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BORANG PENGESAHAN STATUS THESIS ♦

JUDUL : QUALITATIVE PROJECT MANAGEMENT (QPM), A CASE STUDY OF CMMI
INITIATIVES WITH GQM BY AIG SOFTWARE INTERNATIONAL JV

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QUALITATIVE PROJECT MANAGEMENT (QPM), A CASE STUDY OF CMMI
INITIATIVES WITH GQM BY AIG SOFTWARE INTERNATIONAL JV

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This technical report is submitted in partial fulfillment
of the requirements for the award of the degree of
Masters of Science (Computer Science - Real Time Software Engineering)

Centre For Advanced Software Engineering
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MARCH, 2004

DECLARATION

I declare that this thesis entitled “Qualitative Project Management (QPM), A Case Study Of CMMi Initiatives With GQM By AIG Software International JV” is the result of my own research except as cited in references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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*Dedicated to En. Mohd Naz'ri Mahrin my lecturer who formally introduced the
faculty of Quality and instilled the interest in the writings of this thesis.
It is my humble hope that this thesis is worthy of
his invaluable tutelage.*

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ABSTRACT

Quality is seen as having become the single most important force leading to organisational success and company growth in national and international markets. Further, it is argued that: **'Quality is in its essence a way of managing the organisation'** and that, like finance and marketing, quality has now become an essential element of modern management; so as to AIGSI as well. This report analyses the constancy of purpose adopted by AIG Software International (AIGSI) Private Limited Corporation, Malaysia in establishing qualitative project management with the aim of increasing organizational profitability. A well-established process, the five-step Capability Maturity Model Integrated (CMMi) of SEI and the Goal Question Metrics (GQM) lends assistance to AIGSI's intentions. This study attempts to establish the relativity of the GQM, currently a more academically known paradigm with the CMMi modal. We've introduced GQM to develop a set of metrics to help control and monitor the institutionalization of the standards and procedures established in AIGSI in accordance to the CMMi requirements. In relation to, we have created a GQM plan, to help support the CMMi initiatives. As a result of this study, we would like to project a better understanding between the correlation of a combined set of metrics within GQM and the CMMi in an industrial environment. In achieving the goals of this report as stated above, we will also comply to the commitment made in our initial proposal, a supporting initiative of this report wherein to help the legacy team of AIGSI to better their process compliance index (PCI) to a comfortable level of 80% and above.

ABSTRAK

Kualiti merupakan suatu kepentingan bagi memastikan pertumbuhan dan kejayaan sesebuah syarikat di peringkat nasional dan antarabangsa. Kualiti juga dikatakan sebagai suatu cara untuk menguruskan sesebuah syarikat. Oleh yang demikian AIGSI telah memastikan kualiti sebagai suatu element penting dalam pegurusan moden sama seperti kewangangan dan pemasaran. Laporan ini memperkenalkan cara yang di gunakan oleh AIGSI dalam menubuhkan projek pengurusan kualitatif dengan tujuan meningkatkan keuntungan syarikat. Dua proses yang mantap iaitu GQM dan CMMi dari SEI telah di pilih bagi membantu AIGSI untuk mencapai tujuan tersebut. Kajian ini bertujuan mewujudkan hubungan di antara GQM dan modal CMMi. GQM telah di perkenalkan bagi membina satu set metrik untuk membantu mengawal proses dan standard yang telah di sediakan di peringkat organisasi selaras dengan keperluan yang telah di tetapkan oleh CMMi. Hasil daripada kajian ini adalah di harapkan wujudnya satu korelasi di antara gabungan metrik GQM dan CMMi di dalam perindustrian. Untuk mencapai matlamat kajian ini, segala cadangan yang telah di nyatakan di dalam kertas cadangan (proposal) awal akan di patuhi di mana suatu inisiatif sokongan terhadap laporan ini adalah untuk membantu kumpulan “Legacy” mencapai Indeks Pematuhan Proses (PCI) sekurang-kurangnya 80%.

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LIST OF ACRONYMS

Term	Description
AIG	American International Group
AIGSI	AIG Software International JV
CCB	Change Control Board
CEO	Chief Executive Officer
CMM	Capability Maturity Model for software ® Carnegie Mellon University
CMMi	CMM Integrated ® Carnegie Mellon University
GQM	Goal Question Metric
IA	Impact analysis
iPlan	Project management tool used in AIGSI
IT	Information Technology
PCA	Process Compliance Audit
PCI	Process Compliance Index
PM	Project Manager
PMP	Project Management Plan
PSR	Project Status Report
QA	Quality Assurance
QP	Quality Plan
QPM	Qualitative Project Management
S&P	Standards and Procedures

SAD	Software Analysis and Design
SCMP	Software Configuration Management Plan
SEI	Software Engineering Institute
SEPG	Software Engineering Process Group
SMR	Senior Management Review
SQA	Software Quality Assurance
SRS	Software Requirement Specification
UAT	User Acceptance Testing
WBS	Work Break-down Structure

CHAPTER 1

INTRODUCTION

1.1 Overview

The following report is presented in accordance to the requirements of MCT 2145: Professional Training II for the degree of Master of Science in Real Time Software Engineering jointly carried out with Pn. Noor Ezleen Moksen a fellow student pursuing the same degree. The objective of this report is to demonstrate from an industrial perspective the ability to apply the acquired academic knowledge to support activities in an industrial environment. We have for this purpose chosen “Qualitative Project Management (QPM), A Case Study Of CMMi Initiatives With GQM By AIG Software International JV” to provide more insight into the details necessary to demonstrate from a business, organization and industrial perspective the benefits of improved software quality management using software process improvement techniques.

The essence for the QPM report was instilled in Semester 3 in MCT 1632: Quality and Integration under the tutelage of En. Mohd. Naz'ri Mahrin. One of the core activities of this subject was to present a paper on the goal-question-metric (GQM) paradigm (Basili et al. 1994). The GQM method was originally developed by V. Basili and D. Weiss, and expanded with many other concepts by D. Rombach. The works for this paper led to the intense research on the approach and organization of this model, the core relativity of this model to the other quality approaches namely the Capability Maturity Model Integrated (CMMi).

Following pursuit in semester 4 in MCT 1134: Project II where the requirements for this subject were to have a full scale real-time project taking into consideration of all aspects of the software development life cycle:

- Requirement analysis
- Specification
- Design
- Quality and Testing
- Integration and Configuration Management
- Management and Control

This subject required the demonstration in total the theories and practical concepts of attending to each of the above stated software lifecycles phases, based on the academic subjects learned throughout the beginning of the degree course relating to these phases.

In addition, for the above MCT 1134 subject, we presented a separate paper Quality Project Management in a contained project. We created a framework to establish the GQM and completed the project per the requirements of this framework. Further to, we incorporated the requirements of the CMMi Level 5 to this project, and piloted the project for its creditability in meeting the requirements at this level. Our findings clearly showed that the incorporation of GQM assisted in meeting the CMMi requirements. The presence of GQM assisted greatly especially in achieving CMMi's Level 4 (Quantitatively Managed) and CMMi's Level 5 (Continuous Process Improvement) requirements.

Here in this report, we have taken the QPM from a contained project of an academic background and propelled it to an industrial background. Our aim is to project the relativity of GQM in the CMMi initiatives in an industrial environment. Also, this report will update the original QPM in MCT 1134 by examining organizational implications of the benefits such as improving organizational business competitiveness from an industrial perspective to the initial findings in a contained academic environment. The selected environment is AIG-Software International, a software house working on the implementations of CMMi Level 3.

The key highlights of this report:

- Quality and its importance to the profitability of an organization. The cost of implementing software improvement methods are heavily outweighed by the cost savings from reduced development costs, and costs savings resulting from less rework.
- AIG-Software International a key player as the selected industrial organization for MCT 2145. Demonstrate from a business competitiveness aspect and

management perspective the benefits of improved software quality management.

- Quality gurus, specifically those that contributed directly or indirectly to the CMMi and GQM will be analysed in the literature review to provide support to the report.
- CMMi from the Software Engineering Institute (SEI) a five-level evolutionary process model of the capabilities of software development organization. The implementation efforts of AIGSI to Level 3 of this model - will the GQM be a practical aid for this purpose?
- GQM framework to support the activities of the CMMi initiatives. This will be from an analysis point of view – as it is not the intention of this paper to educate the organization on the fundamentals of GQM.
- The Process Compliance Audit of AIGSI a direct activity of the CMMi initiatives will be used to verify the GQM paradigm's contribution to the achievements of CMMi international certification. Therein to assist the AIGSI's legacy team to achieve a PCI of above 80%.

1.2 Quality and Organization

Contrary to popular belief, employees are only responsible for about 10% of productivity and quality issues, whereas management is responsible for around 90%. This is due to the fact that employees have little control over productivity and quality because they've little control over the system that governs them. Employees don't

control the amount of training they receive, the equipment they're given, the deadlines they have to meet, the materials they work with, or the conditions under which they're expected to perform, but management does.

Management generally has a tendency to push for short-term profits, which defeats the constancy of purpose by focussing on volume rather than quality and on profits rather than research, education, and training. Management has to realise that profits are mainly generated by loyal customers. The retention of loyal customers is utmost important not only to maintain current profits but also to generate increased profit for the organization. Studies show that loyal customers' contribution comprises of six to eight times more profits than that of the other customers, henceforth it's important to keep loyal customers and quality is the key ingredient for this purpose.

Improvement of quality reduces the number of post-release defects, improving customer satisfaction, which contributes repeat customer business and an improved company image. The result is a chain reaction – lower costs, better competitive position, and happier people on the job. Many managers mistakenly assume that quality comes at a high price. Alternatively, if quality improves, productivity increases and costs actually decline. How? Fewer mistakes mean less rework.

In other words, the benefits of doing things right the first time far outweigh the cost of doing them again and again. Another mistake that many managers tend to make is to see profit as simply the black and white difference between rigid figures, such as higher revenues and lower expenses, without taking into account other factors. In hopes of increasing profits, they typically cut costs in such areas as testing, training, staffing, and research and development without considering the long-term

consequences. Although this often boosts short-term profits, quality eventually suffers. In the long run, they end up losing loyal customers and profitability is seriously impacted.

1.3 Organization - AIGSI

Historically, when studying the competitive environment, firms concentrated on companies with which they competed directly. However, today competition varies. In the case of AIGSI it faces challenges from various areas. In the domestic market AIGSI has decided advantages in term of fixed clientele affiliated with AIG group of companies, however to capture other non-AIG companies it needs to establish its credibility.

On its international market again its clientele lies around the AIG group of companies. However, its position as a software house supporting the IT environment of these companies is highly challenged by the internal MIS department of these companies. These challenges forces AIGSI to take aggressive measures to be competitive. Product differentiation is a solution in this aspect, and for software product differentiation can be achieved via quality improvements, and at best with an international certification such as CMMi.

Currently CMMi certified companies are classified as the first choice companies to receive any IT related tenders offered by the AIG companies. Furthermore, due to the current rise of quality emphasis even the local customers tend to set this quality certification as the standard measure to dictate business in the IT environment. AIGSI had taken positive measures in meeting these challenges by gearing itself to obtain the CMMi international certification.

Brief overview of the company (www.aigsi.com, 2004) AIGSI is a joint venture between Software International (M) Sdn. Bhd. and American International Group (AIG, USA). The joint venture was established in 1998 to synergize key competencies between the 2 partners. The company has been awarded MSC status and located at Technology Park Malaysia in Kuala Lumpur.

AIGSI has over 80 employees and targeted to increase its work force to 150 by 2005. Through the strength of the staff resources, AIGSI is able to provide the following comprehensive portfolio of services,

- Strategic Solutions
- Business Performance Reengineering
- Project Management
- Platform Migration
- Software Development
- Enterprise Management

At AIGSI, the commitment to business and system solutions extends far beyond just placing personnel or meeting the deliverables of a project in an efficient way. The primary objective of AIGSI is to assist the clients in the planning, implementation and enhancement of their company's total Strategic Solutions.

Through the management and technical staff, AIGSI joins together the diverse expertise of many highly experienced individuals who understand the technical and business issues involved in the implementation of Strategic Solutions. It has broad experience in installing and implementing systems management, information management, telecommunications, and business application solutions.

AIGSI believe that the fundamental ingredient in a successful partnership is making the problem solution represent a seamless extension of the client's operation. AIGSI is uniquely positioned in the information industry to assist the clients to solve their technology challenges in a timely and cost-effective manner.

At AIGSI, it's committed to maintain a positive, long-term relationship with the client, based on mutual respect and recognition that the client's perspective of the system solution is always the best perspective.

AIGSI provides a comprehensive portfolio of services such as IT Strategic Solutions, Software Development, Business Performance Reengineering, Data Centre Management, Project Management and the likes.

In addition, management team in AIGSI is sensitive to the needs of its employees. Each employee is well equipped with computer hardware and software of the latest standards and quality.

1.4 Background and Influences

AIGSI acknowledges that company survival does not rely on figures only. Successful companies look at more than numbers; they pay attention to customer satisfaction, process improvement, pride on delivered products, and quality. In stride, AIGSI chose to go for the CMMi International Certification. In February 2003, the CEO of AIG-Software International launched the CMMi initiative. The aim of this launch was to officiate the beginning of work towards gaining CMMi Level 3 for the organization.

As its first step towards this initiative it engaged an external software consulting firm, Polaris Software Lab, India; to do a gap analysis, the following excerpt is from the Executive summary of the gap analysis findings presented by Polaris to AIGSI.

“A detailed gap analysis was conducted at Kuala Lumpur between March 14th 2003 and March 28th 2003. The gap analysis was done using the prevalent

processes and practices at the development centre with reference to the requirements of SEI CMMi Ver 1.1 – SE/SW/IPPD/SS - Staged Representation.

The objective of this engagement was to study the existing software development and maintenance process of AIGSI against the SEI CMMi model and to provide suggestions for process improvement. The scope of this engagement covered process level gaps and implementation level gaps.

In the absence of an Organization level process the document gap analysis was performed with reference to the systems development manual provided by the legacy team and project specific procedures of e-commerce projects. While verifying the implementation gap it was observed that there were inconsistencies in implementation thereby establishing the need to evolve a set of consistent processes to be used across projects. The absence of a common process set across projects has resulted in none of the process areas being fully satisfied.

The team reviewed a few projects to verify implementation to their documented processes and also observe the prevalent practices. While several good practices were found in projects, however in the absence of a dedicated process group these practices have remained with the projects. A focused process improvement initiative such as the one initiated now would enable all projects to leverage on each other's best practices. It is possible to evolve processes from your prevalent practices to a certain extent thereby facilitating implementation and institutionalization.

Most projects had their processes documented in one form or the other. This clearly shows that there is an appreciation in establishing documented process. The practitioner's involvement in the gap analysis phase also showed their commitment towards this initiative. A dedicated process group to spearhead process improvement activities would go a long way in moving the organization towards higher maturity levels."

(Source: PCG DETAILED REPORT - AIG SI V1.00, April 6th 2003)

Further to, the report provided several recommendations on going forward. One of which was a very high-level process improvement roadmap, which assisted as the foundation to the beginning of the CMMi activities in AIGSI. The roadmap was presented in terms of milestones as shown below:

Milestone-1

- Formation of steering committee to monitor process improvement initiatives
- Formation of a SEPG
- Develop process improvement plan

Milestone-2

- Finalize process architecture
- Address gap (Changes to existing process / new processes etc.)

Milestone-3

- Release process

Milestone-4

- Training of the staff
- Prepare for implementation (would include piloting new process procedure)

Milestone-5 (Ideally one would require a minimum of 6 months of implementation)

- Implementation
- Implementation verification
- Process correction
- **Regular audits – i.e. Process Compliance Audit**

Milestone-6

- Review implementation status
- Depending on the review outcome – decide on assessment

Assessment activities

- Assessment training
- Help with mini assessments
- Identify lead assessor
- Final assessment

The gap analysis report gave the basis for the works to begin to set the frameworks for the CMMi initiatives for AIGSI. The standards and procedures were placed in place and the first process compliance audit as indicated in milestone-5 above, took place on the first week of September, 2003. Again, AIGSI engaged external consultants from Polaris, India; to conduct the process compliance audit. This audit is carried out to ensure that the standards and procedures are in place and

being practiced by all the projects. Further to, it is one of the required practices of CMMi certified companies to carry out this initiative on an on going basis – AIGSI has opted to do it monthly.. In going, forward this exercise will be handled by AIGSI's internal quality personnel.

1.5 Problem Statement

The origin to the problem statement is derived from the milestone-5 activity:

Milestone-5

- Implementation
- Implementation verification
- Process correction
- **Regular audits – i.e. Process Compliance Audit**

The findings of the first process compliance audit carried out by the external consultants' will be used as the quantitative measurement basis to the problem statement of this paper. In 1.5.1 Process Compliance Audit next, a brief explanations is provided to the nature of this audit, prior to the details of the problem statement in 1.5.2 Findings of Process Compliance Audit.

1.5.1 Process Compliance Audit

The Process Compliance Audit is a required activity carried-out regularly on an on-going basis for CMMi certified companies to ensure that the processes and procedures are adhered to. In the case of AIGSI the first of this exercise was carried out pre-CMMi certification to verify the readiness of the company towards the certification initiatives. This audit is required to be carried out by qualified Software Quality Assurance personnel, who understands well the process and practices as dictated by the CMMi process model. The audit is carried out on each individual software projects currently active in AIGSI. The aim of the audit is to verify all the activities carried out within the project are in accordance to the organizational standards and procedures.

The process compliance audit is carried out on 3 main software process areas:

- a) Project planning
- b) Project tracking
- c) Software Development Life Cycle (SDLC)

In each category, a number of related sub-processes are audited. A score is assigned to the compliance of each of these individual activities. The total score is then provided as a percentage to the total awardable score. The final findings of the audit are presented in terms of the Process Compliance Index (PCI). The computation of the Index is the result of adding the above 3 categories (each category has a total of 100%) divided by 3. Each project is awarded a PCI based on this Process Compliance Audit.

$$\text{PCI} = (\text{Project Planning \%} + \text{Project Tracking \%} + \text{SDLC \%}) / 3$$

In Table 1.1, Table 1.2 and Table 1.3 we are able to see the criteria that make-up the components of this three software process areas (Source: AIGSI/Intranet/Standards and Procedure, 2004).

a) Project planning

In the project planning category the audit looks into the following listed criteria's under the specified sub-categories and awards the points according to the degree of adherence of the project team to that criterion:

Table 1.1: PCA – Project Planning

Project Planning	Score
Project Kick-off	
Did a project kick-off meeting take place?	
Was the kick-off meeting recorded?	
Were all action items of the kick-off meeting closed as per the agreed date?	
Project Registration	
Has the project been registered with Process and Compliance Division Head?	
Project Planning	
Is size estimation done as per estimation guideline?	
Is effort estimation done according to estimation guideline?	
Are estimation worksheets available?	
Are project schedules maintained in line with estimation?	

Project Planning	Score
Are detailed WBS available?	
Does the Project Have a PMP?	
Has the PMP been reviewed and review observations recorded?	
Are the review comments - tracked to closure as per agreed date?	
Is the PMP Managed and Controlled?	
Risk Planning	
Are risks associated with the projects identified?	
Are the risks prioritized?	
Are there appropriate mitigation strategies?	
Are there appropriate contingency plans for the high probability risks?	
Process Planning	
Has the project defined/tailored the process to be followed?	
If tailored - has the tailoring been approved by SEPG?	
Are deviations required identified upfront and approvals obtained?	
If there are specific standards, templates and guidelines to be followed for various life cycle stages - have these been defined?	
Are the updates to project plan being reviewed?	
Project's Quality Assurance Plan	
Does the Project have a Quality Plan (QA)?	

Project Planning	Score
Has the QP been reviewed and observations recorded?	
Have the review comments been tracked to closure as per the agreed date?	
Is the QP managed and controlled?	
Project's Software Configuration Management Plan	
Has the project defined a Configuration Management Plan?	
Has the SCMP been reviewed and observations recorded?	
Have the review comments been tracked to closure as per the agreed date?	
Is the SCMP managed and controlled?	
Has the project identified its CM process?	
Has the project identified its Change management procedure?	
Has the project defined a CCB?	
Total	xxx/100
PCI for Project Planning	xx %

b) Project tracking

In the project tracking category the audit looks into the following listed criteria's under the specified sub-categories and awards the points according to the degree of adherence of the project team to the specified criteria:

Table 1.2: PCA – Project Tracking

Project Tracking	Score
Project Status Tracking	
Are activity wise daily time sheets maintained by each team member in iPlan?	
Is the WBS updated as and when an activity is complete?	
Does the project have a formal team review at agreed interval?	
Are action items of these meetings recorded?	
Are action items tracked to closure?	
Is the status of the project reviewed with the division head during monthly SMR?	
Are action items of the SMR meeting recorded?	
Are SMR action items tracked to closure?	
Is the Project Status report prepared and reported to Customer and Sr. Mgmt	

Project Tracking	Score
Is the Phase end data tracked and sent to customer at the end of each Life Cycle phase	
Were Project Issues tracked properly	
Risk Tracking	
Are the risks identified in the project tracked and reprioritized as and when required?	
Project Performance Tracking	
Is the necessary data collected as defined in the QA plan	
Are projects quantitative targets tracked during SMRs?	
Are performance issues analyzed and appropriate corrective actions taken?	
Project Process Tracking	
Are processes defined/tailored reviewed periodically?	
If processes are inappropriate are they changed?	
If processes are changed are necessary approvals obtained?	
Is the changed process disseminated effectively across the team?	
Change Management	
When there are changes - are change requests raised?	
Is impact analysis done and impacted CI's identified?	

Project Tracking	Score
Impact in terms of effort, schedule and CI's - are they documented?	
If the change has an impact on effort - are estimation worksheets created?	
Are the changes approved by the CCB?	
Are schedules reworked based on the changes?	
Are the version control procedures adhered to	
Is release verification done by the SQA	
Are configuration status reported on the defined periodicity	
Is audit trail performed and used for Configuration Audits	
Implementation Checks	
Are the Project related plans discussed and shared with the Stakeholders and their commitment is obtained?	
Are CM audits performed at predefined periodicity?	
Document Control	
Does the project document have appropriate document control features - such as Version no. / Page number etc..	
Is the revision history of the document up-to date?	
Are the templates provided in S&P followed?	
Are documents maintained in directories with appropriate access control?	

Project Tracking	Score
Are naming conventions prescribed followed for all documents?	
Total	xxx/100
PCI for Project Tracking	xx %

c) Software Development Lifecycle

In the software development lifecycle category the audit looks into the following listed criteria's under the specified sub-categories and awards the points according to the degree of adherence of the project team to that criterion:

Table 1.3: Software Development Lifecycle

Software Development Lifecycle	SCORE
Requirements Phase	
Has the Systems requirement specification document been Internally reviewed?	
Has the review report been filed and in the identified format?	
Have the review comments been tracked to closure as per the agreed date?	
SRS Sign off obtained from the Customer team	
Has the project created a Requirement Traceability matrix	
Has the System test plan been reviewed?	
Has the review report been filed and in the identified format?	
Have the review comments been tracked to closure as per the agreed date?	
Has the System test plan been baselined?	
Have the system test cases been reviewed?	
Has the review report been filed and in the identified format?	
Have the review comments been tracked to closure as per the agreed date?	
Have the system test cases been baselined?	
If a prototype was generated, was the same reviewed Internally	
If so, were the review findings tracked to closure	
Are the Requirements phase deliverables kept under appropriate levels of	

Software Development Lifecycle	SCORE
configuration control as defined in CM Plan?	
Were project related plans reviewed at the end of the phase during SMR to accommodate changes to the plan - if any?	
Is the iPlan updated with the actual data by PM?	
Design	
Is the design documented?	
Are the Design standards / templates / checklist defined used for documenting the Design?	
Is the Design Doc/SAD reviewed?	
Has the review report been filed and in the identified format?	
Have the review comments been tracked to closure as per the agreed date?	
Requirements Traceability Matrix Updated?	
Have the Integration Test cases been written if applicable?	
Have the Integration Test Cases been reviewed	
Has the review report been filed and in the identified format?	
Have the review comments been tracked to closure as per the agreed date?	
Requirements Traceability Matrix Updated with mapping to Integration Test Cases?	
Are the Design phase deliverables kept under appropriate levels of configuration control as defined in CM Plan?	
Did the project conduct a phase end review as part of PSR/SMR?	
Were project related plans reviewed at the end of the phase as part of SMR to accommodate changes to the plan - if any?	
Is iPlan updated with the actual data by PM?	
Development (Coding)	
Has the program specification/ tech spec/ IA been reviewed?	
Has the review report been filed and in the identified format?	
Have the review comments been tracked to closure as per the agreed date?	
If there are any project specific standards, have they been reviewed?	

Software Development Lifecycle	SCORE
Are the Unit cases created?	
Have the test case been reviewed?	
Has the review report been filed and in the identified format?	
Have the review comments been tracked to closure as per the agreed date?	
Are the Coding standards / templates / checklist defined used while coding?	
Do Code reviews happen as planned?	
Are checklists used for review?	
Has the review report been filed and in the identified format?	
Have the review comments been tracked to closure?	
Peer/Independent 'Unit Testing' does it happen as per plan?	
Are independent unit testing results logged?	
Are the defects filed in the iPlan?	
Have all defects been tracked to closure?	
Are the Coding phase deliverables kept under appropriate levels of configuration control as defined in CM Plan?	
Requirements Traceability Matrix updated	
Did the project conduct a phase end review as part of PSR/SMR?	
Were project related plans reviewed at the end of the phase to accommodate changes to the plan - if any?	
Is the iPlan updated with the actual data by PM?	
Testing	
Was the Integration Testing done as per the IT cases	
Are the Integration Test Results Logged	
Are the defects filed in the identified format?	
Have all defects been tracked to closure?	
Was the System Testing done as per the System Test cases	
Are the System Test Results Logged	
Are the defects filed in the identified format?	

Software Development Lifecycle	SCORE
Have all defects been tracked to closure?	
System Test Pass/Fail Status List updated for each round of testing	
Was Test Report prepared at the end of System Testing Phase	
Was the software release note generated	
Implementation Phase	
Was an acceptance Report obtained from Customer	
Was a Project imp rev meeting conducted	
Was Customer Satisfaction Survey conducted and results analyzed	
Total	xxx/100
PCI for SDLC	xx %

1.5.2 Findings of Process Compliance Audit

The findings of the first process compliance audit were received in mid-September 2003 (Source: PCA Results by Polaris, India). Based on this audit finding, the legacy team projects received low PCI scores. There were 3 projects that were candidates from the legacy team, herein referenced as project A, B and C (actual project names are withheld). The following were the result of the findings:

Table 1.4: Results of Process Compliance Audit of September 2003

Legacy Project Name	Project Planning	Project Tracking	SDLC	PCI
A	22.61 %	54.78 %	38.89 %	38.76%
B	25.83 %	55.83 %	38.89 %	40.18%
C	67.06 %	66.15 %	63.59 %	65.51%

Based on the above results the legacy team has to improve its adherence to the standards and procedures on the software processes currently being practiced in the individual projects.

The problem statement for this paper is to assist in improving the standards and procedures practiced by the legacy team. The improvement should ensure the legacy team achieves at least a minimum score of 80% PCI on the audit for the month of December, 2003. The improvement will be in the form of ensuring all the practices that are required by the CMMi modal is in place and are practiced by the projects. These practices can also be put in place by following the GQM paradigm. The main aim of this paper is to find the relativity between the GQM paradigm and the CMMi modal. Since the organization is fully into the practices of the CMMi modal, we will analyse the same practices as advocated by the GQM paradigm independently.

1.6 Chapter Layout

Chapter 1: Introduction

The introduction provides a pragmatic argument for this report in demonstrating an aspect from the academic perspective to an industrial environment. A brief statement on the relativity of the selected problem to the report findings is provided. Quantitative measures are used via the PCI to provide an achievement guideline for this report. To show broader importance, the aspects of the PCA review are explained in depth. Chapter 1 ends with a clear statement of the problem statement and a preview of how the research will address this problem.

Chapter 2: Literature Review

This chapter analyses the relativity of quality theories provided by quality gurus who developed the CMMi model; Crosby, Deming, Juran and Humphrey. As these gurus with the exception of Humphrey are of the tangible arena, this review studies the validity of their theories in the face of the intangible arena – software, using AIGSI's organizational practices to validate this. Chapter 2 ends with a brief explanation on the CMMi modal, cost of quality and tools applied to measure quality.

Chapter 3: Research Methodology

In this chapter we provide the overview of the Research and Methodology carried out to examine the problem statements. Here the fundamental steps in establishing the GQM paradigm is shown. Therein, we have processed the entire GQM measures to portray the handling of the AIGSI's legacy systems gap via this initiative.

Chapter 4: Findings and Analysis

In this chapter we present the Analysis of the findings. The findings present the successful meeting of the PCI audit of above 80%. We provide the analysis supporting to the analogy that the GQM may actually be a subset of the CMMi model.

The last, Chapter 5: Conclusion

This chapter presents the overview of this paper and conclusion. The conclusion presents AIGSI on the benefits of improved software management using software process improvement techniques, namely CMMi to better position itself in the competitive market.

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