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ISAT903, AN ASSESSMENT TOOL ON THE QUALITY SYSTEM FOR SOFTWARE INDUSTRY

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ABSTRACT

Software industry is currently facing numerous problems. As such, continuing emphasis has been given in finding ways to solve the problems with main focus on improving software development quality and productivity. Quality and productivity are weapons that have to be utilized by any enterprising organizations to win dominance in the global market as well as in the competitive market of the information age.

One of the solutions to these problems is an implementation of software engineering tools and techniques, such as Computer Aided Software Engineering (CASE) Technology and CASE tools. But up-to-date with the tools only, the software industry is unable to solve these problems completely. This paper presents and proposes a compliance model on the quality system for software development by ISO 9000-3 as a conceptual combination of the Total Quality Management, Software Engineering concept and application of the quality system standard ISO 9000-3.

Keywords: ***Software Engineering, Quality System Standard, ISO 9000-3, Total Quality Management***

1.0 INTRODUCTION

The role of software is becoming increasingly critical for business as well as for human life, and the three main failures of the software industry are cost overrun (over budget), schedule overrun (late), and software which does not work become magnified [1, 2, 3].

Lost of life or widespread inconvenience caused by unreliable software makes big headlines in the news media. It was estimated that in the last few years around 4000 people have died as a result of software defects [4].

If software in a modern aircraft stops functioning for more than 200 milliseconds, the aircraft is irrecoverable. In June 1996, a European space agency rocket carrying a number of European Satellites exploded seconds after its launch. The accident was attributed to software failure [4].

As software products become more essential to an increasing number of applications, more attention has been focused on the problems areas of software development. Software Engineering is considered as one solution to the software development problems, among the other solutions [5, 6, 7, 8]. The industry has realized that CASE tools are not enough [8].

The software industry's experience with CASE tools has proved that the main reason for software projects failing has little to do with technology and tools, and much to do with lack of process disciplines. Only by creating a disciplined process for software development can we manage and control the quality of software product. Hence, we need a practical approach for setting up a disciplined and continuously improved software process environment [9].

Currently, there are a number of software process improvement models and emerging standards developed by international organizations, industry consortia, large software purchaser and software developers. So far, the most popular model for software process improvement are the Capability Maturity Model (CMM) and ISO 9001 with its associated guidance ISO 9000-3 [4, 10].

An effective software process improvement program should be aligned with other organizational initiatives, perhaps under a Total Quality Management umbrella, to address the business issue in totality. One of the quality initiatives which spans multiple disciplines and businesses is Total Quality Management (TQM) [4, 11].

2.0 ANALYSES AND SOLUTION OF SOFTWARE DEVELOPMENT PROBLEM

One of the solutions to the software development problems is the implementation of software engineering tools and techniques, such as Computer Aided Software Engineering Design (CASE) technology and CASE tools. But it is compulsory to be known that the tools are not the only thing to solve all problems completely and totally. Instead of using software engineering tools, the software industry must also apply the quality system standard such as ISO 9001 in its activity process of software development, either for internal company's demand or the customer's. As the

software market matures, a customer wants to be assured of quality. The only way to differentiate a software product from those of the competitors, beyond the short term, is by its quality of support that goes with it. Certification to international quality standard is becoming a prerequisite for getting business; not to have certification will become a competitive disadvantage. There are several reasons why software industry should be concerned with quality [12]:

1. Quality is now a competitive issue;
2. Quality is essential for survival;
3. Quality is essential for international marketing;
4. Quality is cost effective;
5. Quality retains customers and increases profits;
6. Quality is the hallmark of world-class business.

Implementation of a quality system such as ISO 9001 is not enough. A quality culture must be developed that pervades the company. The characteristics of such a culture include [12]:

- Dedication to customer satisfaction
- Emphasis on continuous improvement
- Treating suppliers as business partners
- Communication and team work
- Empowering employees
- Commitment by top management

To enable people in the software industry to take advantage of software engineering tools as well as apply the quality system standard ISO 9001, a proper management style is needed. The appropriate management style is Total Quality Management since its basic principal covers teamwork, continuous improvement and customer focus.

Teamwork

Teamwork is essential for continuous improvement by aligning individual and group's goal, objectives, and activities. Team activities build communication and provide an infrastructure supporting TQM practices.

Continuous Improvement

The primary TQM objective is an unending improvement of every aspect of work. The objective is implemented through a systematic, disciplined approach that improves all processes. The improvement can be incremental (Kaizen), or revolutionary (innovation), depending on the process, people, technology and environment.

Customer focus

Customer response is the absolute test of effectiveness. Although the organization's external customers are the ultimate users of products, many processes also have intermediate customer within the organization. From a customer's standpoint, quality is the customer's perceived value of the product he or she purchased, based on a number of variables, such as price, performance, reliability, overall satisfaction, and others. In Guaspari's book *I Know It When I See It*, the author discusses quality in the customers' context as follow [13]:

> "Your customers are in a perfect position to tell you about Quality, because that all they're really buying a product. They're buying your assurances that their expectations for that product will be met.
>
> And you haven't really got anything else to sell them but those assurances. You haven't really got anything else to sell but Quality".

It is clear that the concept of quality must involve customer or quality is conformance to a customer's expectations and requirements.

Standard For Software Process Assessment

The most popular model for software improvement and assessment are Capability Maturity Model (CMM) and ISO 9001 with it's associated ISO 9000-3. From these two models, the one used in European and Asian countries is ISO 9000-3. On the other hand, CMM is more widely used in USA and Canada [3]. A part of it, ISO 9000-3, is suitable to be applied on software industry starting from small scale to large scale, and in an industry that has not applied the quality system standard at all. Based on this consideration, this project uses the model assessment with ISO 9000-3 [4, 12, 14].

ISAT903 As A Self-Assessment Tool

The most important point in the ISAT903 project is the design of questionnaires. There are three references used to develop questionnaires in this tool. The main references used are ISO 9000-3 and Software Engineering concepts. The third reference is the application of Total Quality Management principles. The questionnaires are managed accordingly, which ISAT903 will check and ensure whether these three disciplines are applied in the software development activities simultaneously. In Table 1, it can be seen that each questionnaire either matches with ISO 9000-3 and Software Engineering, or ISO 9000-3 and Total Quality Management, or with all three, namely ISO 9000-3, Software Engineering and Total Quality Management.

Based on the guideline for the application of ISO 9001 to the development, supply and maintenance of software, which consists of 22 quality elements, they are arranged as an assessment tool to assess the industry's current level of compliance. The current level is used as a starting point to prepare the arrangement steps of quality system with standard on ISO 9000-3 as well as to make preparation to obtain a certification of ISO 9001.

TABLE 1. QUESTIONNAIRES'S DESIGN

Questionnaire	Matching With		
4.1 Management Responsibility	**ISO 9000-3**	**S/W Engineering**	**TQM**
1. Is the quality policy, including objectives for, and commitment to quality documented?	✓		✓
2. Is the policy quality understood, implemented and maintained at all levels of the organization?	✓		✓
3. Is the stated quality policy relevant to internal organization goals and customer needs/expectations?	✓		✓
4. Are the organizational structure, responsibility, authority and interrelationship of personnel who manage, perform & verify work affecting quality, defined and documented?	✓		✓
5. Are the personnel for management, performance of work and verification provides adequate trained?	✓		✓
6. Are adequate resources (skill, equipment, including the number of internal auditors) to meet the company's needs?	✓		✓
7. Are reports issued by the management representative used for improvement of the quality system?	✓		✓
8. Does executive management periodically review and approve all aspects of the quality system, quality policy and defined objectives for quality?	✓		✓
9. Are these reviews documented?	✓		✓
4.2 Quality System			
1. Has the supplier established, documented and maintained a quality system to ensure that product conforms to specified requirements	✓		✓
2. Does the quality manual include or refer to the documented procedures that comprise the quality management system?	✓		
3. Do documented quality system procedures consistent with the quality company's objective and ISO's requirements?	✓		✓
4. Does the software development team follow the procedures?	✓		
4.3 Internal Quality System Audit			
1. Are documented procedures established and maintained for planning and implementing internal quality audits?	✓		
2. Are internal audit schedule on the basis on the status and importance of the activities?	✓		
3. Are the audit reports reviewed and corrective by management?	✓		
4. Is there a mechanism used for ensuring compliance with software engineering standards?	✓	✓	
5. Is there a mechanism used assessing the software engineering process to implement indicated improvement?	✓	✓	✓
6. For each project, is independent audit conducted for each step of software development process?	✓		
7. Are the result of audits and assessments included in the regular reviews of the quality system?	✓		

Continuation of Table 1

Questionnaire	Matching With		
4.4 Corrective Action	**ISO 9000-3**	**S/W Engineering**	**TQM**
1. Are documented procedures established and maintained for implementing corrective and preventive action?	✓		✓
2. Are corrective action and preventive action for corrective and preventive actions that are taken appropriate to the magnitude of the problems and relative to the risks encounter?	✓		
3. Do procedures for corrective action include the effective handling of customer complaints and report of product non conformities investigating the cause of non conformities relating to product process and quality system and recording the results of the investigation	✓		
4. Is there a mechanism used for reviewing error causes to determine the actions required to prevent them?	✓		✓
5. Are the actions resulting from design reviews, code reviews and testing reviews tracked to closure?	✓		✓
5.2 Contract Review			
1. Are contract review procedures established, maintained and documented?	✓		
2. Are the requirements adequately defined and documented?	✓		
3. Are records of contract reviews maintained?	✓		
5.3 Purchaser's Requirements Specification			
1. Has the supplier a complete, unambiguous set of functional requirements, include all necessary to satisfy the purchaser's need.	✓	✓	✓
2. Do these requirements documented and approval by the purchaser before entering the development stage?	✓		
3. Do all interfaces between the software product and other software or hardware products fully specified in the purchaser's requirements specification?	✓	✓	
4. Is the assignment of person (on both side) responsible for establishing the purchaser's requirements specification?	✓		
5.4 Development Planning			
1. Does management establish and maintain procedures for design control to ensure that the specified requirements are met?	✓	✓	
2. Does management prepare plans for each design and development activity, defines responsibility, and assigns activity to qualified personnel equipped with adequate resources, and updates design plan?	✓	✓	
3. Does management define organization and technical interfaces between different groups, documents, transmits and reviews all appropriate information?	✓	✓	
4. Does management identify documents all design inputs and reviews their selection for adequacy?	✓	✓	
5. Does management document the design output appropriately for comparison against the design input to ensure that it meets the acceptance criteria?	✓	✓	
6. Does management plan formal design reviews at appropriate stages for every design? Review includes participation by representatives of all functions involved with the specific design stage.	✓	✓	✓

Continuation of Table 1

Questionnaire	Matching With		
	ISO 9000-3	S/W Engineering	TQM
7. Does management plan design verification at appropriate stages for every design to ensure that the design output meets the design input requirements?	✓	✓	✓
8. Does management plan design validation on final product under defined operating conditions to ensure that the product meets user requirements?	✓	✓	✓
9. Does management identifies, documents, reviews and approves changes before their implementation?	✓		
10. Are there a formal procedure and tool used to estimate software development schedule, cost and size?	✓	✓	
5.5 Quality Planning			
1. Is there a designed software project manager for each software project?	✓	✓	✓
2. Is there a project plan procedure for each project?	✓	✓	✓
3. Is there a Quality Assurance plan produced by each project?	✓	✓	✓
4. Do the quality plan be updated along with the progress of the development?	✓	✓	✓
5. Do the quality plan be formally reviewed and agreed by all organization concerned in its implementation?	✓	✓	✓
5.6 Design and Implementation			
1. Do management identify and plan production, testing, installation and servicing processes which affect quality to ensure that these processes are carried out under controlled conditions?	✓	✓	
2. Do management establish and maintain procedure for the identification, segregation, and disposition of non-conforming product?	✓		
3. Do management document procedures defining the responsibility for reviews and the authority for disposition of non-conforming products?	✓		
4. Do supplier consider the following aspect in each design activity, they are identification of design consideration, design methodology, use of past design experience, subsequent process?	✓	✓	
5. Do supplier consider rules, implementation methodology in each implementation activity?	✓	✓	
6. Is the formal a formal procedure used to review the status of each software development project?	✓	✓	
7. Is there a mechanism used to for controlling changes to the software design?	✓	✓	
8. Are there standards used for the design of human computer interfaces?	✓	✓	
9. Are formal design reviews carried out?	✓	✓	
10. Are code reviews conducted?	✓	✓	
5.7 Testing and Validation			
1. Does the quality plan or documented procedures for testing and validation define the records to be established?	✓	✓	
2. Are there written procedures is used to control in process testing and are they in accordance with specified requirements?	✓	✓	
3. Is software item held until the required testing and validation completed?	✓	✓	
4. Are process testing and validation monitored to demonstrate conformance to the specified requirements?	✓	✓	✓

Continuation of Table 1

Questionnaire	Matching With		
	ISO 9000-3	**S/W Engineering**	**TQM**
5. Are instructions available that indicate what procedures must be followed in the event that process parameters are found to be outside of specified requirements?	✓	✓	
6. Are records of in process testing and validation maintained?	✓		✓
7. Are written procedures in use to control acceptance testing and do they conform to the specified requirements?	✓		
8. Is the evidence that the software product conforms to the specified requirements and do these documents contain proper authorizations?	✓		
9. Are personal assigned to acceptance testing for their tasks and independent of those having direct responsibility for the software product?	✓		
10. Are records for acceptance testing maintained?	✓		
11. Do testing and validation records clearly shows that a software product has passed or failed testing, and /or tests according to defined acceptance criteria?	✓		
12. In event of failure, are controls for non-conformance software product documented in a procedure?	✓		
13. Do testing and validation records identify the testing authority for the release of software product?	✓		
5.8 Acceptance			
1. Is there a formal procedure for testing or inspection of the completed software product before it is delivered to the customer?	✓		✓
2. Is there a mechanism for ensuring trace-ability between the software requirement and the top level design?	✓	✓	
3. Is there a mechanism for ensuring trace-ability between the top level design and the detail design?	✓	✓	
4. Is there a mechanism for ensuring trace-ability between the detail design and code?	✓	✓	
5.9 Replication, Delivery and Installation			
1. Have documented procedures for the preservation of software product been established?	✓		
2. Are there written procedures in use to safeguard the quality and trace ability of item software after final testing and validation through replication, delivery and installation?	✓	✓	
3. Do shipping records indicate delivery lot identification and relation to inspection lot, shipping date, destination and identity of shipping inspection personnel?	✓		
4. Is there a contractual agreement on copyright, licensing and custody of the software product?	✓		
5. Is there a mechanism for verifying the correctness and completeness of copies of the software delivered?	✓		
6. Is there a formal procedure for customer validation of the installation upon completion?	✓		✓

Continuation of Table 1

Questionnaire	Matching With		
5.10 Maintenance	**ISO 9000-3**	**S/W Engineering**	**TQM**
1. Does supplier establish and maintain procedures for performing maintenance activities and verifying that such activities meet the specified requirements for maintenance?	✓	✓	✓
2. Have all maintenance activities been carried out and managed in accordance with a maintenance plan defined?	✓		
3. Is an organization with representatives from both supplier and purchaser to support the maintenance activities?	✓		✓
4. Are the maintenance activities recorded in predefined format and retained?	✓		
5. Is there a mechanism for assignment of support personnel for each software product problem?	✓		
6. Are priorities set for software problems to be fixed?	✓		
7. Is there a mechanism used to inform the customer of current and planned future changes?	✓		✓
6.1 Configuration Management			
1. Is there a mechanism used to manage the different versions of the software tools used in the development process, e.g. Compiler, code generators, DBMS, etc?	✓	✓	
2. Is there a mechanism used for controlling changes to the code?	✓	✓	
3. Is there a mechanism to identify the different versions of the software under development, e.g. the design and codes may undergo revisions during development?	✓	✓	
4. Is there an automated tool used to controlling and track change activity throughout the software development process?	✓	✓	
6.2 Document Control			
1. Does management establish and maintain documented procedures to control all appropriate documents and data?	✓		
2. Does management establish system to review and approve all appropriate documents and data for adequacy before issue?	✓		
3. Are reviews and approvals of documents carried out?	✓		
4. Is there a list to identify the current version of each key document?	✓		
5. Is there a distribution list for notifying appropriate personnel of document changes?	✓		
6.3 Quality Record			
1. Is there a record management function that takes care of the identification, filling, storage, maintenance and disposition of records?	✓		
2. Are formal records maintained on module development progress?			
3. Are retention period established for each document?	✓		
6.4 Measurement			
1. Are statistics collected for actual versus planned man-hours requirements?	✓	✓	✓
2. Are statistics collected for actual versus planned budgets requirements?	✓	✓	✓
3. Are statistics collected for projected versus actual design errors?	✓	✓	✓

Continuation of Table 1

Questionnaire	Matching With		
	ISO 9000-3	**S/W Engineering**	**TQM**
4. Are statistics collected for software codes and test errors?	✓	✓	✓
5. Are statistics collected for planned versus actual modules designed overtime?	✓	✓	✓
6. Are statistics collected for planned versus actual modules completing unit testing overtime?	✓	✓	✓
7. Are statistics collected for planned versus actual modules integrated overtime?	✓	✓	✓
8. Are statistics collected for software release content overtime?	✓	✓	✓
6.5 Rules, Practices and Convention			
1. Are naming standards used for objects such as data sets, program modules, forms, and tables?	✓	✓	
2. Are coding standards applied to each software development?	✓	✓	
3. Are standards applied for the layout of documents?	✓	✓	
4. Are project filling system standards applied?	✓	✓	
5. Are design review standards applied?	✓	✓	
6. Are code review standards applied?	✓	✓	
7. Are unit testing standards applied?	✓	✓	
6.6 Tools, and techniques			
1. Does the software development documentation describe the use of tools and techniques?	✓	✓	
2. Are standard methodologies applied for requirements analysis and design?	✓	✓	
3. Is there a formal procedure for enabling the reuse of existing design and code in new applications?	✓	✓	
4. Are formal design notations such as data Flow Diagram, Entity Relationship Diagram, Data Dictionary, Structure Chart, used in software design?	✓	✓	
5. Are CASE tools used to aid the design process?	✓	✓	
6. Are prototyping methods used?	✓	✓	
7. Is automated test input data generators used for testing?	✓	✓	
8. Are CASE tools used to assist in tracing software requirements to software design?	✓	✓	
9. Are CASE tools used to assist in tracing software design to code?	✓	✓	
10. Are interactive source level debuggers used?	✓	✓	
11. Are automated tools used to analyze cross-references between modules?	✓	✓	
6.7 Purchasing			
1. Are documented procedures established and maintained to ensure that purchased product conforms to specified requirements?	✓		
2. Does management establish policy to evaluate and select vendors or sub contractors based on their ability to meet quality requirements?	✓		✓
3. Does management establish and maintain a list of approved vendors (AVL) or approved subcontractors (ASL)?	✓		✓
4. Does management describe the product to be purchased clearly and precisely?	✓		
5. Does management specifies the verification arrangements and the product release procedures in their purchase orders when verification at the sub contractors' premises is required?	✓		

Continuation of Table 1

Questionnaire	Matching With		
6.8 Included Software Product	**ISO 9000-3**	**S/W Engineering**	**TQM**
1. If a third party software product is incorporated in the software development, is there a review or inspection of software before use?	✓	✓	✓
2. Is there a documented procedure for the controlling of verification, storage, protect and maintain the third party supplied product?	✓	✓	✓
6.9 Training			
1. Does management document appropriate procedures for the identification of training needs and to provide suitable training for all personnel performing activities affecting quality?	✓		✓
2. Is there a training program required for using CASE tool and CASE technology?	✓	✓	✓
3. Is there a training program required for analyzing and designing the system?	✓	✓	✓
4. Is ISO 9000-3 training given to all members of software developer	✓		✓
5. Is software project management training given to all project managers	✓	✓	✓
6. Is Total Quality Management, training given to all members of software developer	✓		✓
7. Are the seven tools and seven quality management tools given to all members of software developer?	✓		✓
8. Is there a training program required for implementing software metric?	✓	✓	✓

The menu design of ISAT903 is as shown in Fig. 1, and consists of:

- **Assessment Section**
- **Reference Section**
- **Report Section and**
- **Help**

In the assessment section, there are 3 parts of sub-assessments, namely [12]:

- **Framework:** consisting of 4 quality elements of ISO 9000-3,
- **Software Development Life Cycle:** consisting of 9 quality elements of ISO 9000-3, and
- **Supporting:** consisting of 9 elements of ISO 9000-

So, there are 22 quality elements as guidance for the users. Each quality element consists of several questionnaires with an explanation below it (see Fig. 2). Thus, ISAT903 is more than common questionnaire. This addition is used to reduce the errors and misinterpretation at the time of filling it up that has a tendency to mark up the evaluation.

The user can also refer to the references related to this tool, in addition to the explanation on each questionnaire (see Fig. 3). The Help Menu also assists the user to be acquainted with the meaning of certain terms, for example "the quality system" (see Fig. 4). The list of International Bureau is also attached on the Help Menu to provide the user with a contact in the process of obtaining a certification of ISO 9001, if user is ready to be audited by External Certification Bureau [15]. In the report section, the user will find a list of answers for each questionnaire, quality scoring per 22 elements and the average of quality scoring (see Fig. 5 and Fig. 6). Each "Yes" answer is weighted as 1 and "No" as 0. If the total weightage is less than 25% (out of 140), the report is Poor. It will give a Fair result if the total is between 26% and 50%. If it is between 51% and 75%, the report is Good. If the total is more than 75%, the report is Excellent.

Through the report section, the user can identify the feedback of his quality system quickly since ISAT903 is designed to be interactive and user friendly. So we can focus on an improvement action on the poor scoring of quality elements. Furthermore, this assessment can be done repeatedly until the user is satisfied on how much improvement is done on each quality element.

ISAT903, developed using Delphi programming language, is a complete assessment tool and easy to implement. It means that the cost is reduced because it is self-implemented. Moreover, it is also accurate for anticipation on the common questionnaire with References and Help and for upgrading the user's knowledge on quality improvement (learning by doing).

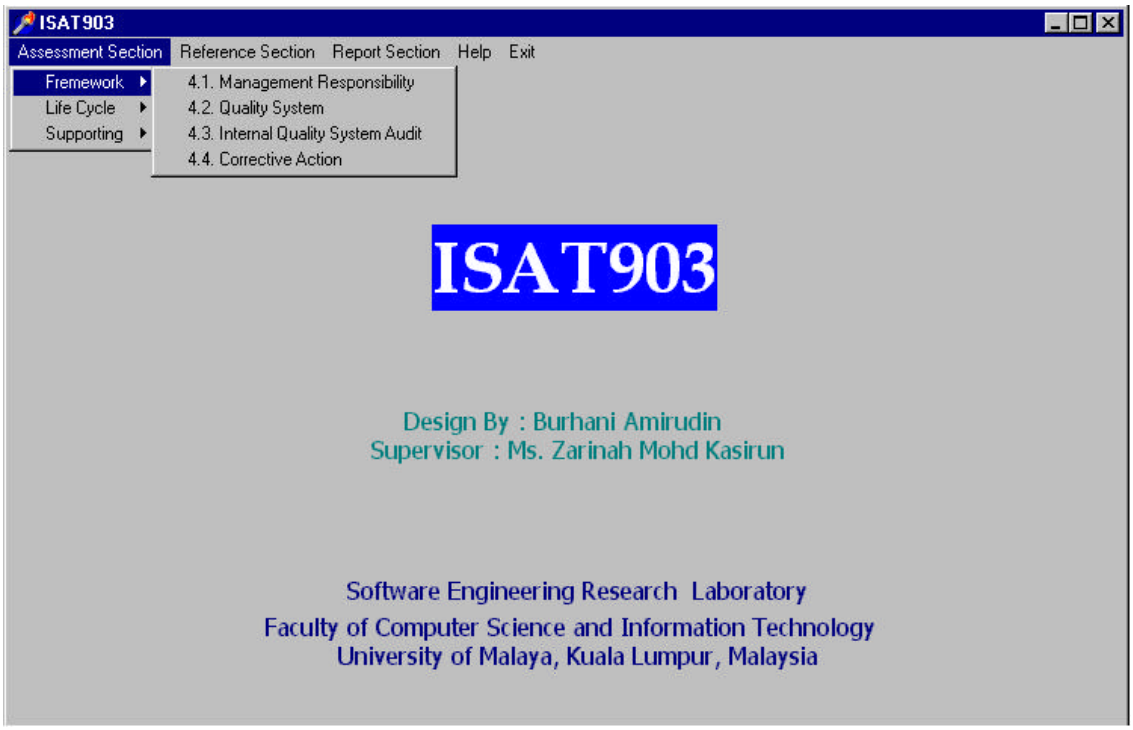

Fig. 1: Main Menu of ISAT903

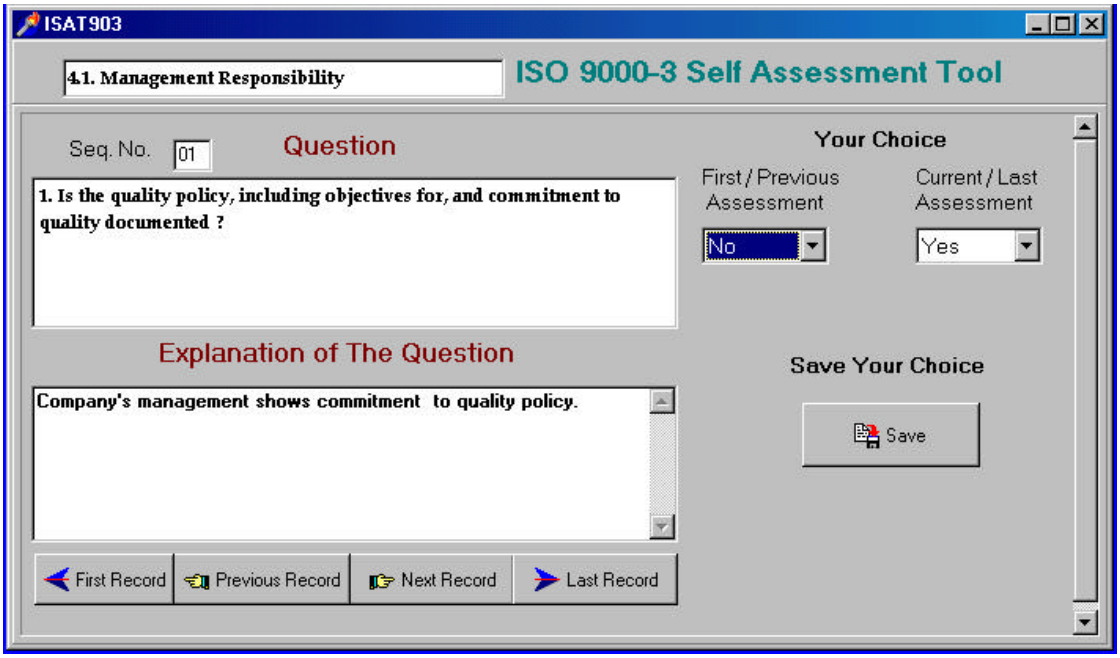

Fig. 2: A Questionnaire of ISAT903

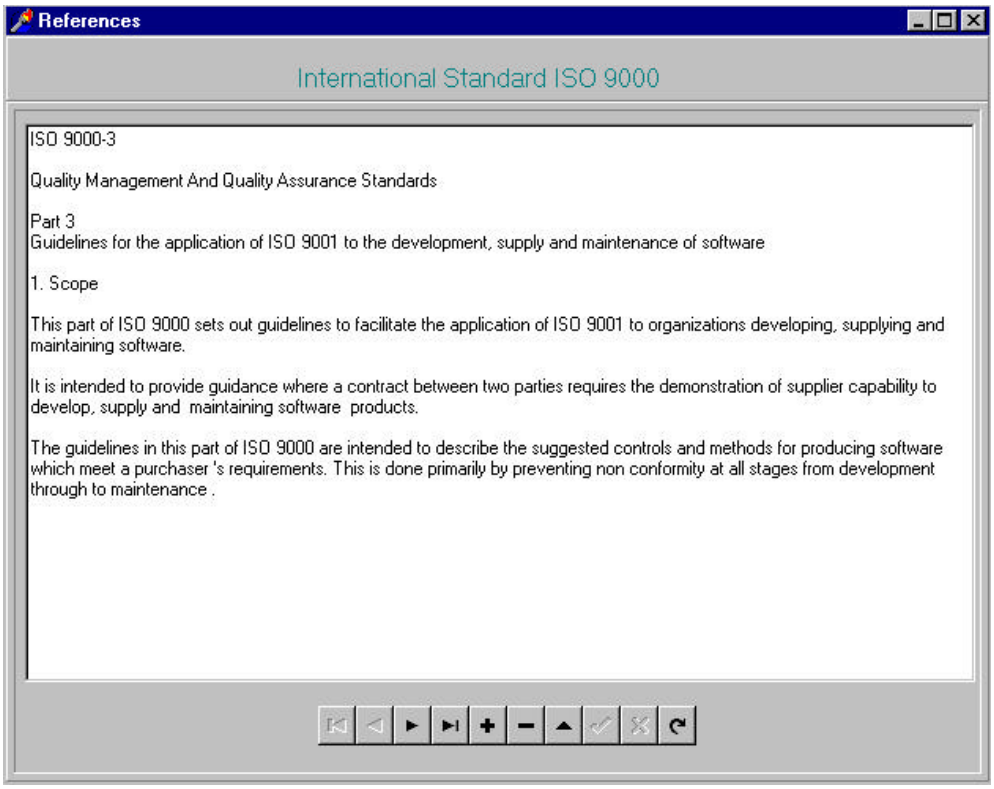

Fig. 3: References

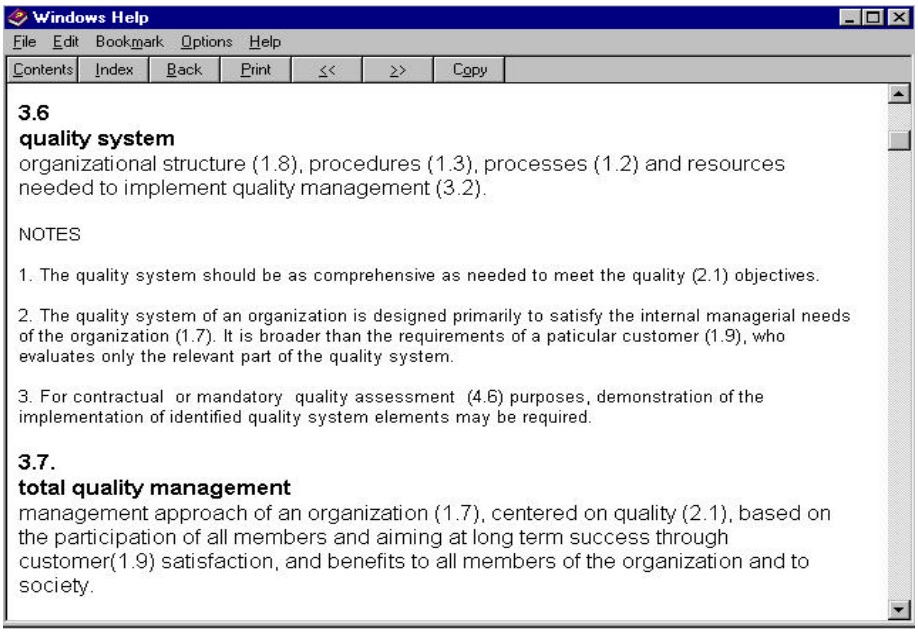

Fig. 4: Help

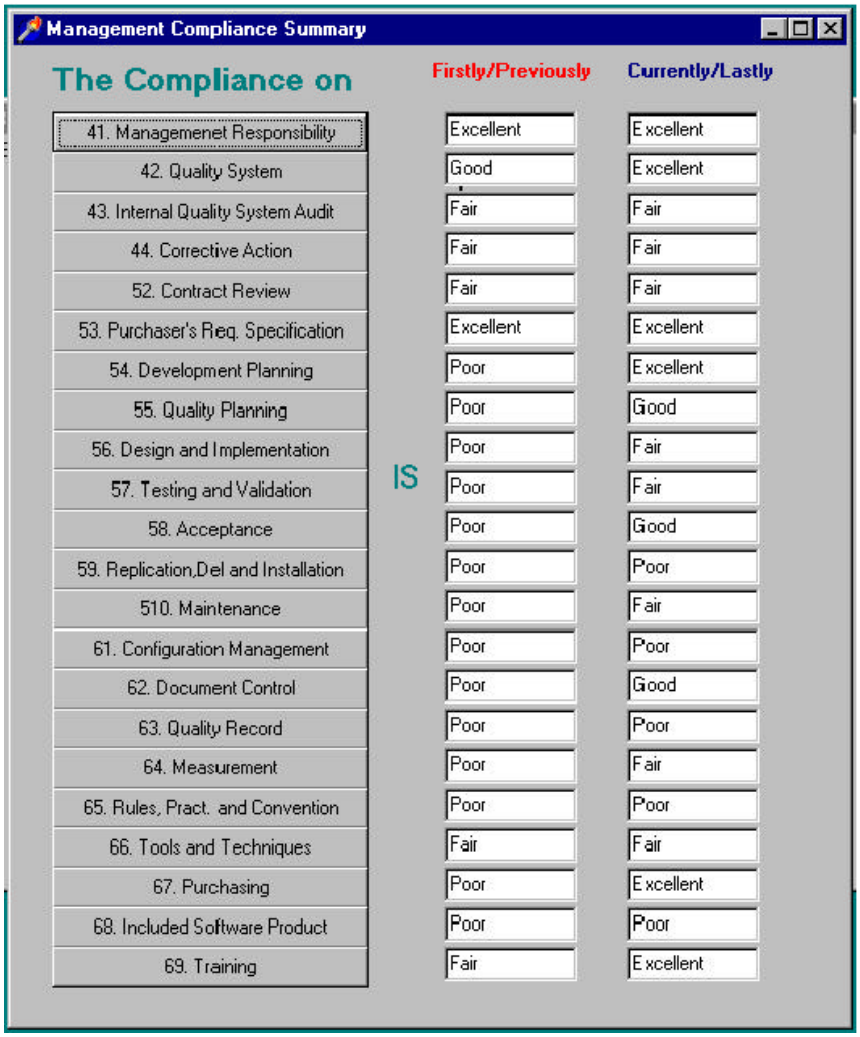

Fig. 5: Management Compliance Summary Report

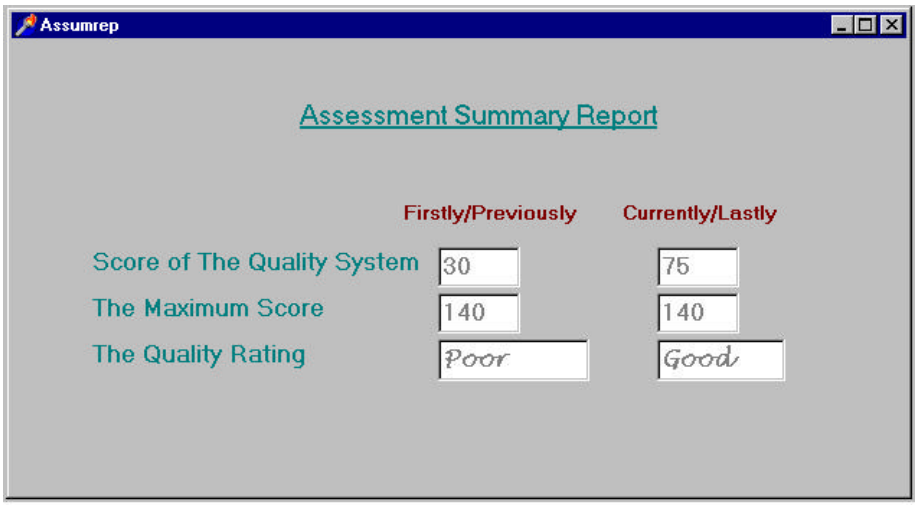

Fig. 6: Assessment Summary Report

ISO 9000-3 Preparation and Implementation

When a software company decides to apply for an ISO 9000-3 registration, the first thing to do is to obtain the top management's support which involves budget, time and a thorough understanding of what is required for an ISO certification. The next steps are as follows:

1. Form an ISO implementation team.
2. Obtain a copy of the ISO standards.
3. Implement a training program for ISO overview and requirements for the rest of staff in the organization.
4. Train the team members on the details of standards and what needs to be accomplished. The training program should not cover just procedural and job-related issues, but also the need for change; include tools for problem solving, developing measurement criteria and presenting data.
5. Start developing and documenting the quality policy, plan and procedures. If the company already has a manual in place, review and update it so that it is current. The quality plan should support the quality policy and the procedures must cover all of the ISO elements such as document control, training, internal audits, corrective action and quality records.
6. Train the staff on any new procedures and ensure the staff follows the new procedures.
7. Form an internal audits team and train the members on how to conduct the audits based on ISO standards and internal documented procedures.
8. Schedule audits by an internal audit team members.
9. Review any nonconformance discovered by the audit members; address the nonconformance and if necessary update the quality manual and procedures accordingly.
10. Interview and select external auditors for pre registration audit to identify any non-conformity that may have been missed by the internal audit process.
11. Address the non-conformities found by the external auditors.
12. Contact, select and apply to a registrar.
13. Undergo formal audit by registrar.

Prior to the audit, the registrar will send the audit plan to the organization. The plan outlines the audit schedule, agenda, and the areas to be audited. When the audit team arrives at the organization, an opening meeting with the management should be conducted which covers the following topics:

- Introduction of team members
- Description of audit, scope, purpose, and procedures
- Review of agenda and confirmation of schedule
- Clarification of any points not understood.

After the opening meeting, the audit begins. The auditors assess predetermined aspects of the operation to the standards. They look for objective evidence that the organization conforms to its own pre-established standards, and that these standards meet with the intent of the ISO standards. When the team completes the audit, they meet with the organization to review all the findings. Copies of non-compliance are given to the organization and the corrective action dates are obtained by the registrar. The organization provides a documented plan on how the corrective actions will be made and implemented. Upon a confirmation of the implementation of this plan, if the registrar is satisfied, it grants a registration and issues a registration document to the organization. The registration is an ongoing process, where the registrar will perform periodic surveillance audits to ensure the quality system is being maintained.

3.0 CONCLUSION

There are three main failures of the software industry namely: cost overrun (over budget), schedule overrun (late), and do not work as well as requirement specifications. These failures are caused by a poor management function that manages software development project. One of the solutions to these problems is the implementation of software engineering tools and techniques, such as Computer Aided Software Engineering (CASE) Technology and CASE tools.

But, in the current era of global market, the problem of the software industry must be solved completely and totally as well as to produce software products of high quality and with a high competitive ability all at once. Up to now, with only these tools the software industry is unable to solve these problems completely and totally. The industry has realized that CASE tools are not enough. The software industry's experience with CASE tools has proved that the main reason for failed software projects has little to do with technology and tools, but much to do with a lack of process disciplines. Therefore, by creating a disciplined process for software development we should manage and control the quality of software product. So, we need a practical approach for setting up a disciplined and to continuously improve software environment.

Currently ISO 9000 is the most popular model for software process improvement with its associated guide ISO 9000-3. But ISO 9000 is focused on technical system. Technical capability is necessary, but not sufficient for success.

Software organization is about people and about the way people behave and interact with each other in groups. They are about the attitude, the aspiration and the motivation of people in work situation.

Therefore, the technical system needs to be integrated with a social system in order to build a quality culture. For that purpose, the management must apply an integrated and effectively discipline of Software Engineering, Quality System Standard ISO 9001 and Total Quality Management.

ISAT903, as a model and a tool for assessment of existing quality system software industry, is easy for self usage and incurs a low cost, as a starting point of preparation to apply for the quality system standard on the ISO 9000-3 as well as to obtain the ISO 9001 certification. ISO 9000-3 is suitable for the software industry, which takes place or markets its products to European and Asian countries. ISO 9000-3 is suitable to be applied on software industry starting from the small scale to the large scale or an industry that has never applied the quality system standard at all.

Limitation of the Tool

ISAT903 cannot certify directly the software industry to be ISO 9001 compliant based on the result obtained. Certification is an audit process by a third party with a rigorous inspection and demonstration of the process documentation and practices

At its best, the result from ISAT903 assessment can be used as an understanding of a general level of readiness, strength and weakness of the software industry with respect to the ISO 9001.

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