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Applying Quality Assurance Practices to Information Systems Project Management

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Abstract

This paper focuses on proposing a quality assurance model for Information Systems Projects Management (IS-PM). This paper presents some important concepts related to this field. It presents the phases and activities of IS-PM. This paper presents a set of proposed steps for achieving each activity of planning ISs projects. Depending on the proposed steps and a combination of statistical techniques, this paper introduces a proposed quality assurance model for IS-PM activities. This proposed model can be used to build an automated software tool. This paper presents a proposed database scheme for building this tool.

Keywords: Information Systems Projects Management; Quality Assurance Tool; Quality Assurance Model; Information Systems Projects

1- Introduction and Problem Definition

IS-PM is the on-going activities for planning, organizing, directing, and controlling progress to develop an acceptable system, i.e., conform to the quality standards within the allocated time and budget. Process management is the on-going activities that establish standards for activities, methods, tools, and deliverables of the life cycle. In other words, process management aims to manage the process of IS development but IS-PM aims to manage the project.

Project management is very important for the success of IS projects. The mismanaged projects may lead to 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 late delivery [5]. ISs projects frequently fail. The rate of failure in large IS projects is larger than the rate of success. The failure rate of large projects is reported as being between 50%-80% [7]. An IS project is considered a failed project if it does not achieve the requirements or specifications. In other words, it is executed less or more than the planned scope. Also, it is considered a failed project if it is executed out of the budget or schedule.

The problem is that there is a considerable number of failed IS projects. Also, there is no integrated standards that can be used for increasing the success chance of IS projects. Most international quality standards or frameworks such as ISO, IEEE, CMM, CMMI, and TICKIT don't focus on IS-PM. There is much literature on the quality of software and IS development but there is no sufficient literature on the quality of IS-PM activities. For previous reasons, the quality of IS-PM is the main concern of this paper.

2- IS-PM Phases and Domains

IS-PM activities can be organized as life cycle phases that include initiating the project, planning the project, executing the project, and closing the project [18]. Also, IS-PM activities can be organized in IS-PM domains that include project scope management, project schedule management, project costs management, project integration management, etc.

2-1 IS-PM Phases

IS-PM can be viewed as life cycle phases that include initiating the project, planning the project, executing the project, and closing the project [4]. Each phase includes a

set of activities. IS-PM activities are achieved throughout developing IS project. Figure (1) illustrates the life cycle of IS-PM. A common life cycle of IS-PM includes four phases [4]:

1. Initiating the project.
2. Planning the project.
3. Executing the project.
4. Closing the project.

Initiating the IS project aims to understand the project environment, background, stakeholders, and management [6]. Planning the project is the process of defining clear, discrete activities and the work needed to complete each activity within a single project. The product of the planning process is the project plan, a document that describes the project and how the project manager intends to execute it [4]. Executing the project includes a set of on-going activities that are achieved throughout the project development. It includes all activities that must be continuously carried out until the project is finished [6]. Closing the project aims to bring the project to an end. Projects can conclude with a natural or an unnatural termination. A natural termination occurs when the requirements of the project have been met – the project is successful. An unnatural termination occurs when the project is stopped before completion [4]. This paper focuses on planning the project.

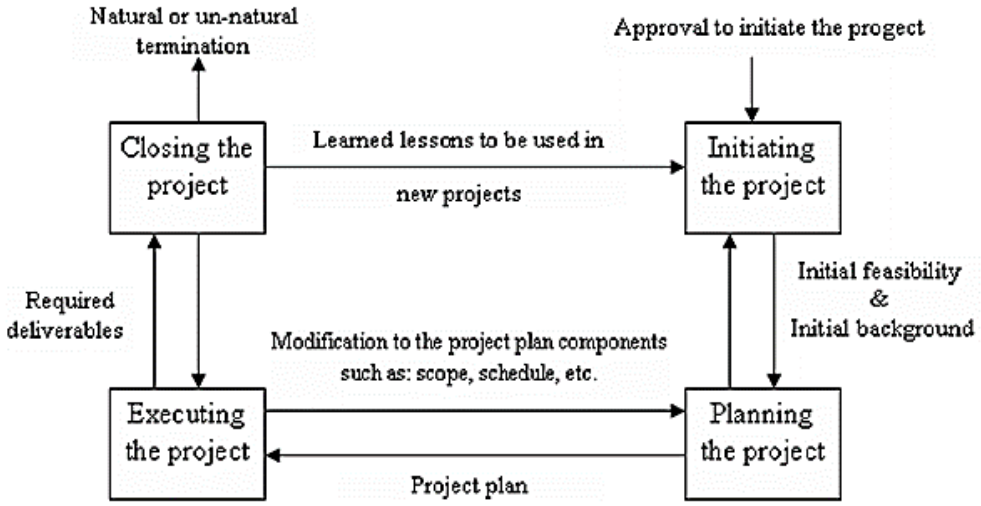

Figure 1. IS-PM life cycle.

2-2 IS-PM Domains

Another common approach for viewing IS-PM activities is IS-PM domains that include:

- Project Scope Management: involves activities to define and control what is included in the project and what is out of its scope. Project scope is the base of the subsequent phases and activities in the project.
- Project Schedule Management: is the administration and control of the finite resource of time. The project manager must manage the schedule carefully for preventing or correcting any slippages.
- Project Costs Management: is the planning and control required to ensure that a project is completed within the approved budget. The three conventional measures of project success are budget, schedule, and functionality.
- Project Integration Management: includes the processes required to ensure that the various elements of the project are properly coordinated.

- Project Quality Management: quality of IS projects means that these projects conform to the requirements or specifications and have minimized errors. The quality of IS projects must be achieved within the planned time and cost for these projects.
- Project Human Resources Management: involves those processes required to make the most effective use of the people involved in a project [2].
- Project Communication Management: involves the timely and appropriate generation, collection, dissemination, storage, and ultimate disposition of project information. It provides critical links among people, ideas and information that are necessary for success within the project team and out to the business.
- Project Risk Management: includes the processes concerned with identifying, analyzing and responding to project risks, maximizing the results of positive events and minimizing the consequences of adverse events.
- Project Subcontracting Management: has a great importance because if one of the subcontractors late, this may lead to project slippage. So, the project manager must ensure that everything is clear to subcontractors. Also, the project manager must know the legal and financial issues of subcontracting.
- Project Documentation Management: there are two types of project documents: those that the project manager needs in order to manage the project, and the vastly more voluminous technical data. The documents of technical data must be kept and accessible to all project staff.
- Users Participation Management: the project manager and his team must make time for users, insist on their participation, and seek agreement from them on all decisions that may affect them. Involving the system users facilitates the definition of the new system requirements.
- Review and Approval Process Management: include the procedures by which project deliverables will be reviewed and accepted. The review process produces

comments that should be documented and analyzed to be considered in making changes to the reviewed deliverables. The review and approval procedures may be iterated till reach to an approved deliverable.

- Systems Development Management: The project manager must select an appropriate development methodology and manage it effectively.
- Feasibility Study Management: The project manager must make attention to the project's feasibility throughout the project phases to decide whether to continue, redirect, or abandon the project. A feasibility study may include the following categories: financial, technical, operational, legal, political, and schedule.

3- Proposed List of Quality Steps for IS-PM Activities

IS-PM phases are achieved throughout a set of steps. Appendix (A) includes a set of proposed quality steps for achieving the activities of the planning project (as an example). These steps were supported with opinions and vision of many textbooks, papers, websites, international standards, CMM and CMMI, consultants, World Bank projects, experience, and technical reports. Figure (2) illustrates sources that were used to support the proposed quality steps.

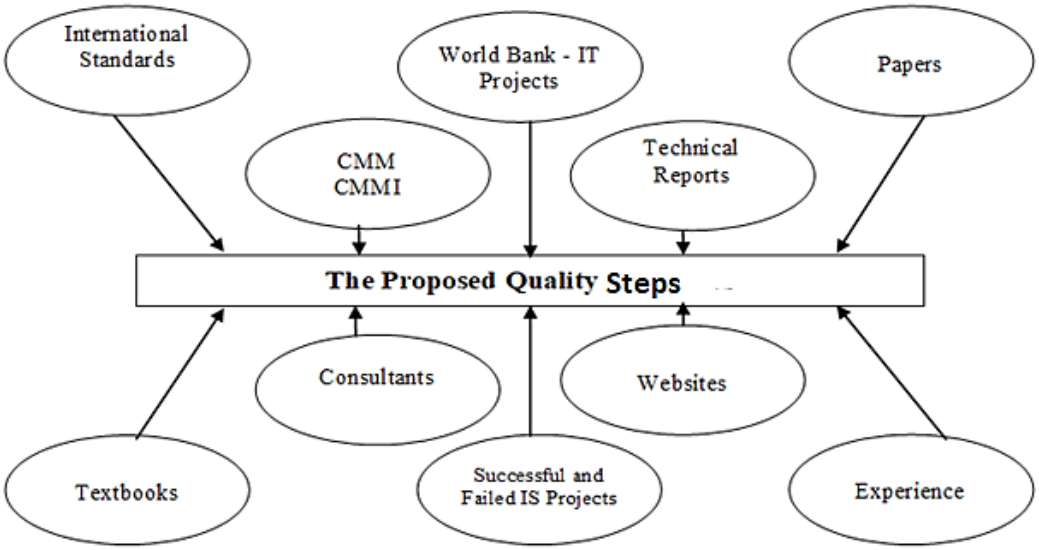

Figure 2. Sources that support the proposed quality Steps

4- Proposed Quality Assurance Model

Based on the proposed steps, the researcher can build a proposed quality assurance model for evaluating the quality of achieving an IS-PM activity.

1. Select an IS-PM activity.
2. Input the actual data of the selected activity.
3. Calculate the quality of the selected activity.
4. Interpret the quality of the selected activity.

4-1 Select an IS-PM Activity

The IS-PM phases, activities, and steps should be identified and described prior to any work in the project. So, the first procedure in the proposed model is identifying the activity to be evaluated and defining its steps. The proposed model enables the project manager and quality reviewers to use any IS-PM life cycle on one condition: the selected IS-PM life cycle must consist of phases, each phase must consist of

activities, and each activity can be achieved through a set of tasks or steps. The quality reviewers may use local or international steps. Also, they may define their own steps. Sometimes, quality steps of achieving IS-PM activities may be imposed by higher level of management. Then, the quality reviewers inform and clarify these steps to the project manager. The project manager should use these steps as a guide for achieving the selected activity. The project manager should understand the proposed steps to apply them effectively for achieving the selected activity. The algorithm of this procedure includes the following steps:

1. Select an IS-PM phase.
2. Select an IS-PM activity related to the selected phase.
3. Recall the steps of the selected activity.
4. Inform and clarify the steps to the project manager.
5. Achieve the selected activity.

4-2 Input the Actual Data of the Selected Activity

The second procedure in the proposed model is entering the actual data of achieving the selected activity that can be used for calculating the quality. This step is reached after executing the identified activity by the project manager. The quality reviewers collect the actual data of achieving the activity and input them into the model for computing the activity quality. For achieving the purpose of the proposed model, the proposed steps are organized in a table as in Table (1). Table (1) presents a sample for this organization. We propose a rating scale for measuring the implementation of the steps of each activity. The proposed scale based on that each step has a five-point rating scale. The midpoint of the scale is an average (AV) implementation of the step. The lower end of the scale is a poor (P) implementation of the steps, with the bottom of the scale being very poor (VP). The ratings on the upper end of the scale are good (G) and very good (VG). During computing the quality, the values 1,2,3,4, and 5 are corresponding to the ratings VP, P, AV, G, and VG respectively. The steps for

achieving each activity are not having the same level of importance. So, each step must have a weight of 1, 2, or 3. The weight is a measure of the importance of each step. A weight 3 is used to show the step of the most importance or it is called a required step. A weight 1 is used to show the steps of the lowest importance or it is called an optional step. A weight 2 is used to show the step of the average importance or it is called a recommended step. Before evaluating any activity, the quality reviewers determine the weights of the steps. These weights are placed in the column titled "Importance Type". Also, some steps may be not applicable in some specific cases. So, there is a column titled "NA" in the table. During computing the quality, the not applicable steps are eliminated. The quality reviewers input the actual data for each step related to the selected activity. Table (1) presents a sample of the actual data for achieving the activity "Defining the project scope and deliverables" in the initiation phase.

The proposed algorithm for entering the data of the activity includes the following steps:

1. Identify the list of steps related to the selected activity.
2. Check the list of steps.
3. If it is not empty, continue, else end.
4. Select a step to be entered.
5. Identify the importance type of the selected step.
6. Identify the implementation value of the selected step (NA, VP, P, AV, G, or VG)
7. Go to step 2.

Phases and Activities	Importance Type	NA	VP	P	AV	G	VG
Phase - Planning the Project							
Activity (1): Defining Project Scope and Deliverables							
1. Involve users in the process of defining project scope and deliverables.	2					√	
2. Define the project scope. The project scope should include functionality, business rules, procedures, interfaces to other systems, and the project deliverables.	3					√	
3. Define project deliverables. The project deliverables should be documented in a list, with brief description, of everything tangible that the project will produce.	3						√
4. Develop a written scope statement.	3				√		

Table 1. A sample of the actual data of achieving an IS-PM activity.

4-3 Calculate the Quality of the Selected Activity

The third procedure in the proposed model is calculating the quality of the selected activity. The not applicable steps and their weights are eliminated from the calculations. We mentioned before that the steps don't have the same level of importance. So, the weighted mean is an appropriate statistical technique to measure the quality for the activity because it takes into consideration the impact of the weights of the steps. The weighted mean can be calculated using the formula:

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

Where: Xi is the implementation value of each step i, Xi may take the value 1,2,3,4, or 5 that are correspondence to the ratings VP, P, AV, G, and VG respectively. Wi is the weight of each step i

Figure (3) illustrates a flowchart that presents the algorithm of this procedure. The algorithm includes the following steps:

1. Identify the list of entered steps related to the selected activity.
2. Initialize the required variables. We will use four variables for calculating the quality. So, we initialize them by zero. Product=0, Sum-of-products=0, Sum-of-weights=0, Quality-value=0
3. Check the list of steps related to the selected activity.
4. If it is not empty, go to step 4,
   Else, compute Quality-value= Sum-of-products/Sum-of-weights,
   End.
5. Select a step.
6. Check the selected step. Is it a NA step?
   If it is not, go to step 6,
   Else, go to step 3.
7. Compute Product=Implementation value*Importance type.
8. Compute Sum-of-products= Sum-of-products + Product.
9. Compute Sum-of-weights=Sum-of-weights +Importance type.
10. Go to step 3.

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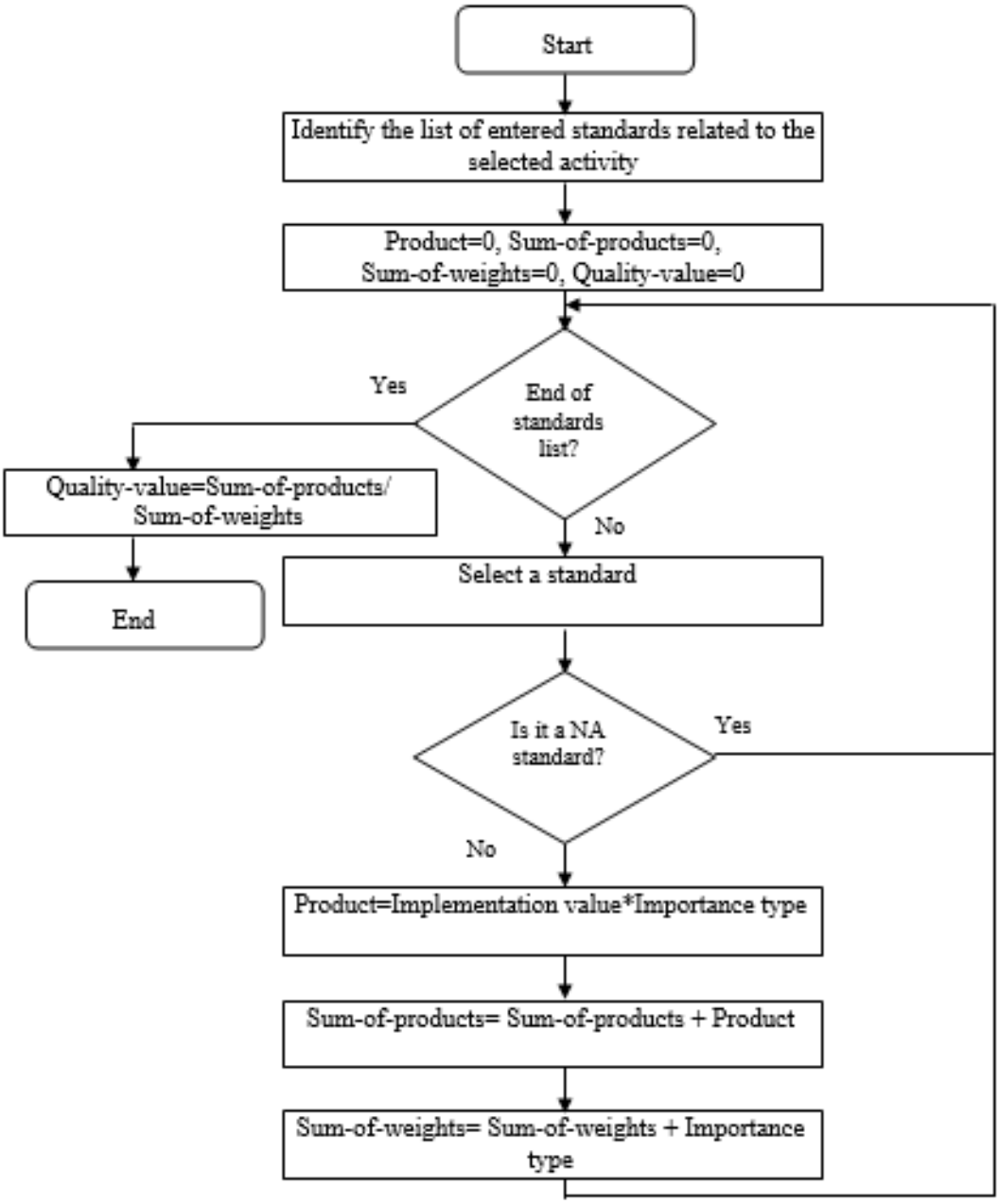

Figure 3. The algorithm of calculating the quality of the selected activity.

To test this algorithm, we can compute the quality value for the selected activity "Defining the project scope and deliverables" according to the actual data presented in Table (1).

Quality value= (4x2 + 4x3 + 5x3 + 3x3)/(2 + 3 + 3 + 3) = 4/5

According to the actual data and calculations, the quality of the selected activity is 4. Based on the used statistical technique and rating scale, the quality value will range from 1 to 5.

4-4 Interpret the Quality of the Selected Activity

The final procedure in the proposed model is interpreting the quality value of the selected activity. The quality reviewers should report their interpretation to their top management. Also, they may inform the project manager to increase the maturity of the implementation of this activity. If the quality value is not accepted, top management may take corrective actions or inform the project manager to take corrective actions. The acceptable level of quality is different from one company to another or from one project type to another. The quality reviewers can determine a specific value in the range from 1 to 5 for judging and interpreting the quality value. The algorithm of this procedure includes the following steps:

1. Identify the interpretation table.
2. Input the quality value of the selected activity.
3. Compare the quality value with the values of the interpretation ranges.
4. Check the quality value.
   If it is accepted, go to step 6,
   Else continue.
5. Produce a report.
6. End.

5- Proposed database schema for building an automated software tool

There are many facts that can be used as business rules for building proposed automated software tool for evaluating the quality of an IS-PM activity. These business rules include:

1. The tool must be easy to use. It must include instructions for completing the forms.
2. The tool must have the ability to run as an online website or as an offline application.
3. The tool must check the data of signing in or up for the user.
4. IS-PM life cycle must include phases.
5. The tool must enable the user to use an existing IS-PM life cycle or to define his IS-PM cycle.
6. The tool user inputs the data of his project. The other users cannot modify or read these data.
7. The tool must enable to evaluate the quality of a specific activity, phase, or project.
8. The tool must enable the user to use an existing interpretation table or to input his interpretation table.

Figure (4) illustrates the database schema of the proposed tool. It takes the impacts of web technology into consideration such sign in, sign up, sign out, and data security. The database schema includes the tables:

- Country: aims to handle codes of countries that will be used in sign up form.
- Occupation: aims to handle codes of occupations that will be used in sign up form.
- User_Sign: aims to handle the data of users. This data will be used in sign in and sign-up forms. It will determine the authority of the user for accessing the data of the project and steps.

- SDLC_Style: aims to handle the data of ISPM life cycle. It will be used in the form of quality steps.
- Phase: aims to handle the data of ISPM phases.
- Activity: aims to handle the data of ISPM activities.
- Standard: aims to handle the data of ISPM steps. This data will be used in the forms of entering or using the quality steps.
- Project: aims to handle the data of the project. This data will be used in the forms of evaluating the quality.
- Actual_step: aims to handle the actual data of evaluating the quality of project activities.
- Interpretation_Style: aims to handle the data of interpretation styles that may be used for interpreting the quality value.
- Interpretation_Range: aims to handle the data of interpretation ranges that may be used for interpreting the quality value.

6- Conclusion and Future Work

- The objective of this paper was to propose a quality assurance model for IS-PM. So, we presented a set of proposed steps for achieving the activities of planning ISs projects as a sample of quality steps that can be elaborated for IS-PM activities. The IS project manager and the quality reviewers can use these quality steps as a guide for achieving IS-PM activities. Based on the proposed steps and a combination of statistical techniques, we built a proposed model for evaluating the quality of IS-PM activities. The proposed model includes the main procedures: selecting an IS-PM activity, entering the actual data of the selected activity, calculating the quality of the selected activity, and interpreting the quality of the selected activity.

- We conclude that quality reviewers are essential to be found within the IS-PM practices. Also, we found that special emphasis must be given to quality assurance for ISs projects in a trial to reduce the failure rate of ISs projects and increase the quality of achieving the IS-PM activities. Also, we found that it is important to build an automated software tool for evaluating the quality of the IS-PM activities. This paper presented a proposed database schema for building such tool.

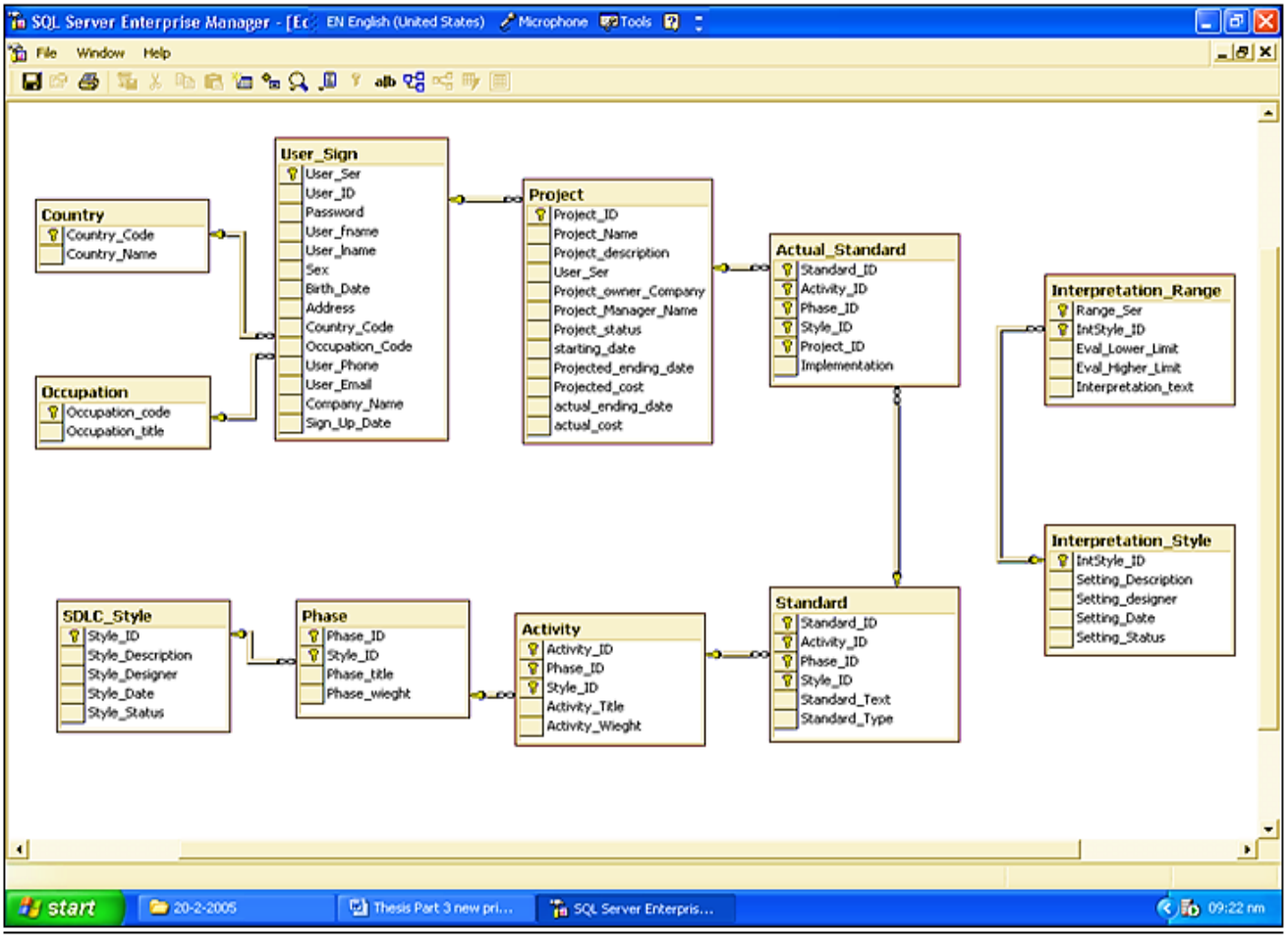

Figure 4. The database schema of the proposed automated tool.

For future work, the following points are expected to be focused:

- Expanding the work to build an automated tool for evaluating the quality of IS-PM activities.
- Searching in more detail in quality and performance metrics.
- Expanding the work to build a model for evaluating the performance indicators of IS-PM domains.
- Expanding the work to build an automated tool for evaluating the performance indicators of IS-PM domains.
- Searching in more detail some critical issues in IS-PM such as risk management, subcontracting management, scope management, and configuration management.
- Elaborating critical success factors of IS projects.

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Appendix (A) – Example of Quality steps of planning IS projects

Activities and steps
Activity (1) - Defining Project Scope and Deliverables
1. Involve users in the process of defining project scope and deliverables.
2. Define project scope. The project scope should include functionality, business rules, procedures, interfaces to other systems, and project deliverables.
3. Define project deliverables. Project deliverables should be documented and described in a list.
4. Develop a written scope statement.
Activity (2) - Listing Project Assumptions and Constraints
1. Define a list of project assumptions and constraints that must include assumptions and constraints of resources, delivery, environment, budget, and functionality.
2. Clarify the list of project assumptions and constraints to the client management, and the project team.
Activity (3) - Identifying, Analyzing, and Prioritizing Project Risks
1. Clarify the importance of project risk management to all team members.
2. Prepare and validate a list of project risks. It should include risks of staff, equipment, client, scope, technology, delivery, and physical risks.
3. Identify the consequence of project risks.
4. Identify the severity of impact for each risk.
5. Identify the probability of each risk.
6. Review and validate the data of the risk analysis with project team members.
7. Identify methods of prioritizing the project risks.
8. Determine and document the level of each project risk.
9. Communicate and clarify the level of each project risk to the project team.