Assignment of COMP 8173

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1. Critical software development information needs
   a) The feasibility of the current schedule and the reason for the schedule slippage
   b) How is the overall product quality of the developed products
   The information needs identified by IPT
   c) In converting the existing database to the shared relational database that would be accessed not only by MAPS but by future applications as well. The existing data would be so error-prone that it would make the conversion process labour-intensive and would result in a schedule slippage.
   d) The process of data standardization needed to make the shared data concept a reality would get bogged down in organisational battles.
2. Indication of the measures

Information Need:	**Information Category:**	**Measurable Concept:**	**Prospective Measures**
The feasibility of the current schedule and the reason for the schedule slippage	Schedule and Progress	Work Unit Progress	*Requirements Traced* *Requirements Tested* *Reviews Completed* *Units designed* *Units Coded* *Units integrated*
		Milestone Completion	*Milestone Dates*
The overall product quality of the developed products	Product Quality	Functional Correctness	*Defects* *Age of Defects*
The existing data may be so error-prone	Technology Effectiveness	Technology Suitability	*Requirement Coverage*
The organizational battles may affect the process of data standardisation.	Process Performance	Process Compliance	*Reference Maturity Rating*

3. The change of the actual effort allocation is so discrete and there is large difference between the actual allocation and the need. A possible reason is that more personnel are not allocated until the manager found current personnel are not enough. When more personnel are allocated, the number is always redundant. The impact would be the budget is cost inefficiently and the project may be over-budget in the end.
4. This is be avoided in the first place if developers with experience with SQL are allocated in the beginning of the project. PSM could help. This information need should be

categorised to Resource and Cost. The corresponding measurable concept is personnel effort. The experience level of each personnel should be measured to ensure that their experience is sufficient for the project.

5. Cooper's strategy figured out the cause for the schedule lagging of the Personnel Information CI. The lagging is visible in figure B-8. However, it does not tell the reason for the lagging. Cooper separated the problem into two perspective and found out the cause is in the Ada code. The inefficient performance in the development of Ada code is alleviated.
6. From the analysis model, the three information categories providing leading information are technology effectiveness, the process performance and product size and stability. The indicators providing leading information are:
   Figure B-3: The MAPS software size estimates
   Figure B-15: increment 1 rework for test – effort allocation
   Figure B-21: Increment 2, readiness for test – effort allocation
   Figure B-27: The rework effort indicator, identifying the unit mobilization (BUM) CI as the major cause of problems
   Other indicators provide lagging information, because they are related to schedule and progress, resources and cost and product quality directly. They are Figure B-4, B-5, B-6, B-7, B-8, B-9, B-10, B-11, B-12, B-13, B-14, B-16, B-17, B-18, B-19, B-20, B-22, B-23, B-24, B-25 and B-26.

7. In order to control the project rather than to react to the project, more attention should be paid on measurement related to technology effectiveness, process performance and product size and stability.
   Produce Size and stability:
   Components, lines of code and function points should be measured. These measurement give better understanding of the scope and size of the project. Based on these measurement, a more realistic plan for the resource, cost and schedule can be made.
   Process Performance:
   Rework should be measured. With the amount of work effort expended to fix defects, the defect in the process will be visible. Improvement will be done and the process of the project can become more and more efficient.
   Technology Effectiveness:
   The technology impact should be measured. Different technologies can be applied to achieve the same goal and they have different impacts on the project. Measuring the positive and negative effects on the technology is useful to estimate other aspects of the project. Some risks can be foreseen and mitigation can be applied earlier.

8. Measurement Information Specification
   a) Figure B-6

Effort Allocation

Version 1.0

Information Need Description	
Information Need	Are there enough personnel working on the project?
Information	Resource and cost

Category	

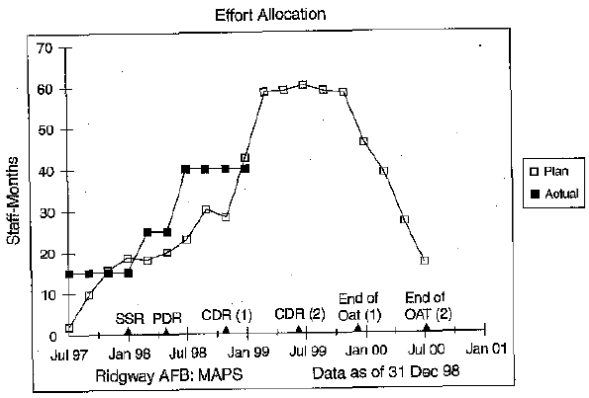
Measurable Concept	
Measurable Concept	Effort

Entities and Attributes		
Relevant Entities	Effort Allocation Plan	Staffing profile
Attributes	Number of staff	Number of staff

Base Measure Specification	
Base Measures	• Number of staff planned for requirements and preliminary design at each time point • Number of staff planned for Increment 1 at each time point • Number of staff planned for Increment 2 at each time point • Total number of staff allocated to the project at each time point
Measurement Methods	Collect the data from Figure B-5 Collect the number of the staff from the staffing profile
Type of Method	Objective
Scale	Natural scale
Type of Scale	Interval
Unit of Measurement	person

Derived Measure Specification	
Derived Measures	• Total number of staff planned for the system
Measurement Function	• Sum the number of staff planned for each part at the same time point

Indicator Specification	
Indicator Description and Sample	A line chart illustrating both the actual and planned number of staffs in the project at different time points.

	
Analysis Model	The actual staffing level should be adjusted based on the plan
Decision Criteria	Monitor the difference between the actual staffing level and the plan one. When there is trend to diverge, control the human resource accordingly.
Indicator Interpretation	Both the actual and the planned staffing level are plotted on the same graph. The actual staffing part will be completed along with the progress of the project. Then the staffing resource can be monitored and the stuffing level can be adjusted in time.

Data Collection Procedure in Effort Allocation Plan	
Frequency of Data Collection	Once
Responsible Individual	Measurement lead – Ms. Cooper
Phase or Activity in which Collected	Before the start of requirement phase
Tools Used in Data Collection	N/A
Verification and Validation	N/A
Repository for Collected Data	PSM Insight database

Data Collection Procedure in Staffing profile	
Frequency of Data Collection	Monthly
Responsible Individual	Measurement lead – Ms. Cooper
Phase or Activity in which Collected	During the whole project life cycle

Tools Used in Data Collection	N/A
Verification and Validation	N/A
Repository for Collected Data	PSM Insight database

Data Analysis Procedure	
Frequency of Data Reporting	Monthly
Responsible Individual	Program manager – Col. Thompson
Phase or Activity in which Collected	During the whole project life cycle
Source of Data for Analysis	PSM Insight database
Tools Used in Analysis	N/A
Review, Report, or User	Weekly status report

Additional Information	
Additional Analysis Guidance	Consider the scope of work to be performed, staff experience, task assignments, schedules, quality problems, and rework when analysing the adequacy of effort and when exploring why effort may not be tracking to plans. Staffing levels may be below plan because the original plan was unrealistic. Vacations, holidays, or other events should be considered.
Implementation Considerations	An automated system for tracking the test results makes this information easier to collect.

b) Figure B-14

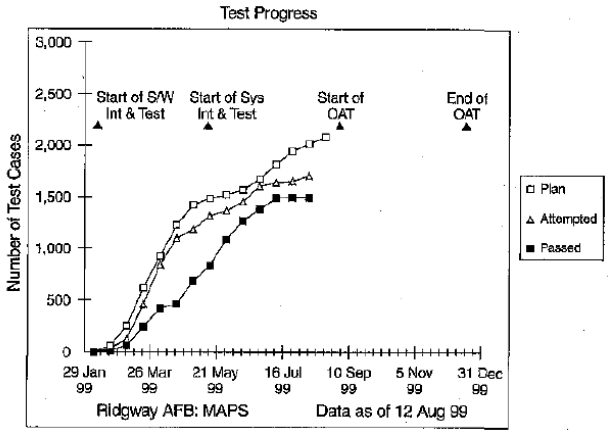
Information Need Description	
Information Need	Is test progress of Increment 1 following the schedule?
Information Category	Schedule and Progress

Measurable Concept	
Measurable Concept	Test Status

Entities and Attributes		
Relevant Entities	Test Progress Plan	Test Report
Attributes	The number of test cases	The number of attempted and passed test cases

Base Measure Specification	
Base Measures	• Number of planned test cases at each time point • Number of attempted test cases at each time point • Number of passed test cases at each time point
Measurement Methods	Collect the data from the initial test plan Count the attempted test cases in a time frame in the test report Count the passed test cases in a time frame in the test report
Type of Method	Objective
Scale	Natural scale
Type of Scale	Interval
Unit of Measurement	cases

Derived Measure Specification	
Derived Measures	• Number of accumulative attempted test cases • Number of accumulative passed test cases
Measurement Function	• Integrate the numbers of the attempted test cases collected before • Integrate the numbers of the passed test cases collected before

Indicator Specification	
Indicator Description and Sample	A line chart illustrating both the number of planned, attempted and passed test cases in different time point. 
Analysis Model	Root-reason analysis should be evaluated when the attempted curve diverges from the planned one or the passed one diverges

	from the attempted one.
Decision Criteria	When the number of the attempted test cases is behind the planned one constantly, the manager should analyse if it is caused by lack of staffs. When the ratio of passing the attempted test cases is bellowed 50%, the manager should analyse the reason for the poor quality of the development.
Indicator Interpretation	From the indicator, it is easy to track the progress of the test. When there is a large gap between the planned and the attempted curve, the test progress is behind the schedule. When the passed curve diverges from the attempted one, it indicates the low quality of the development.

Data Collection Procedure in Test Progress Plan	
Frequency of Data Collection	Once
Responsible Individual	Measurement lead – Ms. Cooper
Phase or Activity in which Collected	In the beginning of the integration and test phase
Tools Used in Data Collection	N/A
Verification and Validation	Review the feasibility of the plan regularly
Repository for Collected Data	PSM Insight database

Data Collection Procedure in Test Report	
Frequency of Data Collection	Weekly
Responsible Individual	Measurement lead – Ms. Cooper
Phase or Activity in which Collected	During integration and test phase
Tools Used in Data Collection	N/A
Verification and Validation	N/A
Repository for Collected Data	PSM Insight database

Data Analysis Procedure

Frequency of Data Reporting	Weekly
Responsible Individual	Program manager – Col. Thompson
Phase or Activity in which Collected	During the integration and test phase
Source of Data for Analysis	PSM Insight database
Tools Used in Analysis	N/A
Review, Report, or User	Weekly status report

Additional Information	
Additional Analysis Guidance	
Implementation Considerations	An automated system for tracking the test results makes this information easier to collect.

9. In the beginning, I will get a profound understanding of the project's software information needs and prioritise them. Then define the set of related measurable concepts. Analyse which software entities are available to be measured within the project. Then develop a measurement plan and follow the plan during the project life cycle. During the measurement, the nine measurement principles should be followed.
    - Use issues and objectives to drive the measurement requirement.
    - Define and collect measures based on the technical and management processes.
    - Collect and analyse data at a level of detail sufficient to identify and isolate problems
    - Implement an independent analysis capability
    - Use a systematic analysis process to trace the measures to decisions
    - Interpret the measurement into the project management process throughout the life cycle
    - Use the measurement process as a basis for objective communications
    - Focus initially on project-level analysis

10. Referring to the Maturity Profile Report in September 2013, there are three types of organisations, Military/Government Agency, Contractor for Military/Government and Commercial/In-house. There are several points to address:
    a) The majority (77.3%) of the reporting organisations is the commercial/in-house one.
    b) The distribution in the Maturity level differs from types. The majority of organisations in the commercial/in-house and contractor for military/government is in Defined level, while the majority of the military/government Agency is in managed level.

c) The ratio of the organisations of military/government agency in Initial level is much higher than the other two types.

In the term of organisation size, the majority is organisations in size between 1 and 100. One fifth of the reporting organisations are in size of above 200. There are several points to address:

a) The majorities of organisations in different size are all in defined level. The ratios are all above 50%.
b) The ratio for organisations in managed level is negative correlated to the size. 45% of organisations with size lower than 25 are in managed level, while there just are 6% of organisations with size above 2000 are in managed level.
c) The ratio for organisations in optimizing level is proportional to the size of the organisations. 42% of organisations in size above 2000 are in optimizing level, while 1% of organisations with size lower than 25 are in optimizing level.
d) The ratio of organisations in quantitatively managed level is always low no matter what the size of the organisation is. One possible reason is that whenever an organisation achieves the upgrade from the defined level to quantitatively managed level, it is easy for them to continue to the next level.
e)

11. The benefits include
    a) Decreased Costs
       General Dynamics Advanced Information systems reduced maintenance staff costs by 64% while doubling the size of the organisation.
    b) Improved On-Time Delivery
       Tufts Associated Health Plans achieved 100% on time delivery of major IT projects in a full year.
    c) Improved Productivity
       SAIC System and Network Solutions Group doubled its productivity.
    d) Improved Quality
       IBM Australia Application Management Services closed 95% of problems within the customer-specified time frame.
    e) Improved Customer Satisfaction
       Northrop Grumman IT, Defence Enterprise Solutions received more than 98% of possible customer award fees
    f) Impressive Return on Investment
       Reuters experienced over 3 to 1 ROI from reducing post-release defects.
12. The two representations are continuous and staged.
    a) The PAs are organised into four categories in continuous representation.

Continuous Representation
Reason: In continuous representation, the PAs are categorised according to the key relationships between them. PAs have contribution to a similar aspect of the project are categorised together. This representation enables the organisation to choose the focus of its process improvement efforts by choosing PAs in a category, that best benefit the organisation and its business objectives.

The continuous representation uses capability levels to characterise the state of the organisation's processes relative to an individual PA.
By using the representation, an organisation is concerned with selecting both a particular process area to improve and the desired capability level for the process area.

Category	**Process Areas**
Process Management	Organisational Process Focus (OPF) Organisational Process Definition (OPD) Organisational Training (OT) Organisational Process Performance (OPP) Organisational Performance Management (OPM)
Project Management	Project Planning (PP) Project Monitoring and Control (PMC) Supplier Agreement Management (SAM) Integrated Project Management (IPM) Risk Management (RSKM) Quantitative Project Management (QPM) Requirements Management (REQM)
Engineering	Requirements Development (RD) Technical Solution (TS) Product Integration (PI) Verification (VER) Validation (VAL)
Support	Configuration Management (CM) Process and Product Quality Assurance (PPQA) Measurement and Analysis (MA) Decision Analysis and Resolution (DAR) Causal Analysis and Resolution (CAR)

b) The PAs are organised by maturity levels in the staged representation

Staged Representation

Reason:
The staged representations characterise the overall state of the organisation's processes relative to the model as a whole using the maturity levels. PAs are categorised into different maturity levels. An organisation should focus on the PAs in a maturity level in order to achieve the maturity level. PAs in a maturity level are the preparation for the next level.

Maturity Level	**Focus**	**Process Areas**
5 Optimising	Continuous Process Improvement	Organisational Performance Management (OPM) Causal Analysis and Resolution (CAR)
4 Quantitatively Managed	Quantitative Management	Organisational Process Performance (OPP) Quantitative Project Management

		(QPM)
3 Defined	Process Standardisation	Requirements Development (RD) Technical Solution (TS) Product Integration (PI) Verification (VER) Validation (VAL) Organisational Process Focus (OPF) Organisational Process Definition (OPD) Organisational Training (OT) Integrated Project Management (IPM) Risk Management (RSKM) Decision Analysis and Resolution (DAR)
2 Managed	Basic Project Management	Requirements Management (REQM) Project Planning (PP) Project Monitoring and Control (PMC) Measurement and Analysis (MA) Supplier Agreement Management (SAM) Process and Product Quality Assurance (PPQA) Configuration Management (CM)
1 Initial		

13. Similarity:
    a) The concept of levels is the same
    b) To reach a level (either capacity or maturity), the organisation must satisfy all the goals of the PA(s) in question up to and including the level in question
    c) They all have defined and managed level. The performed level of the capability level can match to the initial level of the maturity levels.
    d) They are all cumulative. A higher capability level includes the practices of the lower levels. To achieve a higher maturity level, the lower one must to be achieved.

    Difference:

    a) A capability level is an evolutionary for a process area, while a maturity level describes the performance of the whole project.
    b) The capability levels have incomplete level, while the maturity levels have the quantitatively managed level and optimizing level.

    The required components are the specific and generic goals.

    The expected components are the specific and generic practices.

    The informative components are components that help model users understand CMMI required and expected components. It can be sub-practices, notes, references, goal titles,

practice titles, sources, example work products, and generic practice elaborations.

14. The SP 3.2 in project planning is to reconcile work and resource levels. It requires to adjust the project plan to reconcile available and estimated resources. The reason for its importance is that it improves the feasibility of the planning. The estimation and planning of a project should follows the available resources. Another reason is that to make a good estimation and planning for a project, it is important to achieve the specific goal, which is obtaining commitment to the plan (SG 3). The SP 3.2 is a critical process to achieve this goal.
15. It is the SP 1.4 of the requirements management. It requires to maintain bidirectional traceability among requirements and work products. The bidirectional traceability helps to determine whether all source requirements have been completely addressed and whether all lower level requirements can be traced to a valid source.
16. The SP 3.1 and SP 3.2 in Risk Management.
    SP 3.1: Develop a risk mitigation plan in accordance with the risk management strategy.
    SP 3.2: Monitor the status of each risk periodically and implement the risk mitigation plan as appropriate.
    There are 5 actions can be done to mitigate the risk.
    a) Accept
    b) Reduce the probability and keep the impact
    c) Keep the probability and reduce the impact
    d) Reduce both the probability and the impact
    e) Transfer/share the risk
    Typically, the risk parameter for each risk is measured and the risks with highest parameters would be mitigated.

17. Significance of the SP 3.1
    a) The operational concepts and scenarios document the interaction of the product components with the environment, end users, and other product components.
    b) Operation concepts and scenarios are useful for analysing requirements (SP 3.3).
    c) The output of SP 3.1 is useful for requirement validation (SP 3.5) and the process area validation.
    d) Operation concepts and scenarios are used in selection of product component solutions (SP 1.2 of technical solution). Each alternative solution/set of solutions are evaluated against the operational concepts and scenarios.
    e) They are also used in design of the product or product component (SP 2.1 of technical solution). They are used to generate use cases and quality attribute related scenarios that are used to refine the architecture.
18. Comparison of verification and validation

	Verification	Validation
Purpose	The purpose of verification is to ensure that selected work products meet their specified requirements	The purpose of validation is to demonstrate that a product or product component fulfils its intended use when placed in its

		intended environment.
Involve	• Evaluating work products against specifications • Conducting product quality evaluations compared with quality assurance evaluations	• Evaluating work products against operational concepts and use scenarios • Determining the 'fitness for use' of work products
Ensuring	The product is built right	The right product is built
Activities	• Software architecture evaluation and implementation conformance evaluation • Load, stress and performance testing • Decision table based testing	• Discussion with end users, perhaps in the context of a formal review • Prototype demonstrations • Functional demonstrations • Functional demonstrations

19. Peer reviews are important for the following reasons:
    a) It helps to develop a better understanding of the work products and the processes that produced them so that defects can be prevented and process improvement opportunities can be identified.
    b) Conducting a peer review is useful to find and remove defects early. Normally, finding a defect earlier can reduce the cost for the defect.

    There are 3 specific practices, preparing for peer reviews, conducting peer reviews and analyse peer review data.

    In SP 2.1, a plan for the peer reviews is developed. It enhances the efficiency for the peer reviews. Peer reviews are costly. A good preparation for the peer reviews can minimise the cost.

    In SP 2.2, the peer reviews are conducted. It provides the data for SP 2.3. During the peer reviews, defects are found and removed.

    In SP 2.3, data are analysed. It may be referenced in the future and improve the peer review in the future. However, the data are not for evaluation of the performance of people or for attribution.

20.

Practice	Characterisation (FI, LI, PI, NI or NY	Strength(s)/Weakness(es)	Objective Evidence - Artifacts, - Affirmation
RM SP 1.4	PI	(S) The Telelogic DOORS is being used.	(Affirmation) Statement by the engineering manager. (Affirmation) Statement from the engineers (Artifacts) demonstration
		(S) The traceability is established automatically by the system.	(Affirmation) Statement of the engineers
		(W) The impact to the lower level requirements is not automatic.	(Artifacts) demonstration
		(W) The manual operation for database clean-up is the lagged.	(Artifacts) demonstration