This includes retailers moving from economic valuation to business value assessment; sales representatives are replacing general sales efficiency standards, converting leading division valuation and R&D in general from business monitoring to recycling and sustainability calculations [3].

The software measurements involve the use of technicians by engineers or programmers to identify faulty components as long as they encode and manage the project to detect as early as possible that it has a lifespan of half a year delay instead of days [6]. There are many ways to use software metrics, some of which are almost professional on their own. There are many ways to share the field of software measurement [7]. The most advanced area of software measurement is cost and size estimation technology [37] [44]. There are many custom software packages on the market that provide estimates of the size of the software system, the cost of the development system, and the duration of the development or improvement project. This software is based on planning models, the best known of which the construction cost model is developed by Barry Boehm, which was then updated based on the experience of many enterprises and individuals [3, 34]. Extensive research has been conducted in this area, and research is continuing in the United States, Europe and elsewhere. Most are funded by the United States Department of Defense, governments around the world, and the European Economic Community. The result of this study is one thing, which means that organizations cannot rely solely on the use of their software packages [8]. Measuring software development projects through measurement has received a lot of attention in Europe and the United States. This has become more relevant for the increase in fixed price agreements and the use of fines for software development customers, not to mention outsourcing, facility management or "cooperation" agreements [9]. The enterprises should use metrics to decide where their changes should go. Early measurement of soft factors can often provide a useful overview of how a process works and provide business benefits by improving performance in key areas such as time to market [10, 13, 32, 43].

This study helps us in examining the agile method of in the Saudi enterprises that is the framework to address the adaptive complication issues for the product delivery with the high possible value. The result of this article is focusing on the software metrics which are not meaningful, or imperfect can have the significant impact on the overall performance and the leading management of the enterprises' situated in the Saudi. Due to the poor performance of the software metrics leading the management of Saudi enterprises were making the poor decisions which hurt the overall performance of the enterprise.

2 LITERATURE REVIEW
2.1 Software Processes Used by Saudi Arabian Companies

Saudi Arabian enterprises need software methods that are offered quickly. In most cases, employees of a Saudi enterprise expect that agile methods are more useful and relevant than forecasting methods. Although engineering methods have been applied, special instructions must be followed. It has been found that the use of forecasting methods does not accept possible changes in roadmap modification [11]. As an expert in business analysis, the availability of agar software solutions is becoming increasingly popular. Also, it should not further complicate software operations compared to forecasting solutions. As there is evidence of more excellent resistance to consent whenever they try to make new changes, the ideal approach is to establish a collaborative and agile approach with strong predictive power [32]. Agile methods can make significant changes and achieve satisfactory results [12]. To support an eternal plan, they can support the changes required to achieve long-term success in any business. Changes are welcome with agile methods. Managing the Saudi environment is a human rather than a process-based process, and enterprises prefer to use agile approaches to implement agile methods effectively. Using agile methods, develop short-term adaptive plans [24, 45].

Software measurement is the measurement of measurable or numerical properties of software [46]. Software metrics are essential for several reasons, including measuring software performance, scheduling tasks, measuring productivity, and many other purposes [14]. There are many interconnected invoices in the process of software development. Software indicators relate to four management functions: planning, organizing, managing, or improving.

2.2 Impact of Software Metrics on Saudi Arabian Enterprises

Several studies stated that if the Saudi enterprises implement software metrics, so it helps the enterprises in monitoring and managing through qualitative measurements is essential for the success of any project [4, 14, 16]. Relevant metrics explain how measures can be applied to improve processing of Saudi enterprises by providing objective methods for characterizing processes and assessing the impact of process changes [15, 35, 38]. Saudi enterprises can also be used as a diagnostic tool to help the quality control team identify the cause of problems or fail to achieve

pre-defined objectives. The same is true of the Ministry of Education's GRP project [16].

2.3 Improve Transport Performance

The decision to go to the next level depends mainly on the availability of all current/previous period deliveries. As the implementation of an ERP system on Saudi enterprises requires a lot of investment, it can lead to considerable time costs, additional investments, and business losses even if the deadlines are not met. To avoid such costs for customers, Saudi enterprises should implement software metrics which helps in identifying effective measures and collect relevant data to ensure that all deadlines are completed before the deadline and, where necessary, implement software metrics [18, 29]. Achieving satisfactory delivery results is the most important challenge for ERP implementation and development of Saudi enterprises. When implementing ERP, the planning method (waterfall) is usually followed, where each step gives some achievements [17, 28].

2.4 Improve the Quality of Processes

Improving data quality is essentially a series of steps to achieve quality objectives by identifying, analyzing, and improving existing processes [38]. This requires a continuous review of the implementation of current strategies and the necessary corrections in case of problems [48]. Saudi enterprises can achieve this with appropriate metrics that can clearly show whether the process is in line with pre-defined objectives and meets customer expectations by providing quality ERP systems. Metrics can provide an overview of all aspects of the process and identify areas for improvement for the Saudi enterprises. Therefore, there must be appropriate evidence to manage quality control throughout the lifecycle of ERP implementation [19].

2.5 Improve Product Quality

Product quality is generally measured according to pre-defined specifications, standards, and expectations [38]. Deviations from these criteria, standards and expectations can lead to product degradation, such as loss of functionality, poor reliability, and reduced deliveries. Improving the quality of the ERP system is essential for Saudi Arabian enterprises, as it is the basis of all future enterprises. The poor quality of an enterprise's disruption can have severe consequences for the organization [39]. Also, operators need to ensure the high quality of the ERP system on offer, as failure to achieve this goal may lead to its exclusion from ERP consulting in a competitive environment [20].

2.6 Improving Productivity (Efficiency)

Appropriate resources can be used to improve the implementation and development efficiency of ERP in the Saudi Arabian enterprises. Resources must be used in a way that lacks resources and does not create competition for the enterprises working in Saudi Arabia. The productivity meter provides an overview of the reasons for high and low productivity. Poor productivity can be due to inexperienced teams, inability to use the right resources, poor management control over team members, and early evaluation of efforts. Higher productivity can also be misleading, for example, because the product quality objective was not achieved at the beginning of the project and was not adequately implemented [21, 41, 47]. Therefore, the quality assurance team of Saudi Arabian enterprises needs to identify and collect appropriate productivity measurements and investigate the reasons to ensure that the implementation of ERP can achieve the set goals. Sufficient productivity and that there are no false-positive results that would undermine the objectives of ERP implementation [22].

3 DATA ANALYSIS

This section of the study explains, and analyses of the data gathered through qualitative methods using interviews conducting with the top management and the managers of the Saudi companies that are using and working on the software metrics [23]. The results of the study are further divided into different parts to formulate the themes. Moreover, this section of the article represents the correct image of the companies that are involved in the study while collecting the data and conducting an interview with the top management and the managers of the selected companies [24].

3.1 Software Process Implemented by the Saudi Companies

The results of the interview conducted by the manager of Saudi company showed that the companies in Saudi Arabia needed to adopt the mechanism of the software like this is provided by the Methods of Agile [25]. The managers of the Saudi company generally expect the Agile techniques are more effective and useful than the other predictive methods. Moreover, the different methods of engineering are mainly implemented effectively so fulfil the needs of the individual roadmaps to track the records. The results of the interviews also showed that the when the software metrics and predictive approach have been applied the changes are not effectively adopted well when making the change with the help of roadmap [26].

Changes in management policy reviews are positive and related to changes in management techniques. It is also found that as management technology changes, all operations continue to run smoothly [27, 33]. Some have commented negatively on the ineffectiveness of the policy, mainly due to staff, lack of communication and poor policy implementation. Managers and managers respond positively to results and procedures, and managers should interact with users and employees [28].

End-user feedback was positive, and lessons learned. The level of understanding of the system is high, and the efficiency of implementation is high. However, there are still some complaints, but they are optimistic about the choice of software. The comments on the basic structure are favorable due to problems in the work of the technology group. For all challenges, material costs are very profitable [29]. Some comments on this basic structure are negative because the

system is complex, and the server-to-server relationship is unsatisfactory. However, the organizational culture of the organization has a positive effect. All problems were resolved on time with negative consequences, as the issues were not resolved quickly and the IT team also resolved IT issues efficiently [30].

Respondents said they did not have enough cost experience and decided to take advantage of profitability. However, the quality of staff training is high and positive, as the study materials and documents are good [31]. The staff handbook and the training process are very useful, and the people responsible for the training are well organized. The shortcomings of the training have not received enough attention from the management [32].

3.2 Identify the Software Processes Used by Saudi Arabian Companies

For a Saudi company, the value of the people adds unique qualities to the project, not sensible organization and management. When efficient software is used to develop agile development, the company's services are implemented correctly. There are many possibilities for implementing engineering services [33]. Scrum, Extreme Programming and Lean Development are the methods commonly used in the proposed methodological approach. Agile methods are created in the form of a manifesto, which is considered a universal element. They can build software reliability to prove their pros and cons. When scrum has implemented various programming software technologies for enterprise management services, it has proven to be very effective.

Saudi Arabian companies need to develop management-oriented services. Scrum is effective in software programming and generally focuses on management performance. The software must be developed through scrum with efficient management-based performance [26]. Thanks to the careful monitoring, inspection and control of scrum's software technology, these management tasks can be implemented effectively. Saudi Arabian companies need to hold regular meetings to manage scrum's software development most efficiently. Engineering practice in Saudi Arabian companies has proven to be the most suitable for scrum's development software [34]. Some have found that employees work best in a controlled environment through on-site meetings. The success of a project is rarely emphasized because the effectiveness of the Scrum method can be used in project management. Extreme programming practices in inter-engineering development create software with scrum's methodology that gets the best control. Saudi Arabian companies need to adopt significant results and implement them where possible to promote effective engineering management [35].

4 CONCLUSION

The result of this article showed that the use of software metrics for quantitative software review is also a recognized area. Extensive research has been done, and some organizations have used this technology successfully. This software measurement area is also used to monitor current software products that need improvement. Reasons for choosing existing software for this area are accessibility, low prices and other value-added services, such as the ability to create applications and projects between departments. Agile scrum was chosen as analysis or business management software due to its ability to compare project schedules. Respondents' responses indicate that the software is useful enough to support business processes. In an attempt to assess the complexity of implementing this software, positive feedback was received, suggesting that such issues are not being addressed. Extensive production and processing capacity and availability are the most interesting factors in assessing the benefits of the software. Analysis of the advantages and disadvantages of using software that needs to restore the integrity of the management team.

This study is helping in understanding the root cause that lies in the company related to the historical metrics, which mainly measures what is effectively possible to tract when these measures were developed not what can or should be measure. This study also contribute to the management and the operations of the Saudi enterprises so that the management can be able to use the results of this study to underline the types of metrics can be suitable for the company. This study also helps the companies in gaining the competitive edge among their competitors in the Saudi Market.

Finally, this study helps in understanding the most common uses of software metrics: providing administrative information. This includes information on the productivity, quality and efficiency of processes. It is essential to understand that this is an ongoing activity. They can use a snapshot of the current situation, but when they see progress in the data, the most valuable information is displayed [36]. Does productivity or quality improve or decrease over time? If so, why is that? What can leaders do to make things better? Communicating management information is both an art and a science. Statistical analysis is one of them, but it must be presented at the right time and for the right reason in a way that managers can use [37].

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