International Journal of Computers and Informatics (IJCI)

Vol. (2), No. (6)

المجلة الدولية للحاسبات والمعلوماتية

الإصدار (2)، العدد (6)

October 2023

"A Proposed Approach for Monitoring Information Systems Projects"

Oweeda Basel
M.Sc. of Business Administration, Project Management, University of Kirkuk, Iraq
Consultant of Institutional Development, ARWAK, Arab Emirates
baselabed@uokirkuk.edu.iq

Khalaf Majeedy
M.Sc. of Business Administration, Project Management, University of Kirkuk, Iraq
Khalaf.majeedy@uokirkuk.edu.iq

Abstract:

This paper aims to evaluate the performance of Information Systems Project Management (ISPM). It clarifies the relationships between ISPM domains, performance metrics, and performance indicators. This paper presents a proposed list of metrics for ISPM. Based on these ISPM metrics and a combination of statistical techniques, we built a model for calculating ISPM performance indicators. The quality reviewers can use this model to evaluate and track the performance of IS project managers.

Keywords:

Projects Management, Software Projects, Metrics, Measures, Performance Indicators.

1- Introduction

A metric is a quantitative measure of the degree to which the project manager performs ISPM domain. The metrics can be used for measuring the performance of

the project manager in IS projects. They can be useful in extracting performance indicators that can help in increasing capability level and productivity, improving quality, tracking project progress, and assessing project status. An indicator can be defined as a function of metrics. Calculating metrics is a simple process because it depends on simple or known statistical or mathematical formulas such as percentage, ratio, present value, and time deviation (in hours, days, weeks, or months). On the other hand, calculating indicators from metrics is not easy process because the indicator value may depend on a combination of metrics and each of them doesn't have the same level of importance and they may not have the same nature [1].

The rate of failure in large IS projects is larger than the rate of success [12]. So, there is a need to a set of performance indicators that may help for managing ISs projects to reduce the failure rate of these projects. The mismanaged projects may lead to the following results: unfulfilled or unidentified requirements, uncontrolled change of project scope, uncontrolled change of technology, uncontrolled risk of the project, uncontrolled subcontracting and integration, cost overruns, and/or late delivery [8].

The problem is that there are no agreed or clear performance indicators that can be used for evaluating ISPM practices. The process of evaluating performance indicators is very complicated and there are no clear or sufficient techniques for this process. For previous reasons, evaluating the performance indicators is the main concern of this paper.

2- ISPM Domains and Phases

ISPM activities can be organized in ISPM domains, and each domain includes a set of activities related to a specific field in ISPM practices. From our survey, ISPM domains include project scope management, project schedule management, project costs management, project integration management, project quality management,

IJCI, VSRP Publishing, UK
https://ijci.vsrp.co.uk
E-ISSN 2976-9361
https://doi.org/10.59992/IJCI.2023.v2n6p1

project human resources management, project communication management, project risk management, project subcontracting management, project documentation management, users' participation management, review and approval process management, systems development management, and feasibility study management.

ISPM activities are encountered throughout the project life cycle. So, ISPM activities can be organized in life cycle phases. Each phase includes activities, and each activity can be achieved through steps by using standards. A common ISPM life cycle includes the phases [7]: initiating the project, planning the project, executing the project, and closing the project.

3- Key Performance Metrics and Indicators

Performance measurements are used in project management and quality processes to determine and communicate status and accomplishments measured against specific objectives, schedules, and milestones. These measurements extend to include the delivery of desired products and services to customers, whether external or internal [2]. Performance measurement can be useful to improve future work estimates [11]. Performance measurement is the ongoing monitoring and reporting of project accomplishments, particularly progress toward pre-established goals. Performance measures may address the type or level of project activities conducted, the direct products and services delivered by a program, and/or the results of those products and services [1].

3-1 Key Performance Indicators for ISPM Domains

Metrics should be objective, timely, simple, accurate, useful, and cost-effective. An indicator may be extracted from a metric or a combination of metrics. Figure (1) illustrates the relationships between ISPM domains, metrics, measures, and indicators.

IJCI, VSRP Publishing, UK
https://ijci.vsrp.co.uk
E-ISSN 2976-9361
https://doi.org/10.59992/IJCI.2023.v2n6p1

International Journal of Computers and Informatics (IJCI)

Vol. (2), No. (6)

IJCI

المجلة الدولية للحاسبات والمعلوماتية

الإصدار (2)، العدد (6)

October 2023

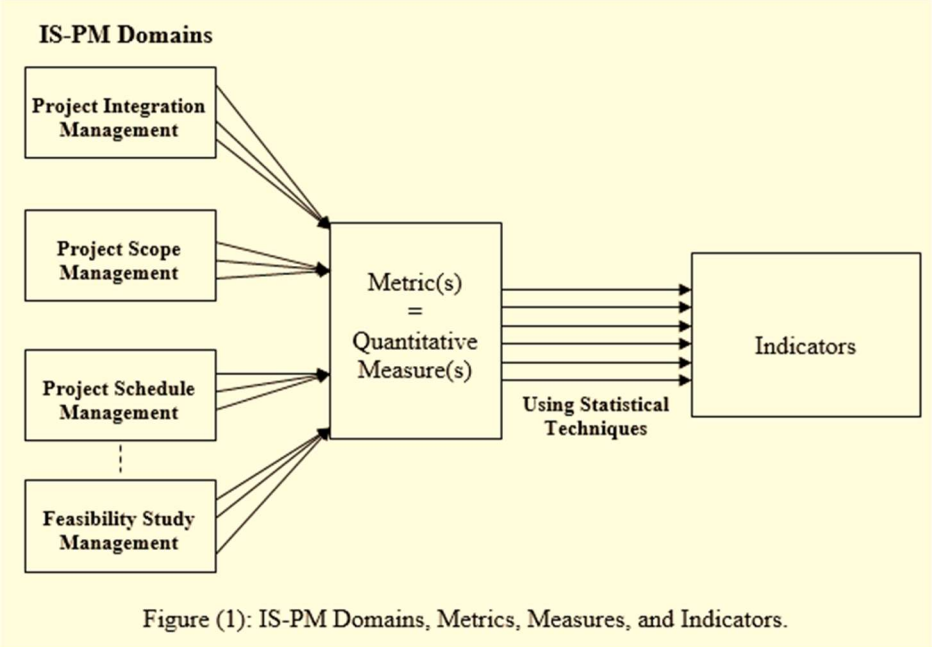

Figure (1): IS-PM Domains, Metrics, Measures, and Indicators.

The typical performance measurement for an ISPM domain includes identifying performance metrics, collecting measurement data, calculating metrics, and calculating performance indicators.

The performance metrics can be divided into three basic categories: measures of efforts, measures of accomplishments, and measures that relate efforts to accomplishments [1].

- Measures of efforts: Efforts are the number of resources, in terms of money, people, etc., applied to a project. Examples: The amount of money spent, and the number of person-hours burned on a project.
- Measures of accomplishments: Accomplishments are milestones achieved with the resources used. Examples: number of modules coded and number of deliverables.

IJCI, VSRP Publishing, UK
https://ijci.vsrp.co.uk

E-ISSN 2976-9361
https://doi.org/10.59992/IJCI.2023.v2n6p1

- Measures that relate efforts to accomplishments: These measures are associated with resources or costs relative to accomplishments achieved. Examples may include amount of money expended for the portion of the project completed versus the amount of money planned to be expended for this portion of work.

Table (1) presents examples of ISPM performance metrics. These performance metrics include the three categories of performance metrics.

Table (1): Examples of Performance Metrics for ISPM Domains.

ISPM Domains	Performance Metrics
Project Scope Management	• No. of business areas involved in the project scope. • No. of users involved in defining scope and deliverables. • No. of acceptance and approval criteria identified for the project. • No. of assumptions and constraints identified for the project. • No. of modifications of the project scope statement. • No. of meetings of the project team. • No. of scope changes requested, documented, and analyzed. • Percentage of users involved in defining scope and deliverables vs. total number of users. • Percentage of scope management procedures applied vs. planned. • Percentage of project deliverables reviewed and approved vs. achieved. • Percentage of major milestones met vs. planned. • Average ratio of feasibility studies to scope change requests. • Average ratio of integration tests related to scope change requests. • Average ratio of configuration management tests related to scope change requests.
Project Schedule Management	• No. of identified activities in Work Breakdown Structure (WBS). • No. of modifications of the approved plan. • Percentage of schedule management procedures applied vs. planned. • Percentage of major milestones met vs. planned. • Percentage of project deliverables achieved vs. planned. • Slippage time of the project schedule (in days).

IJCI, VSRP Publishing, UK
https://ijci.vsrp.co.uk
E-ISSN 2976-9361
https://doi.org/10.59992/IJCI.2023.v2n6p1

3-2 Quality Metrics for ISPM Domains

There are many ISPM performance metrics that are not have the same degree of importance or efficiency in measuring the performance of IS project managers. So, we proposed a set of ISPM quality metrics. ISPM quality metrics are the most important or efficient performance metrics for each ISPM domain. So, we can say that the set of ISPM quality metrics is a subset of the set of ISPM performance metrics. Figure (2) illustrates the relationships between quality metrics, performance metrics, and performance indicators.

ISPM quality metrics can be effectively used in calculating performance indicators. Table (2) provides examples of the proposed quality metrics for ISPM domains. Appendix (B) includes a list of these proposed quality metrics. We classified the proposed ISPM quality metrics into two categories:

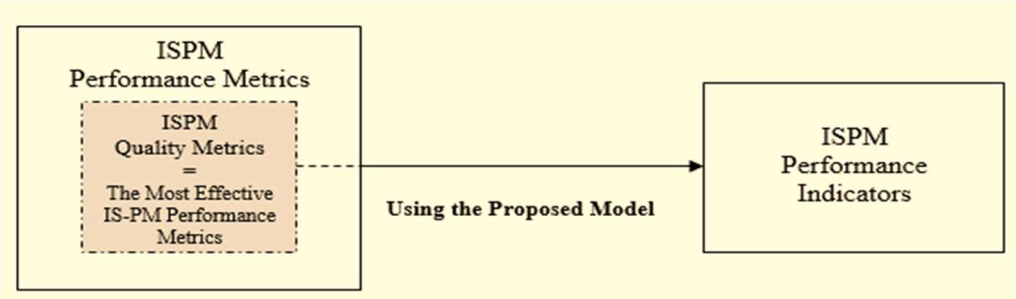

Figure (2): Quality Metrics, Performance Metrics, and Performance Indicators.

Category "Q": It can be used to give a quick vision of the performance of the IS project manager. So, they are called "Q" or "Quick". Category "R": It includes the rest of ISPM quality metrics. So, they are called "R" or "Regular". If the quality group decides to evaluate the detailed performance of the IS project manager, they should use the two categories "Q" and "R" in calculating performance indicators.

E-ISSN 2976-9361
https://doi.org/10.59992/IJCI.2023.v2n6p1

Table (2): Examples of Quality Metrics for ISPM Domains.

ISPM Domains	ISPM Quality Metrics	Type
Project Scope Management	Percentage of users involved in defining scope and deliverables vs. total number of users.	R
	Percentage of scope management procedures applied vs. planned.	R
	Percentage of project deliverables achieved vs. planned.	Q
	Percentage of project deliverables reviewed and approved vs. achieved.	Q
	Percentage of major milestones met vs. planned.	Q
	Percentage of project team meetings vs. planned.	R
	Average ratio of feasibility studies to scope change requests.	R
	Average ratio of integration tests related to scope change requests.	R
	Average ratio of configuration management tests related to scope change requests.	R
Project Schedule Management	Percentage of schedule management procedures applied vs. planned.	R
	Percentage of tasks completed vs. planned at a point of time.	R
	Percentage of major milestones met vs. planned.	Q
	Percentage of project deliverables achieved vs. planned.	R
	Slippage time of the project schedule (in days).	Q

4- The Proposed Model for Calculating Performance Indicators

Calculating indicators is not an easy process because the indicator value may depend on a combination of different metrics. So, we propose a simple model for calculating the performance indicators for ISPM domains. Figure (3) illustrates a general flowchart that presents the proposed model. The proposed model includes the following main procedures:

IJCI, VSRP Publishing, UK
https://ijci.vsrp.co.uk
E-ISSN 2976-9361
https://doi.org/10.59992/IJCI.2023.v2n6p1

1. Define quality metrics, weights, and required implementation range for ISPM domains.
2. Calculate the quality metrics for an ISPM domain.
3. Input the data of the quality metrics.
4. Calculate the performance indicator.
5. Interpret and analyze the performance indicator.

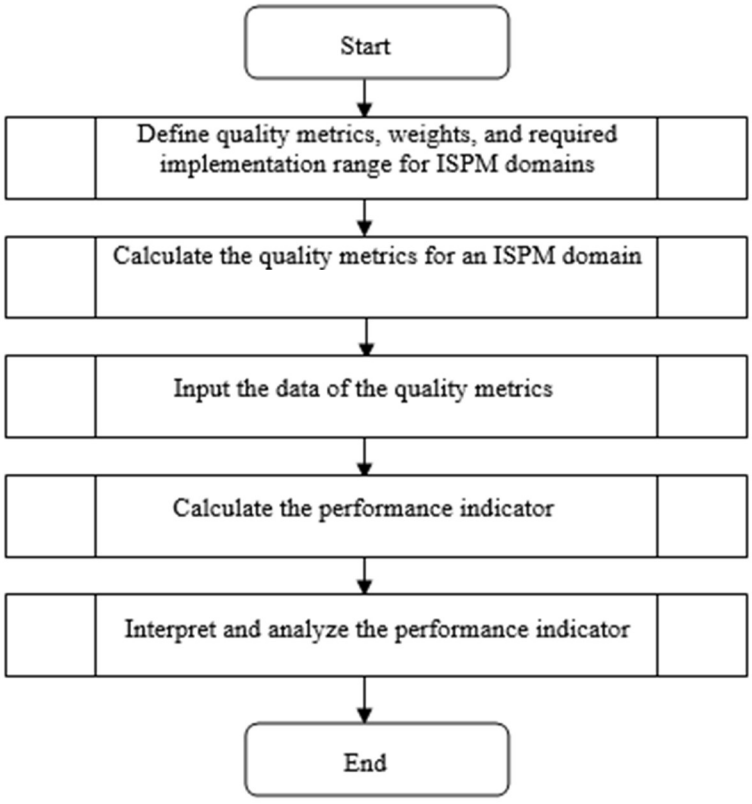

Figure (3): The Proposed Model for Evaluating the Performance Indicator.

IJCI, VSRP Publishing, UK
https://ijci.vsrp.co.uk
E-ISSN 2976-9361
https://doi.org/10.59992/IJCI.2023.v2n6p1

4-1 Define ISPM Quality Metrics

The quality group should define quality metrics for ISPM domains. The definition of each ISPM quality metric should include the mathematical or statistical techniques for calculating this metric. The quality metrics for a specific domain are not having the same level of importance. So, each metric must have a weight of 1, 2, or 3. Weight is a measure of the importance of each metric. A weight 3 is used to show the quality metric of the most importance. A weight 1 is used to show the quality metric of the lowest importance. A weight 2 is used to show the quality metric of the average importance. So, the quality group should determine the appropriate weight for each quality metric that is required for calculating the performance indicator for each ISPM domain.

Also, the quality group should determine the required implementation range for each ISPM quality metric. The required implementation range is the acceptable range of the quality metric. The time check points for calculating the ISPM quality metrics. These metrics can be calculated weekly as a part of the project progress report. The project manager should be involved in this process. The quality group should present the ISPM quality metrics to the project manager and deal with his objections by clarifying, negotiating, or modifying these metrics.

The previous experience from similar projects can be useful in this process. Also, this process can be achieved with the assistance of external consultants to define and validate the ISPM quality metrics. Figure (4) illustrates a flowchart that presents the algorithm of this procedure.

IJCI, VSRP Publishing, UK
https://ijci.vsrp.co.uk
E-ISSN 2976-9361
https://doi.org/10.59992/IJCI.2023.v2n6p1

International Journal of Computers and Informatics (IJCI)

Vol. (2), No. (6)

IJCI

المجلة الدولية للحاسبات والمعلوماتية

الإصدار (2)، العدد (6)

October 2023

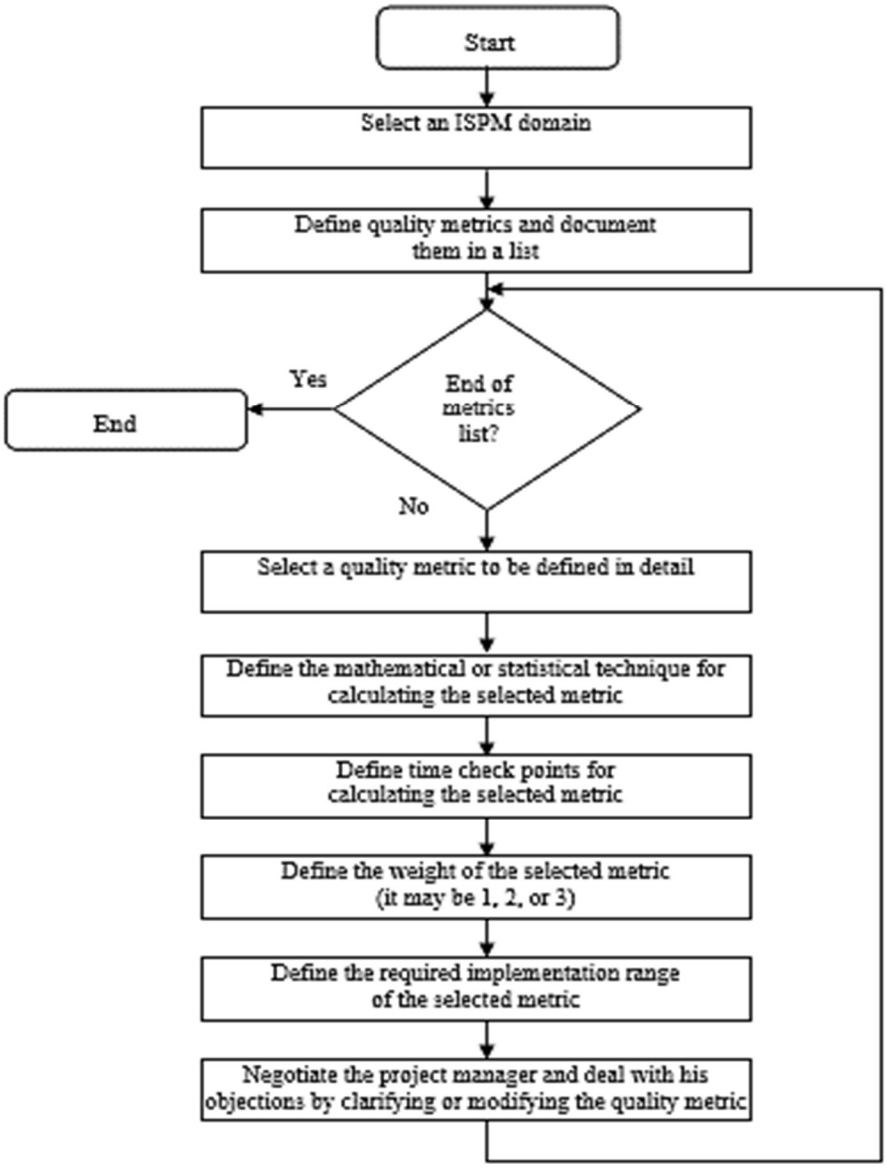

Figure (4): The Proposed Algorithm for Defining ISPM Quality Metrics.

IJCI, VSRP Publishing, UK
https://ijci.vsrp.co.uk

E-ISSN 2976-9361
https://doi.org/10.59992/IJCI.2023.v2n6p1

4-2 Calculate the Quality Metrics for an ISPM Domain

The second procedure in the proposed model is calculating the quality metrics for a specific ISPM domain. The quality group should select an ISPM domain to calculate its quality metrics. Figure (5) illustrates a flowchart that presents the algorithm of this procedure.

4-3 Input the Data of the Quality Metrics

The third procedure in the proposed model is entering the data of the quality metrics for a specific ISPM domain. For achieving the purpose of the proposed model, the quality metrics are organized in table as in table (3). We proposed a scale for measuring the implementation of the quality metrics. The proposed scale is based on that each quality metric value is compared with the required implementation range. If the metric value is in the required range, the implementation value will be "Accepted" or equal the numeric value "2". If the metric value is greater than the required range, the implementation value will be "Excellent" or equal the numeric value "3". If the metric value is less than the required range, the implementation value will be "Poor" or equal the numeric value "1".

Some quality metrics may be not applicable in some specific cases. So, there is a column titled "NA" in the table [13]. During computing the performance indicator, the not applicable quality metrics will be eliminated. The quality group input the actual data for each quality metric related to the performance indicator to be evaluated. Table (3) presents a sample of the actual data for ISPM quality metrics related to a real IS project. This project is GAZADCO project. Gazan Agricultural Development Company (GAZADCO) is one of the largest companies in the

IJCI, VSRP Publishing, UK
https://ijci.vsrp.co.uk
E-ISSN 2976-9361
https://doi.org/10.59992/IJCI.2023.v2n6p1

Kingdom of Saudi Arabia. In the next section, the performance indicators of these ISPM domains listed in table (3) will be calculated.

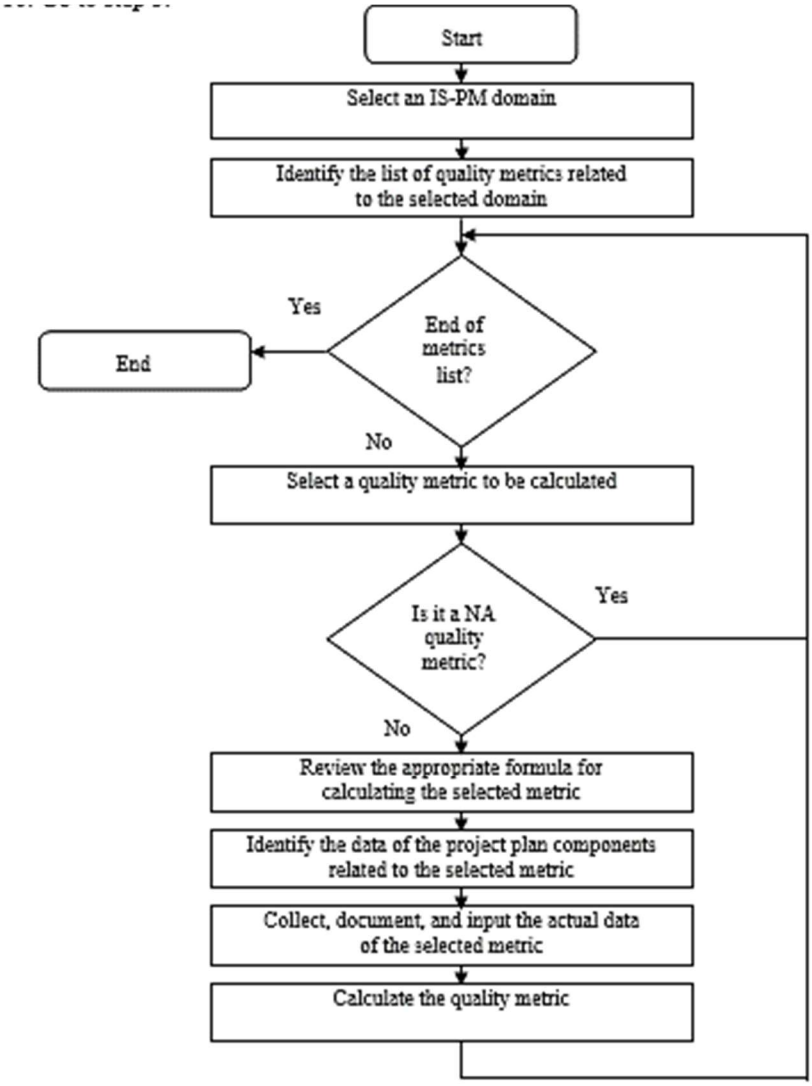

Figure (5): The Proposed Algorithm for Calculating the Quality Metrics for a Specific Domain.

IJCI, VSRP Publishing, UK
https://ijci.vsrp.co.uk
E-ISSN 2976-9361
https://doi.org/10.59992/IJCI.2023.v2n6p1

International Journal of Computers and Informatics (IJCI)

Vol. (2), No. (6)

المجلة الدولية للحاسبات والمعلوماتية

الإصدار (2)، العدد (6)

October 2023

Table (3): The Organization of Quality Metrics.

ISPM Domains and Quality Metrics	Metric Value	Required Range	Metric Weight	NA	Poor	Accepted	Excellent
Domain - Project Scope Management							
Percentage of users involved in defining scope and deliverables vs. total number of users.	90%	85-95 %	2			√	
Percentage of scope management procedures applied vs. planned.	100%	95-100 %	3				√
Percentage of project deliverables achieved vs. planned.	70%	80-90 %	3		√		
Percentage of project deliverables reviewed and approved vs. achieved.	65%	80-90 %	3		√		
Percentage of major milestones met vs. planned.	75%	80-90 %	3		√		
Percentage of project team meetings vs. planned.	90%	80-90 %	2			√	
Average ratio of feasibility studies to scope change requests.	4:1	4:1	3			√	
Average ratio of integration tests related to scope change requests.	2:1	2:1	3			√	
Average ratio of configuration management tests related to scope change requests.	2:1	2:1	3			√	
Domain - Project Schedule Management							
Percentage of schedule management procedures applied vs. planned.	100%	95-100 %	3				√
Percentage of tasks completed vs. planned at a point of time.	90%	85-95 %	3			√	
Percentage of major milestones met vs. planned.	75%	85-95 %	3		√		
Percentage of project deliverables achieved vs. planned.	70%	85-95 %	3		√		
Slippage time of the project schedule (in days).	45	30	3		√		

IJCI, VSRP Publishing, UK
https://ijci.vsrp.co.uk

E-ISSN 2976-9361
https://doi.org/10.59992/IJCI.2023.v2n6p1

International Journal of Computers and Informatics (IJCI)

Vol. (2), No. (6)

IJCI

المجلة الدولية للحاسبات والمعلوماتية

الإصدار (2)، العدد (6)

October 2023

4-4 Calculate the Performance Indicator

The fourth procedure in the proposed model is calculating the performance indicator for a specific ISPM domain. Calculating the performance indicator is not an easy process because the performance indicator is a function of a set of quality metrics. The source of complexity is due to the different nature of the data types of the quality metrics. They may include ROI, PV, percentage, ratio, number of days, or/and numeric amounts. Table (3) and the following proposed model may facilitate this process. The performance indicator can be calculated using the weighted mean. The weighted mean is appropriate because it takes the weights into account during calculations [13]. The basic formula of the weighted mean is:

Weighted Mean= $(\sum Xi.Wi)/ \sum Wi$

Where:

Xi is the implementation value of the quality metric i

Xi may take the value 1, 2, or 3 according to the rating Poor, Accepted, or Excellent respectively.

Wi is the metric weight of each quality metric i. It may take the value 1, 2, or 3.

Based on to the rating scale that is used, the performance indicator value will range from 1 to 3. According to this algorithm, the performance indicator for the two domains in table (4) can be computed as follows:

Performance indicator of "project scope management" = (2x2 + 3x3 + 1x3 + 1x3 + 1x3 + 2x2+ 2x3 + 2x3 +2x3)/ (2 + 3 + 3 + 3 + 3 + 2 + 3 +3 + 3) = 1.76/3

Performance indicator of "project schedule management" = (3x3 + 2x3 + 1x3 + 1x3 + 1x3)/ (3 + 3 + 3 + 3 + 3) = 1.6/3

IJCI, VSRP Publishing, UK
https://ijci.vsrp.co.uk

E-ISSN 2976-9361
https://doi.org/10.59992/IJCI.2023.v2n6p1

4-5 Interpret and Analyze the Performance Indicator

The fifth and final procedure in the proposed model is interpreting and analyzing the value of the performance indicator for a specific ISPM domain. The quality group should report their interpretation to their top management. If the performance indicator is not accepted, top management may take corrective actions or inform the project manager to take corrective actions. The acceptable value of the performance indicator for a specific ISPM domain depends on: ISPM domain itself, company, and the project nature. The quality group can determine a specific value in the range from 1 to 3 for judging and interpreting the quality value. For example: if we determined that the acceptable value of any performance indicator is 1.7. So, performance indicator of "project scope management" is acceptable, but the performance indicator of "project schedule management" is not acceptable.

The value of performance indicator should be analyzed to discover the weaknesses and strengths points of ISPM practices. The analysis may return to ISPM quality metrics to reveal which of them contribute to increase or decrease the value of the performance indicator. This analysis can be used to reduce or avoid many risks or obstacles that may be encountered in later phases in the same or next IS project.

5- Conclusion

Evaluating performance indicators for managing IS projects is helpful for increasing capability level and productivity, improving quality, tracking project progress, and assessing project status. The main objective of this paper was to propose a model for evaluating the performance indicators of managing ISs projects. So, we presented a proposed list of quality metrics that are very important for evaluating performance indicators of ISPM domains. Depending on this list of quality metrics, we built a proposed model for evaluating the performance indicators. The proposed model

IJCI, VSRP Publishing, UK
https://ijci.vsrp.co.uk
E-ISSN 2976-9361
https://doi.org/10.59992/IJCI.2023.v2n6p1

includes five procedures: define ISPM quality metrics, calculate the quality metrics for an ISPM domain, input the data of the quality metrics, calculate the performance indicator, and interpret and analyze the performance indicator.

We conclude that the roles of quality group are very important in ISs projects. They can use the list of quality metrics and the proposed model to evaluate and track the performance of the IS project manager.

Also, we conclude that the IS project manager can use the proposed quality metrics and the proposed model to evaluate, enhance, and correct his performance in managing an IS project.

Finally, we conclude that special emphasis must be given to performance indicators in ISs projects in a trial to reduce the failure rate of ISs projects.

There are some hot topics in this domain and must be targeted, which are:

- Developing a software tool for evaluating the performance indicators of software project managers.
- Finding a relation between the Capability Maturity Model (CMM) and the performance of the software project manager.

IJCI, VSRP Publishing, UK
https://ijci.vsrp.co.uk
E-ISSN 2976-9361
https://doi.org/10.59992/IJCI.2023.v2n6p1

References

[1] Department of Energy (DOE), "Basic Performance Measures for Information Technology Projects", 2002, http://cio.doe.gov/ITReform/sqse/download/PE-WI-V3-011502.doc

[2] Department of Energy (DOE), "IT Project Management Review Process Guide", 2003, http://cio.doe.gov/ITReform/sqse/download/QR-CP-F3-011403.doc

[3] Ince, "Software Quality Assurance - A Student Introduction", McGraw-Hill international (UK) limited, 1995.

[4] Information Systems Audit and Control Foundation (ISACF), "Project Management: Skill and Knowledge Requirements in an Information Technology Environment", 2002.

[5] Institute for Developing Policy and Management (IDPM), University of Manchester, UK, "The National Data Bank Project: An Expensive Lesson for Bangladesh", 2002, http://www.egov4dev.org/ndb.htm

[6] ISO 10006, "Quality Management Systems – Guidelines for Quality Management in Projects", Second Edition, 2003.

[7] Jeffrey A. Hoffer, Joey F. George,and Joseph S. Valacich, "Modern System Analysis and Design", Addison Wesley Longman, Inc, 1999.

[8] Jeffrey L. Whitten, Lonnie D. Bentley and Kevin C.Dittman, "System Analysis and Design Methods", Fifth edition, Mc Graw Hill Companies, Inc, 2001.

[9] Joel Henry,"Software Project Management – A Real-World Guide to Success", Pearson Education, Inc, 2004.

[10] Jolyon E. Hallows, "Information Systems Project Management: How to Deliver Function and Value in Information Technology Projects", AMACOM, a division of American Management Association, 1998.

[11] Karl E. Wiegers, "A Software Metrics Primer", Process Impact, 1999, http://www.processimpact.com/articles/metrics_primer.html

E-ISSN 2976-9361
https://doi.org/10.59992/IJCI.2023.v2n6p1

[12] Paul Dorsey, "Top 10 Reasons Why Systems Projects Fail", 2000, http://www.duclcian.com/papers/top%2010%20reasons%20why%20systems%20projects%20fail.htm

[13] William E Perry, "Quality Assurance for Information Systems: Methods, Tools, and Techniques", QED technical publishing Group, 1991.

E-ISSN 2976-9361
https://doi.org/10.59992/IJCI.2023.v2n6p1