**1.**

**Solution**

Thompson’s critical software development information needs:

* The feasibility of current schedule
* The reasons that performance lags schedule
* The overall quality of developed product

Information needs IPT identified:

* The existing data was so error-prone which made the conversation process labor-intensive and led to a schedule slippage (Risk 1).
* The data standardization process to make the shared data reality would get bogged down in organizational battles (Risk 2).
* The size of the software needed by Ms. Cooper

**2.**

**Solution**

|  |  |  |  |
| --- | --- | --- | --- |
| **Map Information Needs** | | | |
| **Information Need** | **Information Category** | **Measurement Concept** | **Prospective Measures** |
| The feasibility of current schedule | Schedule and Progress | Milestone Completion | * Milestone Dates |
| Critical Path Performance | * Slack time |
| Work Unit Progress | * Problem Reports Opened * Problem Reports Closed * Test Cases Attempted * Test Cases Passed |
| The reason that performance lags schedule | Progress Performance | Process Compliance | * Process Audit Findings |
| Process Effectiveness | * Rework Effort |
| The overall quality of developed product | Product Quality | Functional Correctness | * Defects |
| Efficiency | * Utilization * Throughput |
| The size of the software needed by Ms. Cooper | Product Size and Stability | Physical Size and Stability | * Lines of Code * Components |
| Functional Size and Stability | * Function Point |
| Risk 1 | Technology Effectiveness | Technology Volatility | * Baseline Changes |
| Risk 2 | Technology Effectiveness | Technology Suitability | * Requirement Coverage |

**3.**

**Solution**

Firstly, it can be seen that there are three periods (Jul 97 – Jan 98, nearly Mar 98 – about May 98 and Jul 98 – Dec 98) whose numbers of staffs stay the same. However based on the plan, the number of staff should gradually increase according to the number of work before Jan 1999. It means at the starts of those three periods above, too many staff was inflexibly allocated or during these three periods which results in the actual completeness of work did not according to the plan. Secondly, among these three periods, there are two sharp incensements, which means the planned number of work could not be completed as schedule or the allocated number of work was more than plan; hence it had to increase people to finish them. Thirdly, at the start of the project, the number of staff should be zero because of there was no work to do. However the actual allocated staff was not zero, which caused more unnecessary cost.

**4.**

**Solution**

PSM can help to address such information needs. Use the Prospective Measure of Experience Level to pre-allocate professional staff for coding and adjusting SQL. If so, when meet the SQL issues, there will be no serious problems in SQL, let alone re-work on SQL costing more money.

**5.**

**Solution**

Thompson and Cooper provided three indicators to find and alleviate the problems of Personnel Information CI lag. From B-8, it can be seen that the development of Personnel Information CI lagged plan. However it did not show the exact reason. Therefore Thompson and Cooper separated the whole CI into indicating the development of screens and reports (B-9), and Ada coding (B-10). It is obvious that former one had no problems but Ada coding lagged schedule which was also the reason of Personnel Information CI lag.

**6.**

**Solution**

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| --- | --- | --- | --- |
| **Indicators** | **Prospective Measures** | **Information Category** | **Leading/Lagging Information** |
| B-2 | Function Points & Code Lines | Product Size and Stability | Lagging Information |
| B-4 | Milestone Dates | Schedule and Progress | Lagging Information |
| B-12, B-13, B-16, B-17, B-18, B-19, B-20, B-22, B-25 | Problem Reports Opened and Closed |
| B-23, B-24 | Component Integrated |
| B-14 | Test Cases Attempted and Passed |
| B-5, B-6 | Development Effort | Resource and Cost | Lagging Information |
| B-7 to B-11 | Process Audit Findings | Progress Performnce | Leading Information |
| B-15, B-21, B-26, B-27 | Rework Effort |

**7.**

**Solution**

1) Rework Effort

This measure can help find which part of the project exits more problems. In this case study, Cooper used this measures to find Unit Mobilization CI had more problems.

2) Process Audit Findings

This measure can help identify problems of specific progress. In this case study, Cooper identified the reason that Personnel Information CT lag via this measure.

3) Lines of Code & Function points

These two measures can help estimate the size of software. In this case study, Cooper summarize the size of the software using these measures together.

**8.**

**Solution**

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| **Information Need Description** | |
| **Information Need** | Does the actual effort allocation according to the plan? |
| **Information Category** | Resource and Cost |

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| --- | --- |
| **Measureable Concept** | |
| **Measureable Concept** | Personnel Efforts |

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| --- | --- |
| **Entities and Attributes** | |
| **Relevant Entities** | 1. Allocation reports from the project 2. Planned effort allocation |
| **Attributes** | 1. The number of staff at each given time point of actual allocation 2. The number of staff at each given time point of planned allocation |

|  |  |
| --- | --- |
| **Base Measure Specification** | |
| **Base Measures** | 1. The number of staff at each given time point of actual allocation 2. The number of staff at each given time point of planned allocation |
| **Measurement Methods** | 1. Count the number of staff at each given time point of actual allocation 2. Count the number of staff at each given time point of planned allocation |
| **Type of Method** | Objective |
| **Scale** | Quantity |
| **Type of Scale** | Ordinal |
| **Unit of Measurement** | Staff-Month |

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| **Derived Measure Specification** | |
| **Derived Measure** | Absolute value of the difference of staff number between actual and planned allocation in each given time point |
| **Measurement Function** | 1. Get the difference of staff number between actual and planned allocation at each given time point.   2. Get the absolute values of the differences |

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| **Indicator Specification** | |
| **Indicator Description and Sample** | The numbers of staff of both actual and planned effort allocation at each time point indicating as two curves connecting corresponding points. Sample: |
| **Analysis Model** | During any period, if the gap between two lines is too big, it should evaluate the actual effort allocation during that period. |
| **Decision Criteria** | N/A |
| **Indicator Interpretation** | N/A |

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| --- | --- |
| **Data Collection Procedure (for Base Measure 1)** | |
| **Frequency of Data Collection** | 45 days |
| **Responsible Individual** | Lt. Col. Thompson |
| **Phase or Activity in which Collected** | During the time of revising the project management plan |
| **Tools Used in Data Collection** | N/A |
| **Verification and Validation** | N/A |
| **Repository for Collected Data** | PSM Insight database |

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| **Data Collection Procedure (for Base Measure 2)** | |
| **Frequency of Data Collection** | N/A |
| **Responsible Individual** | Requirement analysts |
| **Phase or Activity in which Collected** | During the time of preliminary design |
| **Tools Used in Data Collection** | N/A |
| **Verification and Validation** | N/A |
| **Repository for Collected Data** | PSM Insight database |

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| **Data Analysis Procedure** | |
| **Frequency of Data Reporting** | 45 days |
| **Responsible Individual** | Lt. Col. Thompson |
| **Phase or Activity in which Analyzed** | During the time of revising the project management plan |
| **Source of Data for Analysis** | PSM Insight database |
| **Tools Used in Analysis** | PSM Insight |
| **Review, Report, or User** | Effort allocation reports |

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| **Additional Information** | |
| **Additional Analysis** | N/A |
| **Implementation Considerations** | N/A |

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| **Information Need Description** | |
| **Information Need** | Are the numbers of passed test cases according to the planned and attempted numbers? |
| **Information Category** | Schedule and Progress |

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| **Measureable Concept** | |
| **Measureable Concept** | 1. Test Cases Attempted 2. Test Cases Passed |

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| **Entities and Attributes** | |
| **Relevant Entities** | 1. Tests reports from the project 2. Planned test plan |
| **Attributes** | 1. The number of attempted test cases at each given time point of actual allocation 2. The number of passed test cases at each given time point 3. The number of planned test cases at each given time point |

|  |  |
| --- | --- |
| **Base Measure Specification** | |
| **Base Measures** | 1. The number of attempted test cases at each given time point of actual allocation 2. The number of passed test cases at each given time point 3. The number of planned test cases at each given time point |
| **Measurement Methods** | 1. Count the number of attempted test cases at each given time point of actual allocation 2. Count the number of passed test cases at each given time point 3. Count the number of planned test cases at each given time point |
| **Type of Method** | Objective |
| **Scale** | Quantity |
| **Type of Scale** | Ordinal |
| **Unit of Measurement** | Number of Test Cases |

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| **Derived Measure Specification** | |
| **Derived Measure** | Absolute values of the difference of test cases among passed, attempted and planned test cases at each given time point |
| **Measurement Function** | 1. Get the difference of test cases between passed and attempted test cases at each given time point. 2. Get the absolute values of the differences 3. Get the difference of test cases between attempted and planned test cases at each given time point. 4. Get the absolute values of the differences |

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| **Indicator Specification** | |
| **Indicator Description and Sample** | The numbers of passed, attempted and planned test cases at each given time point indicating as three curves connecting corresponding points. Sample: |
| **Analysis Model** | The more obvious the decreased trend of these gaps, the more consistent it is between plan and attempt, and the higher the result is |
| **Decision Criteria** | N/A |
| **Indicator Interpretation** | N/A |

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| **Data Collection Procedure (for Base Measure 1)** | |
| **Frequency of Data Collection** | 12 days |
| **Responsible Individual** | Ms. Cooper |
| **Phase or Activity in which Collected** | During the time of evaluating readiness for test |
| **Tools Used in Data Collection** | N/A |
| **Verification and Validation** | N/A |
| **Repository for Collected Data** | PSM Insight database |

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| **Data Collection Procedure (for Base Measure 2)** | |
| **Frequency of Data Collection** | 12 days |
| **Responsible Individual** | Ms. Cooper |
| **Phase or Activity in which Collected** | During the time of evaluating readiness for test |
| **Tools Used in Data Collection** | N/A |
| **Verification and Validation** | N/A |
| **Repository for Collected Data** | PSM Insight database |

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| **Data Collection Procedure (for Base Measure 3)** | |
| **Frequency of Data Collection** | N/A |
| **Responsible Individual** | Test designers |
| **Phase or Activity in which Collected** | During the time of evaluating readiness for test |
| **Tools Used in Data Collection** | N/A |
| **Verification and Validation** | N/A |
| **Repository for Collected Data** | PSM Insight database |

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| **Data Analysis Procedure** | |
| **Frequency of Data Reporting** | 1 days |
| **Responsible Individual** | Ms. Cooper |
| **Phase or Activity in which Analyzed** | During the time of revising the project management plan |
| **Source of Data for Analysis** | PSM Insight database |
| **Tools Used in Analysis** | PSM Insight |
| **Review, Report, or User** | Test reports |

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| --- | --- |
| **Additional Information** | |
| **Additional Analysis** | N/A |
| **Implementation Considerations** | N/A |

**9.**

**Solution**

1) Plan Measurement

I will **identify and prioritize information needs** firstly. Then I will **select and specify measures**. The last step I will **integrate them into the project processes**.

2) Perform Measurements

The first step I will do is **collecting and processing data for analyzing**. Based on the analyzed results, there will be **corresponding recommendations**.

3) Establish and Sustain Commitment

I will **obtain organizational commitments** at start. Then I will **define responsibility and provide resources**. The last step is to **reviewing progress of measurement programs**.

**10.**

**Solution**

Based on the Process Maturity Profile published on September 2013, it can be seen that there are four categories: Military/Government Agency, Contractor for Military/Government and Commercial/In-house. From all reporting organizations, most organizations whose percentage is 77.3%, belong to the category of ‘Commercial/In-house’. Military/Government Agency occupies the smallest percentage (4.1%) of reporting organization category. In terms of organization size, the size containing 26-50 employees holds the largest percentage which is 63.93%. At the same time, ‘2000+’ has the smallest portion (1.66%).

**11.**

**Solution**

There are six benefits

* Decreased Costs (e.g. General Dynamics Advanced Information Systems reduced maintenance staff costs by 64% while doubling the size of the organization.)
* Improved On-Time Delivery (e.g. General Motors improved the percent of milestones met from 50% to 85%.)
* Improved Productivity (e.g. IBM Australia Application Management Services improved account productivity over 20%.)
* Improved Quality (e.g. Tufts Associated Health Plans decreased software defects identified in testing 25%.)
* Improved Customer Satisfaction (e.g. Lockheed Martin Management and Data Systems increased their award fees by 55%.)
* Impressive Return on Investment (e.g. Siemens Information Systems Ltd. experienced 2 to 1 ROI over 3 years.)

**12**

**Solution**

CMMI exists in four generally accepted representations: **Process Management, Project management, Engineering, Support.** They also decide four groupings of 22 process areas.

1) Process Management

In this category, process areas contain the cross-project activities related to defining, planning, deploying, implementing, monitoring, controlling, appraising, measuring, and improving processes, including process areas of

* Organizational Process Definition
* Organizational Process Focus
* Organizational Performance Management
* Organizational Process Performance
* Organizational Training

2) Project management

In this category, process areas cover the project management activities related to planning, monitoring, and controlling the project, including process areas of

Integrated Project Management (IPM)

* Integrated Project Management
* Project Monitoring and Control
* Project Planning
* Quantitative Project Management
* Requirements Management
* Risk Management
* Supplier Agreement Management

3) Engineering

In this category, process areas cover the development and maintenance activities that are shared across engineering disciplines. These progress areas are

* Product Integration
* Requirements Development
* Technical Solution
* Validation
* Verification

4) Support

In this category, process areas cover the activities that support product development and maintenance. These progress areas are

* Causal Analysis and Resolution
* Configuration Management
* Decision Analysis and Resolution
* Measurement and Analysis
* Process and Product Quality Assurance

**13.**

**Solution**

1)

Similarities

* To reach a particular level, an organization must satisfy all of the goals of the process area or set of process areas that are targeted for improvement, regardless of whether it is a capability or a maturity level.
* Both representations provide ways to improve your processes to achieve business objectives, and both provide the same essential content and use the same model components.
* Both capability levels and maturity levels provide a way to improve the processes of an organization and measure how well organizations can and do improve their processes

Differences

* Capability levels apply to an organization’s process improvement achievement in individual process areas but maturity levels apply to an organization’s process improvement achievement across multiple process areas
* Capability levels achieved by the continuous representation which is concerned with selecting both a particular process area to improve and the desired capability level for that process area but maturity levels achieved by the staged representation is concerned with selecting multiple process areas to improve within a maturity level; whether individual processes are performed or incomplete is not the primary focus

2)

**Required components**

It is an essential CMMI component for a given progress area to achieve progress improvement.

This achievement must be visibly implemented in organization’s progress. In CMMI, requirement components are specific goals and general goals. During estimation, satisfactions of goals are used as the basis for judging whether a progress area has been satisfied.

**Expected components**

It is a CMMI component that describes achieving important activities of required CMMI component. Expected components guide those people who implement the improvement or estimation. In CMMI, expected components are specific practices and general practices.

**Informative components**

It is a CMMI components that helps model users understand required and expected CMMI components.

**14.**

**Solution**

SP3.2 under **Project Planning** process area is ‘**Reconcile Work and Resource Levels’.** A project normally has not only one stakeholder. Every stakeholder may have various different requirements. Some of these whole requirements may be duplicated, inconsistent, unclear or unfeasible. Therefore it is very important to reconcile these requirements by integrating and classifying, negotiating more resources or modifying requirements to systematic them. The aim of this SP is adjusting the project plan based on the requirements to be correct, efficient, and feasible. Therefore it is very important.

**15.**

**Solution**

1)

The specific practice of ‘**Maintain Bi-directional Traceability of Requirements’** under the progress area of **Requirement Management.**

2)

Bi-directional traceability helps judge whether all lower requirements can be traced to a valid source and whether all source requirements have been completely addressed. It can cover both horizontal and vertical relationships. It allows project to assess the impact of requirement changes on the whole project activities

**16.**

**Solution**

1)

Under the process area of **Risk Management**, specific practices contain **Risk Identification** **and Mitigation**, **Risk Mitigation** and **Risk Log**

For risk identification and mitigation, what should be done contains:

* Determine risk sources and categories
* Define risk parameters
* Establish a risk management strategy

For risk mitigation, what should be done contains:

* Identify risks
* Evaluate categories and prioritise risks

For risk log, what should be done contains:

* Develop risk mitigation plans
* Implement risk mitigation plan

2)

Typical mitigation actions

* Accept do nothing.
* Keep consequence but reduce probability.
* Keep probability but reduce consequence.
* Reduce both probability and consequence
* Transfer and share.

3) Project risks whose probabilities are high and whose impacts are serious.

**17.**

**Solution**

The SP3.1 in the **Requirement Development** process area is **establishing operational concepts and scenarios**. They can be used for validating. Scenarios are used to realize the functional or quality attributes needs of the stakeholders. Operational concepts are used when analyzing the requirement. It can also become the scenarios for product components. Operational concepts and scenarios have benefits of:

* facilitate the selection of product component solutions which will satisfy the intended use of the product
* document the interaction of the product components with the environment, end users, and other product components, regardless of engineering discipline

During the whole engineering lifecycle, requirement development acts a significantly important role. However, requirements are always changing and when the lower-level requirements are modified, it has to re-design the general requirements. In other word, the top general requirements decide the detailed requirements, which means each change of requirement has to be modified from top to bottom. The more detailed requirements are changed, the more cost will generate. Usually, the project management has no enough time to verify whether each requirement is right. Operational concepts and scenarios can help project managements to judge the correctness of requirement. They are gradually refined as solution decisions are made and lower detailed requirement are developed. They can help reduce the number of changes and avoid incorrect or unsuitable changes for reducing cost and maintaining quality.

**18**

**Solution:**

For verification, the purpose is to ensure that selected work products meet their specified requirements. Verification is ensuring ‘the product is built right’, which means it only focuses on the realization of project. It contains activities of verification preparation such as establishing the verification environment, verification performance such as prepare for peer reviews, and identification of corrective action such as analyzing verification results.

In terms of validation, the purpose is to demonstrate that a product or product component fulfills its intended use when placed in its intended environment. Validation is ensuring ‘the right product is built’, which means it focuses on the targets of project. The range of validation is larger than verification. It contains activities of validation preparation such as selecting work product for validation and validate product or product components such as perform validation.

**19**

**Solution:**

Through inspections, structured walkthroughs, or a number of other collegial review methods, the peer review can identify defects to remove them and provide other necessary changes, which is an important and effective verification method. Under this specific goal, it involves specific practices of preparing for peer reviews of selected work products, conducting peer reviews and analyzing peer review data.

In preparing for peer review of selected work products, it identifies people, product, schedule, checklist and criteria for peer review. This phase builds the base for the following two specific practices. It identifies ‘how to peer review’. In terms of conducting peer reviews, it can find and remove defects early. At the same time, during this practice, it can collect peer review data used by the third practice for analyzing. It focuses on ‘what to peer review’. In the last practice, analyzing peer review data, it provides insight into data supporting performance analysis to effectively managing quality and cost of the project, and to judge whether the product is built right.

**20.**

**Solution**

|  |  |  |  |
| --- | --- | --- | --- |
| **Practice** | **Characterization**  **(FI, LI, NI or NY)** | **Strength(s)/Weakness(es)** | **Objective Evidence**   * **Artifact** * **Affirmation** |
| REQM  SP 1.4 |  |  |  |