Software Quality

SOFTWARE QUALITY AID AND CHECK LIST

For

PROJECT MANAGERS

When Undertaking

SOFTWARE QUALITY ASSURANCE

And

SUPPLIER ASSESSMENTS

Introduction and Quality System Definitions and Standards

What is Quality?

The word 'Quality' has become an everyday word to mean 'excellence' or 'perfection' in describing a product.

The real meaning should be how much does a product meet its design purpose and satisfy its design requirement.

The ISO9000:2000 definition of Quality is '*The degree to which a set of inherent characteristics fulfils requirements*'.

It is the delivery of a product with a consistent level of quality from product to product.

Outline of ISO9000:2000

The new ISO9000:2000 family is an all encompassing series of standards that lay down requirements for incorporating the management of quality into the design, manufacture and delivery of products, services and software. The family consists of three primary standards supported by a number of technical reports. These are:

- **ISO9000:2000 Quality Management Systems - Fundamentals and Vocabulary**. This describes the fundamentals of Quality Management Systems and specifies the terminology.
- **ISO9000:2000 Quality Management Systems - Requirements**. This specifies the requirements for Quality Management Systems for use where an organisation's capability to provide products that meet customer and applicable regulatory requirements need to be demonstrated.

- **ISO9000:2000 Quality Management Systems - Guidelines for performance improvement.** This provides guidance for Quality Management Systems, including the processes for continual improvement that will contribute to the satisfaction of an organisation's customers and other interested parties.

What are the key elements of ISO9000:2000

When ISO9000 was first released in 1987, it was recognised as being largely incomplete and required the auditors to fill in lots of the gaps.

The first revision of ISO9000 in 1994 removed many of these problems. However, an organisation could still conform to the standard but at the same time produce sub-standard products that were consistently of a poor quality. There was clearly a major loophole that enabled organisations to comply with the requirements of ISO9000:1994 but without having to improve their quality.

ISO9000:2000 uses eight (8) quality management principles which reflect best practice and which are designed to enable a continual improvement of the business, the overall efficiency and be capable of responding to customer needs and expectations.

The eight principles contained in ISO9000:2000 are of primary concern to an organisation, as they will affect an organisation's overall approach to quality. These are:

- **Customer Focus**: Organisations depend on their customers and therefore should understand current and future customer needs and should meet customer requirements and should strive to exceed customer expectations.
- **Leadership**: Leaders establish unity of purpose, direction and the internal environment of their organisation. They create the environment in which people can become fully involved in achieving the organisation's objectives.
- **Involvement of People**: people at all levels are the essence of an organisation and their full involvement enables their abilities to be used for the organisation's benefit.
- **Process Approach**: A desired result is achieved more efficiently when related resources and activities are managed as a process.
- **System Approach to management**: Identifying, understanding and managing a system of interrelated processes for a given objective contributes to the effectiveness and efficiently of the organisation.
- **Continual Improvement**: Continual improvement is a permanent objective of any organisation.
- **Factual Approach to Decision Making**: Effective decisions are based on the logical and intuitive analysis of data and information.
- **Mutually Beneficial Supplier Relationships**: Mutually beneficial relationships between an organisation and its suppliers enhance the ability of both organisations to create and add value.

What is a Quality Manual

'A document specifying the quality management system of an organisation'

A Quality Manual is a document setting out the general quality policies, procedures and practices of an organisation. Or, put another way, it is an organisation's written record of what they say and do to produce a quality product or deliver a quality service.

A Quality Manual is also an organisation's formal record of its Quality Management System (QMS), it is:

- A rule book by which their organisation functions
- The organisations corporate memory of procedures and lessons learnt
- A source of information from customers may derive confidence in the product
- A means of defining the responsibilities and interrelated activities of every member of the organisation
- A medium for defining the level of quality that an organisation wishes to consistently deliver
- A vehicle for auditing, reviewing and evaluating the organisations QMS

A Quality Manual is the single point of reference required to run all aspects of an organisation to consistent quality levels. It is the heart of a QMS and is essential for anyone aspiring to ISO9000:2000 certification.

What Goes in a Quality Manual

To be effective, the Quality Manual must:

- Include a statement of the organisation's policy towards quality control
- Contain details of the organisation's quality management structure and organisation, together with job descriptions and responsibilities
- Describe the organisation's quality control requirements, training programmes, etc.

A Quality Manual should also identify sub-sets of Quality Processes, Quality Procedures (QPs) and Work Instructions (WIs) and provide templates of the various forms and documents used by the organisation - such as production control forms, inspection sheets and documents used to purchase components from sub-contractors.

QPs and WIs will need to include details of specifications, which must be complied with. For a Manufacturer for example, this may include:

- Particulars of drawings
- Supporting documentation
- Tools and gauges are going to be used
- Sampling methods
- Any tests which have to be made
- Test specifications and procedures
- Acceptance / Rejection criteria, etc

For organisations providing a service the following may also be found in their Quality Manual:

- Response time criteria
- Service standards
- Customer satisfaction and complaints procedure
- Courtesy requirements (e.g. acceptable telephone manner)

What Does Each Part of the Quality Manual do

To be effective, each part of the Quality Manual has a specific role to play as follows:

- Quality Processes including Quality Policies - Quality Processes outline the inputs, outputs and sequence in which the work is carried out. They also include process specific policies on how management intends achieving quality levels.
- Quality Procedures - Quality procedures detail what has to be done to implement the Quality Policies and Processes.
- Work Instructions - Work instructions document the detailed procedures used to carry out the work.

What is a Quality Policy

A Quality Policy is a statement of the Organisation's overall quality intentions and direction regarding quality. It should outline how management intends to achieve quality and dictates how every other aspect of an organisation's QMS is set up and operated.

Typically there are two types of policy statements that an organisation needs:

- Mission Statement - a high level statement if intent from the senior management
- Process Specific Policies - clear statements of intent for each specific activity

ISO9000:2000 has a set of mandatory system level procedures, these are:

- The activities required to implement the QMS
- Approving the adequacy of QMS documents prior to their release
- Reviewing, updating and re-approving QMS documents
- Ensuring that the relevant versions of QMS documents are available at locations where they are needed
- Ensuring that obsolete documents are suitably identified (if they have to be retained)
- The identification, storage, retrieval, protection, retention time and disposition of quality records
- The management review of the QMS
- Training that determines competency needs; determines training needs; evaluates the effectiveness of training at defined intervals; maintains records of education, training skills and experience.
- Ensuring access to, and protection of information.
- Internal audits, which must cover:
    - Audit scope
    - Frequency
    - Methodologies
    - Responsibilities
    - Requirements for conducting audits
    - Recording of results

    - Reporting of results to management.
- The control of non-conformities
- Ensuring customer satisfaction
- The analysis of applicable data to determine the effectiveness of the QMS
- Identifying where improvements can be made to the QMS
- Continual improvement, utilising;
    - Quality policies
    - Objectives
    - Internal audit results
    - Analysis of data
    - Corrective and preventative maintenance
    - Management review.
- Corrective action to define the requirements for;
    - Identification of non-conformities (including customer complaints)
    - Determining the causes of non-conformities
    - Evaluating the need for action to ensure that con-conformities do not recur
    - Implementing actions determined necessary to prevent reoccurrence of non-conformities
    - Recording the results of actions taken; reviewing that corrective action is effective and recorded.
- Preventative action, to address the following:
    - Identification of potential non-conformities
    - Determining the causes of potential non-conformities
    - Recording the results
    - Determining the preventative action needed to ensure that potential non-conformities do not occur
    - Implementing preventative actions determined necessary
    - Reviewing that corrective action is effective and recorded

What is a Quality Plan

Quality Plan should be used to identify any special or unusual requirements, processes and techniques (including those requirements that are unusual by reason of unfamiliarity, lack of experience, absence of precedents or that they are simply new). If a contract requires that a Quality Plan is produced, then that plan should have full coverage as described in ISO9000:2000.

The Quality Plan should show who is responsible for:

- Management Responsibility
- Contract Review
- Design Control
- Document and Data Control
- Purchasing
- Customer Supplied Products
- Product Identification and Build Tracing
- Process Control

- Inspection and Testing
- Inspection, Measuring and Test Equipment
- Non-Conforming product

Comparison Chart of Equivalent Standards to ISO9000

Standard No.	Equivalent Standard								
	AS	ASQC	BS	CSA	DIN	EN	IEC	JIS	NFX
ISO9000	AS3900	ASQC Q90		CSA Q9000	DIN ISO 9000	EN29000		JIS-Z9900	NFX 50-121
ISO9000/1		ASQC Q9000-1	BS EN ISO 9000-1		DIN EN ISO 9000 PT1	EN ISO 9000/1			NFX 50-121
ISO9000/2	AS 3900.2	ASQC Q9000-2							
ISO9000/3		ASQC Q9000-3	BS 5750 PT 13 (1991)	CSA Q9000.3	DIN ISO 9000 PT3	EN29000 PT3			NFX 50-121/3
ISO9000/4	AS 3900.4		BS 5750 PT 14 (1993)		DIN ISO 9000 PT4	EN 60300 PT1	IEC 300 PT1		
ISO9001	AS 3901	ASQC Q9001	BS EN ISO 9001	CSA Q9001	DIN EN ISO 9001 DIN ISO 9001	EN ISO 9001		JIS-Z9901	NFX 50-131
ISO9002	AS 3902	ASQC Q9002	BS EN ISO 9002	CSA Q9002	DIN EN ISO 9002 DIN ISO 9002	EN ISO 9002		JIS-Z9902	NFX 50-132
ISO9003	AS 3903	ASQC Q9003	BS EN ISO 9003	CSA Q9003	DIN EN ISO 9003 DIN ISO 9003	EN ISO 9003		JIS-Z9903	NFX 50-133
ISO9004	AS 3904	ASQC Q9004-1		CSA Q9004	DIN ISO 9004	EN 29004		JIS-Z9904	
ISO9004/1		ASQC Q9004-1	BS EN ISO 9004-1			EN ISO 9004/1			
ISO9004/2	AS 3904.2	ASQC Q9004-2	BS 5750 PT8 (1991)	CSA Q9004.2	DIN ISO 9004 PT2	EN 29004 PT2			NFX 50-122-2
ISO9004/3	AS 3904.3	ASQC Q9004-3							
ISO9004/4	AS 3904.4	ASQC Q9004-4	BS 7850 PT2						

			(1994)						

Hints, Tips and Techniques

Hints, Tips and Techniques - 1

Determine if the managers within the suppliers organisation adhere to a quality system and don't concentrate solely on target delivery dates and costs.

Determine a Suppliers attitude to the through-life budgets of a project; do they close down projects only after a year or two of maintenance activity as unprofitable? For bespoke systems there will normally be a team fielding errors from the purchaser. Any resource consumed in rectifying errors, up to a certain point in time, should be subtracted from the original project budget. In manager appraisal, this is the figure that should be used to judge performance. If the budget has been exceed, then two things might have occurred, first; the project manager may have badly estimated the project; or second, the quality system was not used properly.

Hints, Tips and Techniques - 2

One effective way on ensuring independence in programming is to involve two members of staff. The first programs the module; the second then has to listen while the first programmer explains the logic of the module. Even if the second programmer says nothing, the very act of describing a module to another programmer always seems to result in the first programmer discovering errors. When all the errors are rectified, the second programmer then has to go away and test the module. This ensures that he or she actually listens to the narrative produced by the programmer, for example when the tests have finally been successful, the second programmer signs-off the module as being correct. A crafty project manager will often assign the first programmer to another programmer who he or she respects, is in awe of, or fears. In this way the first programmer almost always delivers correct program code first time.

Hints, Tips and Techniques - 3

Do not be afraid of telling your staff about war stories. Companies should not feel bad about talking about past disasters. Staffs get to know about them anyway. Use stories about past project disasters to motivate staff about the quality system. It is a good test to see whether your staff are reviewing and updating a quality system based on past experiences by asking hard questions about past project failures and whether the quality manual can now prevent them. By addressing past project disasters to get over to staff that a quality system is only a repository of best practice, rather than something just there to stifle creativity.

Hints, Tips and Techniques - 4

One of the main things to look for in a quality management system is trace-ability. This is the ability to move 'effortlessly' from a document or program code to other related documents and program codes. It is also important aspect of planning, as the quality plan will detail the quality tasks that are part of the project.

Hints, Tips and Techniques - 5

When improving a quality system pay particular attention to what the staff involved in maintenance say. This staffs see the worst part of the quality system manifested in poor specifications, incomplete designs and poorly structured program code.

Hints, Tips and Techniques - 6

One technique that has been used to test out effectiveness of particular parts of the quality system is known as 're-bugging'. It is applied to technical reviews using program code. The quality assurance department intercepts any program code that is to be reviewed, and inserts a number of artificial errors into the code. They then examine the documentation of the completed code review and discover how many of the artificial errors have been discovered. The percentage of those errors discovered can be regarded as a measure of either the effectiveness of those parts of the quality system orientated to code reviews or the efficiency of the staff involved.

Hints, Tips and Techniques - 7

It is a good idea to have a company disaster list. This list would contain all the bad events that have happened to software projects over the and years, including events which can be laid at a purchaser's door and for events which were out of the control of the supplier. This list can be initially created by asking project managers to remember the bad things about past projects. It can be updated by asking staff in project debriefings if any problems occurred during the project. This list of bad events can be read by a project manager in order to jog his or her mind the about some of the risks that could happen in a project and has the effect of concentrating the mind during the process of risk analysis.

Hints, Tips and Techniques - 8

Always express your documentation in a hierarchic way. This is most important when developing the requirements specification. For the functional part of this specification, partition the functional description into functions, sub-functions, sub-sub-functions and so on. If you do this, then staff-both from the purchaser and the supplier-are able to concentrate on one section of the functional specification at a time without getting other parts of the functional specification intruding. For example, a purchasing manager who is liasing with the supplier's staff and checking out the part of the requirements specification concerned with his or her function does not want details intruding from other functions such as accounting and delivery.

Hints, Tips and Techniques - 9

Always give reasons for directives in the quality manual. For example, in describing why an audit trail of requirement changes should be kept, mention the fact that the company almost went to costly litigation over some changes, which a customer insisted on, which were never documented and which, the customer denied all knowledge of. Computer staffs are usually happy to follow standards and procedures provided they are told the reason why.

Hints, Tips and Techniques - 10

One of the most useful methods for documenting trace ability is the *verification matrix.* This consists of a table whose columns represent the modules in a system and whose rows represent functions, which are detailed in the requirements specification. Each row documents the fact that a particular set of modules will be executed when a particular function is exercised. The design team develops the matrix after the system design has been completed. It serves two purposes: it is a quality record, which provides assurance that the functional properties of the system are implemented by the system design and it also provides trace ability documentation

Hints, Tips and Techniques - 11

A quick way to evaluate a subcontractor is to ask for the agendas of board meetings held over the last two or three years together with the minutes of any discussions on software quality. If there are no quality discussions, then that is a poor sign. If there are some discussions, but they are scheduled near to the end of the meeting, that is a slightly better sign, but not ideal. If the discussions about software quality occur at the beginning of a board meeting, and are primarily about prevention and improvement, then that is an excellent sign.

Hints, Tips and Techniques - 12

It is useful practice to include in the project plan a set of assumptions that the supplier is making about the behaviour of the purchaser together with a statement that if these assumptions are invalidated, then the supplier cannot guarantee the specified delivery date. Some examples are: that any purchaser-supplied product is correct; and that the purchaser will return documents which have been sent for approval within a certain time and will not cancel meetings.

Hints, Tips and Techniques - 13

If you were really confident that some purchaser-supplied product is of a very high quality, then some form of quick testing would be in order. One form of testing which does not require very much resource is known as *random testing.* With this form of testing the supplier uses data produced by software, which generates random numbers, characters and strings. If the software does not crash and a small subset of the outputs from the random testing examined by the supplier are correct, then it is safe to assume that the software is of a high quality. However, it is worth warning you that this technique should only be used if you have a high confidence in the quality of the purchaser supplied software.

Hints, Tips and Techniques - 14

Always attempt to include a directive to your staff in test procedures, which asks them to explain why they have chosen certain test data. This is of most value in procedures governing unit and integration testing which are relatively informal processes, For example, there are three main testing strategies used for generating test data: normal data derivation, error guessing and boundary data generation. The first, normal data derivation is the construction

of well-behaved test data. The second involves the development of test data, which, in a sense, is in error; for example, floating point data for a command, which expects integer or string data. The third is the development of data, which lies on the boundary of two functions. For example, a command may carry out one function if a parameter is less than 200 and another function if the parameter is greater or equal to 200; in this case a test value of 200 should be used.

MANAGEMENT RESPONSIBILITY

Ensure that the supplier is adhering to quality standards such as ISO 9000:2000. Concentrate on the following issues with your suppliers:

- Get assurances that the quality system is being applied uniformly and is not being used at the whim of individual project managers.
- Ask to see how managers employ the quality system. Check for consistency across projects, for example some managers may only be using those aspects of the quality system that they believe will not hinder the delivery of a system on time and to budget, whilst others will apply the system in its entirety.
- Ask to see the Suppliers reference quality manual, which for new staff should describe how software is developed in the company and ask how they communicate these principles to new staff.
- Ask to see a typical set of standards and procedures as applied to a project, any project, so that you can get assurances that development tasks are not carried out in an ad hoc way. Good developers and engineers will use best practices and the quality systems, whilst poor staff will not.
- Ask about how the supplier provides direction to quality factors and the use of quality controls relevant to these factors. Establish if the supplier has balanced the project management load spectrum from one extreme of having too many quality controls through to the more likely scenario of too few.
- Ask about the level of senior manager support to their quality system; look for evidence that quality is a regular agenda item at meetings, at the board of directors meetings, because without this commitment few members of a staff will take the quality system seriously.
- Ask when the quality system was last reviewed, the outcome will quickly determine where quality sits in the scale of priorities and their technical and business needs.
- Does supplier have a director who is responsible for quality management and how are policy changes communicated when these affect quality systems and assurance staff.
- Ask to see regular board reports on the state of the quality assurance system; check that the board is sanctioning major resources to improve the quality system.
- If the company does not have a designated member of staff responsible for the day-to-day running of the quality system, then assume there will be little, if any, control over projects and an inadequate information flow to the board. Also expect the development of medium-term quality assurance policies to be ignored and no career development for quality assurance staff will take place.
    - Without designated quality management staff, developers will perceive the gap between them and the board is so large that there is little point in carrying out or improving the quality management system.

    - Without designated quality management individuals, development engineers and support areas will feel that the company does not take quality assurance seriously.
- Ask how the supplier approaches quality system improvements and whether these are evolved in harmony with changes in software technology and company policy.
- Ask what support is delivered from the management boar and what high-level policy statements have been issued and are prominently displayed. Developers will feel that the company does not take quality assurance seriously if this ethos does not exist.
- Ask about the suppliers induction programme, does it seriously address staff training and does it feature quality assurance topics.

Management Responsibility – CHECK LIST

An ISO9000:2000 certified supplier should be able to supply you with assurances that their quality management is sufficient. Score your supplier using Table-1.

QUALITY SYSTEMS

Ensure that Supplier is adhering to their quality system. This is why:

- A lack of a documented quality system that sets out the application of quality controls, standards and procedures indicate a supplier who uses ad-hoc processes, which will result in variability in the quality of software delivered from project to project and customer to customer.
- Quality systems that are not documented will impact on conscientious project managers who then spend valuable time making up standards and procedures to ensure success of their own projects. The impact (risk) will be that work will not be delivered to consistent or sufficient standards since the specific expertise of quality assurance staff might not be used.
- Without specific instructions on how to use a quality system to then develop a quality plan, the resultant risk is the danger that existing standards and procedures will be used without taking into account project-specific factors. For example, cross project quality factors like reliability and interoperability will not be adequately taken into account.
- Quality systems that are not continually reviewed will soon become out of date, especially due to changes in software technology, hardware technology, and modifications to a company's business and corporate policies.
- An undocumented quality system sends clear messages to staff about the attitude of a company to quality assurance.
- Quality systems that are not documented cannot give important baseline understanding to staff during their induction process, for example by describing how a company manages projects; develops software and applies quality assurance. Typically you would see the training department with training documentation that does not match the quality system. Read the suppliers induction pack, does it mention the company’s quality management systems
- Audits are an important quality control mechanism that measures the extent of quality control application in a project, whilst also ensuring that the project manager and the quality assurance function are aligned, without which, it is likely that controls will be

omitted by project managers to ensure on-time delivery at the expense of maintaining quality standards.

Quality Systems – CHECK LIST

An ISO9000:2000 certified supplier should have an established quality system and be able to supply you with assurances that this is the case. Score your supplier using Table-2.

CONTRACT REVIEW PROCESS

Correctly reviewing a tender bid is essential to success of the project:

- Contractors can commit to delivery of a system that software suppliers cannot deliver without either losing money or compromising on quality.
- Risks occur that result in the software supplier losing money or having to sacrifice quality in order to make a profit.
- Changes to requirement or statement of requirements are not noted and tracked, leading to development of a system that does not satisfy user requirements.
- A bid is made which is based on faulty initial costing, leading to either lost of money or compromises on quality.
- A lack of standards and procedures during technical feasibility analysis leads to a system that does not meet constraints. Such systems are often seriously deficient and give rise to legal proceedings. An example is a system that is deficient in response time, where the supplier was unaware of this requirement.
- Project bids are so poorly structured that the company loses many contracts which it had a good chance of gaining.

Contract Review – CHECK LIST

An ISO9000:2000 certified supplier should have an established system for the review of potential contracted work. Score your supplier using Table-3.

DESIGN CONTROL

Ensure that your supplier will apply sound controls over the design and development of software systems by seeking assurances that mitigation is in-place to guard against the following:

- When requirement specifications are not sufficiently detailed or managed this results in an incorrect design, then system test specification and program code together with user documentation.
- Poorly constructed designs, which do not match the user requirement, yield program code, which is error prone.
- Designs, which have not captured and then implement non-functional attributes such as response time adequately, will never meet customer expectations or requirements.
- Poorly specified software modules will give rise to erroneous program code and inevitably wastes programming time when the module specification is queried.

- Poor communication between design and requirements specification results in resource consumption that is higher than expected and means that more resource is expended on validation and reworking.
- Poor communication between a design and a requirements specification that results in more resources than is necessary being spent on maintenance.
- Inadequate standards for functional validation resulting in errors slipping through, and only being detected at the later stages of software development such as system testing. The detection and rectification of errors at such a late stage in a project is much more expensive than if the errors were detected close to the point when they were committed.
- Inadequate standards for non-functional validation. This leads, at best, to unnecessary, major reworking during the later stages of a project. At worst, it can lead to the delivery of unusable systems.
- Poorly specified interfaces between the design team and other parts of the project, for example the staff charged with requirements analysis. There are two results of this: first, unnecessary effort is spent in communication; and second, errors are committed in the inadequate, informal communication channels that will be used if a formal communication channel is not set up.
- Inadequate change control, which then leads to designs that are out of step with the requirements specification. This leads to the development of program code, user documentation and systems, which are out of step with customer requirements.

Design Control - CHECK LIST

An ISO9000:2000 certified supplier should have an established system for design control. Score your supplier using Table-4.

DOCUMENTATION CONTROL

The problems that are encountered if this part of the standard is not adhered to are:

- Developmental personnel use out of date documents and consequently develop systems that do not match customer requirements or system design intents.
- Developmental personnel spend time chasing the correct version of documents or program source code.
- System changes are applied haphazardly and not documented. The result is a system that does not meet its requirements or it incurs a large expenditure of extra resource in order to then ensure that it does.
- Changes to a system cause errors in other parts of the system, which should have remained unchanged. Systems become error-prone.
- Personnel apply unsanctioned changes to a system, leading to error-prone software.

Documentation Control – CHECK LIST

An ISO9000:2000 certified supplier should have an established system for documentation control. Score your supplier using Table-5.

PURCHASING

The problems, which are encountered if this part of the standard is not adhered to, are:

- Faulty software components are incorporated into a system. These can contain errors, are of poor quality or give rise to a large amount of resource expenditure when the supplier rectifies the error.
- Standards and procedures are used by a subcontractor which might be adequate for development but which provide problems for maintenance staff who may have to maintain a system that is expressed in two notations: the supplier's and the purchaser's.
- A subcontractor produces poor requirement specifications, resulting in either poor quality software on which large amounts of resource are expended in order to bring the quality to acceptable levels.
- Inadequate monitoring of a subcontractor's developmental progress, leading to missed delivery dates and a subsequent slipping of developmental schedules.
- Poor system and acceptance tests are specified for subcontracted software leading to error-prone software being incorporated into a system.
- Inadequate technical documentation is produced by a software subcontractor leading to increased resources being required for maintenance of the system into which the contracted software is to be inserted.
- A poor selection of subcontractor leading to the development of poor quality contracted software.
- Poor quality product is purchased. Since the supplier has little control over bought-in software, such as a spreadsheet package, this leads to a serious degradation of software quality, which cannot usually be rectified.
- Documents or software which are so poorly documented it is difficult to determine their origin. This leads to high levels of resource being expended when, for example, attempting to find out information required for the maintenance task.

Purchasing - CHECK LIST

An ISO9000:2000 certified supplier should have an established system for purchase control. Score your supplier using Table-6.

PURCHASER SUPPLIED PRODUCTS

The problems, which are encountered if this part of the standard is not adhered to, are:

- An inadequately documented product when used in a system, leads to extra resource being spent during development in detecting errors, this then delays the project while the supplier or the purchaser rectifies errors and an error-prone system is produced.
- Error-prone software is integrated into a developed system resulting in an overall error-prone system.
- Staffs expend extra resources in determining the source of inadequately identified software.

Purchaser Supplied Products – CHECK LIST

An ISO9000:2000 certified supplier should have an established system for Customer Supplied Products. Score your supplier using Table-7.

PRODUCT IDENTIFICATION AND TRACEABILITY

The problems, which are encountered if this part of the standard is not adhered to, are:

- Time is wasted in retrieving documents, which have inadequate identification.
- Documents are used for developmental activities, which have not yet been validated and are, hence, non-conforming. This would give rise to other documents or program code that is in error.
- Code is included in a delivered system that is non-conforming.
- Errors are not removed from a system after modification to program code, or a document such as a system design, has taken place.
- Maintenance staff incurs extra effort when functional enhancements are added to a system.
- Maintenance staff commits errors when functional enhancements are added to a system.

Product Identification and Trace-ability – CHECK LIST

An ISO9000:2000 certified supplier should have an established system for Product Identification and Traceability. Score your supplier using Table-8.

PROCESS CONTROL

The problems that are encountered if this part of the standard is not adhered to are:

- Without adequate standards and procedures for process identification and documentation the project manager has major problems in costing a project.
- Without adequate standards and procedures for process identification and documentation the project manager has major problems in monitoring the progress of a project supplier in terms of time and resources.
- Without an adequate means of documenting the relationship between processes the project manager will find major problems if he or she has to re-plan a project.
- Without an adequate means of documenting processes the project manager has major problems in determining the feasibility of a project in terms of resources available and resources required.
- Without adequate work instructions staff perform substandard work leading to errors in the tasks they have currently been assigned to.
- Without adequate standards that define for example the form of a particular document such as a system design, staff assigned to tasks such as requirements specification paid for expend unnecessary resources and commit errors which would not have occurred with better standards.
- Without a procedure for identifying special processes there is the danger that the software company will sign a contract that contains requirements that they are unable to guarantee can be met. If a procedure for identifying special processes exists, then the software supplier has less chance of being involved in litigation when the product of a special process is unable to meet requirements.

Process Control – CHECK LIST

An ISO9000:2000 certified supplier should have an established system for Process Controls. Score your supplier using Table-9.

INSPECTION AND TEST

The problems that are encountered if this part of the standard is not adhered to are:

- Poor items of software from other sources are incorporated into a final system, with these items giving rise to major quality problems such as exhibiting errors in functionality.
- Inadequate direction is given to staff carrying out unit testing. This results in the production of modules, which are in error.
- Poor quality records are produced from unit testing. This gives rise to problems in providing assurance that the system is of a high quality, and allows programming staff to be less thorough than they would be if good quality records were produced.
- Inadequate direction is given to staff carrying out integration testing. This results in errors being present in the interfaces between modules and between the system and the outside world.
- Poor quality records are produced from unit testing. This gives rise to problems in providing assurance that the system is of a high quality and allows staff charged with unit testing to be less thorough than they would be if good quality records were produced.
- Inadequate tests are generated for unit and integration testing. This leads to residual errors, which will either be present in the final system, or will take much more resource to remove during system and acceptance testing.
- Inadequate system testing takes place, with the result that errors, which should have been detected during this testing phase, are detected in front of the purchaser during acceptance testing.
- Inadequate quality records are generated by technical reviews. The absence of such records will provide a lower level assurance of the quality of a system and lead to residual errors. Their absence also removes a potential source of data that can be used to evaluate the operation of a quality system.
- Poor quality records are produced from system and acceptance testing. This gives rise to problems in providing assurance that the system is of a high quality and allows staff charged with system and acceptance testing to be less thorough than they would be if good quality records were produced.
- System and acceptance tests do not reflect the functional and non-functional requirements specified in the requirements specification.

Inspection and Test - CHECKLIST

An ISO9000:2000 certified supplier should have an established system for Inspection and Test. Score your supplier using Table-10.

INSPECTION, MEASURING AND TEST EQUIPMENT

The problems that are encountered if this part of the standard is not adhered to are:

- The supplier develops software-testing tools, which are in error and which do not adequately support the testing process. At the very worst such tools may provide erroneous evidence that a test was successful.
- Inadequate specification of the properties of a testing tool is produced, resulting in the development or purchase of a tool, which does not carry out its functions.
- Inadequate checking of a testing tool resulting in errors, which affect the validation, carried out by the supplier.
- Tools are purchased from inadequate sources, which do not carry out their promised functions. This could either lead to project delays or to errors not being detected during testing.
- Changes to testing tools cause errors, which delay a software project or result in the delivered product containing errors.

Inspection, Measurement and Test Equipment – CHECKLIST

An ISO9000:2000 certified supplier should have an established system for the control of Inspection, Measurement and Test Equipment. Score your supplier using Table-11.

INSPECTION AND TESTING STATUS RESULTS

The problems that are encountered if this part of the standard is not adhered to are:

- Modules are integrated into systems that have not been fully tested. This will result in errors being inserted, which will require more resource to detect than if they were discovered during the programming task.
- Work is started on a system design based on a requirements specification that has not been adequately checked out.
- Work is started on programming, based on designs that have not been adequately checked out.
- Not enough information is available to the project manager to allow him or her to track progress on validation.

Inspection and Testing Status Results – CHECKLIST

An ISO9000:2000 certified supplier should have an established system for the control of Inspection and Testing Status Results. Score your supplier using Table-12.

CONTROL OF NONCONFORMING PRODUCTS

The main problem that this part of the standard is intended to address is of prod user documentation being released to the purchaser or to system and acceptance testing staffs, which has not been properly validated. If your quality system is weak in this respect then there will be a high number of error reports generated during system and acceptance testing

or a high level of purchaser problems detected during operation. Normally a good configuration management system satisfies the requirements of this part of the standard.

Control of Non-Conforming Products – CHECKLIST

An ISO9000:2000 certified supplier should have an established system for the control of Non-Conforming Products. Score your supplier using Table-13.

CORRECTIVE ACTION

The problems that are encountered if this part of the standard is not adhered to are:

- Inadequate procedures governing the feedback of information from staff that has detected problems. These give rise to errors not being rectified, or too much effort being spent on discovering what the error was, or what needed to be addressed.
- Inadequate procedures and standards governing the interface between staff who detect errors and staff responsible for configuration management. These give rise to errors not being notified to the project and inadequate validation of the changes, which address those errors, which have been notified.
- Poor information from the analysis of defects leads to important information not being used by staff charged with improving the quality system. This results in the quality system evolving less efficiently than it might if the information was available.

Corrective Action – CHECKLIST

An ISO9000:2000 certified supplier should have an established system for the control of Corrective Actions. Score your supplier using Table-14.

HANDLING, STORAGE, PACKAGING AND DELIVERY

The problems that are encountered if this part of the standard is not adhered to are:

- Time is wasted in looking for poorly identified documents.
- Documents, which have been base-lined, are updated in an unorganised manner. This leads to errors by staff using these documents because circulated documents such as the system design may not be up to date.
- Valuable project documents are destroyed or lost because of events such as fire.
- Software is destroyed or degraded due to virus attack.
- Systems are released to the purchaser, which contain wrong components.
- Inadequate communication between staff who are supporting purchasers and those who are maintaining a system.
- Inadequate communication between the purchaser and staff involved in support.

Handling, Storage, Packaging and Delivery – CHECKLIST

An ISO9000:2000 certified supplier should have an established system for the Handling, Storage, Packaging and Delivery of products and services. Score your supplier using Table-15.

QUALITY RECORDS

The problems that are encountered if this part of the standard is not adhered to are:

- An incoherent quality plan is produced which may result in many validation activities not being carried out at all, some validation activities being carried out inefficiently and other validation activities being only partially executed.
- A poor quality plan that is not giving the project manager enough indication of the level resources-hardware, software and staff-required for validation. This either leads too many staff being allocated to validation or too few.
- Inadequate quality records are generated. This means that both project management and the purchaser would have great difficulty discovering whether a system had been adequately validated.
- A poor quality plan is produced which leads to inadequate quality controls being associated with the project.
- Poorly specified test documentation, which results in not enough information, being given to testers and almost certainly leads to tests being poorly carried out.
- Poor testing standards, which result in inadequate coverage of the functional I non-functional properties of a system during acceptance and system testing.
- Poor module testing and integration testing standards, which result in a system being sent to the system and acceptance testers that still have major errors. This result an increased level of resource required for these activities.

Quality Records – CHECKLIST

An ISO9000:2000 certified supplier should have an established system for the maintenance of Quality Records. Score your supplier using Table-16.

INTERNAL QUALITY RECORDS

The problems that are encountered if this part of the standard is not adhered to are:

- Poor or infrequent auditing results in projects not adhering to the agreed quality controls. This normally results in software which contains errors and which does not meet purchaser requirements.
- Poor auditing leads to staff perceiving a lack of importance of quality in a company.
- Inadequate auditing removes a useful technique for external checking on the progress of a project.
- Poor or non-existent auditing leads to valuable information, which could be used to improve the quality system and improve developmental tasks being lost.

Internal Quality Records - CHECKLIST

An ISO9000:2000 certified supplier should have an established system for the maintenance of Internal Quality Records. Score your supplier using Table-17.

TRAINING

The problems that are encountered if this part of the standard is not adhered to are:

- Tasks are executed poorly because the staffs allocated to a task are not adequately qualified to carry it out.
- The workforce of the company becomes gradually outdated in skills.
- The company is unable to tender in particular application areas because of a lack if knowledge of those areas.

Training – CHECKLIST

An ISO9000:2000 certified supplier should have an established system for the management of Training. Score your supplier using Table-18.

SERVICING

The problems that are encountered if this part of the standard is not adhered to are:

- Changes applied after release, which are not adequately quality assured result in the d gradual degradation of the quality of a system.
- Versions of a system are sent to the purchaser containing errors in functions, which previously were correct.
- Supplier staffs spend a large amount of time discovering which version of a software system a customer was previously sent.
- The wrong version of a system is sent to the purchaser after a modification or a series of modifications have been carried out.
- The supplier continually violates the provisions of a service contract because of an inadequate servicing plan.
- Functional enhancements are carried out under the guise of error eradication due to m- inadequate procedures for screening problem reports.
- Problem reports get lost or disappear because of inadequate communication mechanisms, or because the wrong person from the purchaser's side spoke to the wrong person from the supplier's side.

Servicing – CHECKLIST

An ISO9000:2000 certified supplier should have an established system for the management of Servicing. Score your supplier using Table-19.

STATISTICAL TECHNIQUES

The problems that are encountered if this part of the standard is not adhered to are:

- Inadequate feedback from projects on important statistics such as the degree of slippage of a project.

- Inadequate feedback on the quality of the delivered product. This leads to a lack of confidence in the supplier by the purchaser.
- A value source of data, which could be used for quality system improvement, is lost.

Statistical Techniques – CHECKLIST

An ISO9000:2000 certified supplier should have an established system for the management and use of Statistical Techniques. Score your supplier using Table-20.

Software Metrics

An increasingly important area of research, which is now bearing fruit on real software projects, is that of software measurement. Software metrics are measurements which can be extracted from a product of a software project such as a during a system design phase. A metric is used to measure aspects of a product, which can theoretically be used to control some quality factors. For example, the depth of nesting within control structures contributes to readability of the modules; a high depth of nesting results in code that is difficult to read and understand and hence difficult to modify during future maintenance activities.

Other techniques can include metrics that set an upper size to module lengths so that programmers during development do-not exceed metric limits.

Table-1: Management Responsibility Check List

Table-1: Management Responsibility Check List	**Score**	**Weighting**	**Result**
A documented quality system containing standards and procedures exists	1	75%	75
A description of quality controls and their associated documentation, and instructions on how to apply these quality controls	1	75%	75
A designated member of the board of a company is responsible for quality assurance	1	15%	15
Quality reports are a major agenda item at meetings of the board of directors	0	95%	0
Adequate levels of resource are delegated to the quality assurance function	1	65%	65
Regular reviews of the quality systems that are aimed at checking its effectiveness	0	25%	0
A designated member of staff is responsible for the day-to-day running of the quality system.	0	25%	0
Regular audits of projects to check whether agreed quality controls are being followed	1	45%	45
The board of a company issues a high-level policy statement on software quality assurance, with the statement being displayed prominently on company	0	80%	0

publications and premises			
Every new member of staff undergoes an induction programme that contains a substantial amount of detail on the company's quality system	1	5%	5
Total Score			280

Score 1 = Yes, 0 = No

Table-2 Quality Systems Check List

Table-2 Quality Systems Check List	Score	Weighting	Result
Does a quality manual exists which is given to every member of staff and does it provide a description of how the company manages projects, develops software and applies quality controls			
Does the quality manual have standards and procedures for all activities associated with development, management and quality assurance, including those that are undertaken infrequently.			
Are regular reviews of the quality systems performed and do they use project sources such as debriefs, reports from maintenance staff and R&D.			
Are quality staff performing regular audits of projects and are they checking for adherence to agreed quality controls set out in the quality plan			
Check that there is a standard and procedure for the generation of quality plans. Does this cover format and production.			
Check that there is a board member who is responsible for improvements to the quality management system?			
Check that there is a formal group who are responsible for improvements to the quality system.			
Do project guidelines exist to assist with the selection of quality controls used on Projects?			
Determine if the new staff induction process allocated significant training time on the quality management systems used.			
Check that each project past or present uses its own quality plan and that an off-the-shelf solution or copy is not being used.			

Table-3 Contract Review Process Check List

Table-3 Contract Review Process Check List	Score	Weighting	Result

The quality system gives guidance on feasibility work for standards, procedures and guidelines?			
The quality system covers the activities needed during the process of project planning?			
Standards and procedures exist for requirements analysis and design specific needs of a bidding process?			
Standards and procedures exist for pre-bid costing and the process of checking these costs?			
Standards and procedures exist for pre-bid risk analysis outcomes?			
The quality manual gives direction to pre-development audits and has standards and procedures for maintaining that trail. Requirements can be tracked as they change during the process of establishing requirements from a statement of requirements?			
Standards exist to guide the primary aspects of bidding documents and don't vary from project to project?			
Procedures are in place for the review of bidding documentation?			
Do procedures exist for the review of the contract between the customer and supplier?			

Table-4: Design Control Check List

Table-4: Design Control Check List	**Score**	**Weighting**	**Result**
Standards and procedures exist which describe the process of constructing the requirements specification and matching it up with the purchaser's statement of requirements			
Standards exist which describe the form and structure of the requirements specification and the system design. If the supplier uses a detailed design notation, then a standard should exist for this too			
Standards and procedures exist which detail all the validation activities that a supplier uses to validate a design against a requirements specification. These activities will include prototyping, technical reviews, and calculation of response time, calculation of file occupancy figures and simulation			
Planning standards and procedures insist that adequate communication channels are set up between designers, analysts and the purchaser. These channels should be documented in the project plan			

Design and requirements specification standards insist that there is a trace-ability between functions expressed in the latter and the modules specified in the former			
Adequate change control procedures are in existence, and the system design specification and requirement specification is expected to conform to these procedures			

Table-5: Documentation Control Check List

Table-5: Documentation Control Check List	Score	Weighting	Result
The quality manual has guidance on the identification of configuration items			
The quality manual has a standard for describing configuration items in the project plan			
The quality manual describes the steps necessary for developing a configuration management system and a standard which sets out how the system is described in the project plan or the quality plan			
A procedure exists in the quality manual that details how communication channels between the change control board and development staff or servicing are set up and maintained			
A standard exists for the documentation that is sent to the change control board describing a proposed change			
A procedure exists which details how the change control board organises its business			
A standard exists that details how the results of a change control board decision, or set of decisions, are communicated to developmental staff			
A procedure exists which governs the process of carrying out a change sanctioned by the change control board and validating that change			
A procedure exists to control the application of a change and its validation is checked and signed off			
A standard exists which describes how the current configuration of a system is expressed in terms of its current configuration items and their versions			

Table-6: Purchasing Controls Check List

Table-6: Purchasing Controls Check List	Score	Weighting	Result
Procedures exist which instruct the project manager to			

insist on the employment of the same standards and procedures used in a project for the requirements specification of any subcontracted software			
Procedures exist which instruct the project manager to insist that a subcontractor employs similar progress-reporting procedures as those used on the project, which uses the subcontracted software			
Procedures exist which instruct the project manager to use the same standards for the system and acceptance tests employed to judge the functional and non-functional correctness of the subcontracted software as used for validating the overall system			
Procedures exist which instruct the project manager to insist that a subcontractor uses the same, or similar, documentation standards as those in the development of the system, which is to incorporate subcontracted software.			
Procedures exist which describe the information gathering exercises that need to be carried out prior to selecting a subcontractor			
The quality system provides guidelines, which provide advice on how to select a subcontractor.			
Procedures exist which govern the interface between a project and any internal purchasing function such as a purchasing department			
Standards and procedures for project debriefing insist that the project manager produces a report about subcontractor performance			
The quality system provides guidelines, which enable the project manager to decide on the level of validation that a purchased software product should receive.			
The quality system should provide standards and procedures, which govern the validation that a purchased product receives. Normally these will be similar to the standards and procedures used for system and acceptance testing			
Documentation standards for entities such as the requirements specification, system design, program modules and system tests insist that not only the staff who developed the tests are identified, but also whether they are employed by the supplier or are staff of a subcontractor.			
The subcontractor employs the same level of configuration management practices as used by the supplier.			

The interface between a project's configuration management system and that of the suppliers is precisely the defined			

Table-7: Customer Supplied Products Check List

Table-7: Customer Supplied Products Check List	Score	Weighting	Result
Standards and procedures exist for the pre-validation and checking of any product supplied by the purchaser - both software and its documentation			
Guidelines exist which advise the project manager what to do when poor documentation and software is supplied by the purchaser			
The risk analysis procedure includes actions to be taken if the purchaser delivers poor software or documentation			
Guidelines for project planning describe the options, which can be exercised if a soft- ware project has to cope with poorly specified or error-prone software			
Guidelines exist which direct the project manager and legal staff on the measures to be taken in drawing up a contract for a system for which poorly specified or error-prone purchaser supplied software is to be included.			
Guidelines exist which advise the project manager what actions need to be taken during bidding, for a project, which will include either poorly-specified or error-prone purchaser supplied software			
Guidelines exist which provide advice on the level of testing to apply to purchaser-supplied software and that standards and procedures are available, which guide the process of testing			

Table-8: Product Identification and Tracing Check List

Table-8: Product Identification and Tracing Check List	Score	Weighting	Result
Standards insist that every document and item of program code is properly identified			
Version numbering, project identification and item identification information is included in each configuration item			
Standards exist which make it relatively easy to trace from a function to the code, which implements the function			

Standards exist which make it relatively easy to trace from a module to the functions which the module helps implement			
Standards exist to make it relatively easy to trace from a function to the test documentation for that function.			
Standards exist to make easy to trace from testing documentation to the functions that are tested			
A procedure exists that insists that the developer places documentation under configuration control as well as program code			

Table-9: Process Controls Check List

Table-9: Process Controls Check List	**Score**	**Weighting**	**Result**
Standards and procedures exist which describe how processes in a software project are identified and documented. These standards and procedures are usually contained in that part of the quality manual concerned with planning			
Standards and procedures exist for the reporting of completion of a particular process and the amount of resources expended			
Standards exist for the description of work instructions for each type of process in a software project.			
Standards exist which define the layout of major items in the software project, such as the system design and the code of modules			
A procedure exists which enables a project manager to identify special processes during planning, and ensures that the software supplier does not commit himself or herself to a delivered system whose properties depend on special processes			

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Table-10: Inspection and Test Check List

Table-10: Inspection and Test Check List	Score	Weighting	Result
Standards and procedures exist which detail how requirements in the requirements specification are extracted, documented and expanded out into system and acceptance tests			
Standards and procedures exist which detail how system tests and acceptance tests are applied and the results of the test documented			
Standards and procedures exist which detail how unit tests are applied and how the results of the tests are documented			
Standards and procedures exist which detail how integration tests are applied and how the results of the tests are documented			
Procedures exist which detail what should happen when a test fails			
Standards and procedures exist which detail what a project manager should do when his or her software project contains software from other sources. These standards and the procedure should cover the tests that have to be carried out in order to discern whether this software is of a comparable quality to that generated by the project			
Standards and procedures exist which direct the project manager on the contents of the test plan and how to develop this plan			

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Table-11: Inspection, Measurement and Test Equipment Check List

Table-11: Inspection, Measurement and Test Equipment Check List	Score	Weighting	Result
The project planning standards and procedures specify that all internally developed means testing tools are produced using at least the same degree of quality control as the project in which they are to be used			
The planning procedures include a section on the specification of testing tools, which are either bought in from outside suppliers or are developed internally. This section could be subsumed in a general section about the process of buying in or developing any software used for support			
Guidelines exist which enable the project manager to decide whether a software-testing tool is to be developed internally or purchased			
The configuration management standards and procedures specify that any internally developed testing tools should be regarded as configuration items			

Table-12: Inspection and Testing Status Results Check List

Table-12: Inspection and Testing Status Results Check List	Score	Weighting	Result
The main check is that for every project the documentation standards adopted should insist that the test status of every configuration item and module, if they are not configured items, can be easily found by development staff and the project manager			

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Table-13: Control of Non-Conforming Products Check List

Table-13: Control of Non-Conforming Products Check List	Score	Weighting	Result
Standards and procedures exist for the identification of modules as conforming or non-conforming			
Standards and procedures exist for the identification of user manuals as conforming or non-conforming			
Standards and procedures exist for the identification of internal documents such as system designs and requirements specifications as conforming or non-conforming			
Standards for acceptance testing and system testing include documentation, which can be consulted to determine the status of subsystems or the overall system			
Standards are in place which allow staff to quickly discern what the state of a project is in terms of the number of items which are conforming and non-conforming			
Procedures exist which instruct staff when they discover errors during validation to flag the items that caused the error to be marked as non-conforming			
Procedures exist which instruct staff to check on the status of all the items, which make up a software system before release to the purchaser			
Procedures exist which instruct staff to check on the status of the user manual before it is released to the purchaser			

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Table-14: Corrective Actions Check List

Table-14: Corrective Actions Check List	Score	Weighting	Result
Standards exist which govern the nature and layout of information generated when an error is detected			
Project planning procedures exist which enable the project manager to define the interface between the configuration management systems used on a project and the staff charged with validation			
Procedures exist for immediate feedback from projects to the quality system when a serious deficiency in a component of the system is detected			
Guidelines exist which detail how information from the validation process can be used by staff charged with the improvement of the quality system			
A standard exists which describes the nature of the information to be included in a project's defect log and procedures exist which detail how that log is updated			

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Table-15: Handling, Storage, Packaging and Delivery Check List

Table-15: Handling, Storage, Packaging and Delivery Check List	Score	Weighting	Result
Project planning standards exist which describe the form of a project library			
Numbering conventions are included in standards for all the main document code produced by a project			
Procedures exist to restrict access to the project library			
Procedures exist which describe the safe storage of both project documents and program code			
Standards exist which describe the various configurations that a software sy8W be released in			
Procedures exist which direct staff to check that the configuration of a released product matches the configuration, which was specified to be released			
Standards exist which govern the communication between staff that carry out the support function and the maintenance function			
Standards exist which govern the communication between staff charged with support and staff charged with maintenance			
Standards exist to govern the communication between the purchaser and the staff who carry out support			
Guidelines exist to help project managers decide on a quality plan for support, given that the software supplier will have signed a contract for support - often at the same time as the contract for development			
Procedures and standards exist which enable staff charged with support to generate statistics on the level and severity of the errors notified by the purchaser.			

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Table-16: Quality Records Check List

Table-16: Quality Records Check List	Score	Weighting	Result
Guidelines exist which provide advice to the project manager on how to construct a quality plan.			
Standards exist to specify the form of the quality plan			
Procedures exist which govern the construction and development of the quality plan.			
Standards exist for all the documents generated by quality control-based activities such as technical reviews			
Procedures exist for the conduct of all activities associated with quality controls			
Standards exist for all testing documentation including verification requirements, designs, and test specifications, test procedures and test reports			
Procedures exist that result in subcontractors producing similar quality record those produced on the project that uses the subcontractors. These procedures could be included in those, which relate to the process of contracting subcontractors			

Table-17: Internal Quality Records Check List

Table-17: Internal Quality Records Check List	Score	Weighting	Result
Guidelines exist that inform quality staff when and what to audit in a project			
Procedures exist to describe how an audit is to take place			
Procedures exist that describe how a spot check is to take place			
Standards exist which describe the documentation generated by audits or by spot-checks.			
Procedures for quality planning describe how audit points are identified and how are documented in the quality plan			
Procedures exist which detail the steps that are to be taken when a minor infringement is discovered during an audit or a spot check			
Procedures exist which detail the steps that are to be taken when a major infringement is discovered during			

an audit or a spot check			

Table-18: Training Check List

Table-18: Training Check List	Score	Weighting	Result
Guidelines exist which help the project manager allocate the most suitable staff to technical tasks.			
Guidelines exist that enable a company to determine its future training needs			
Part of the standards and procedures for project planning describe how the work experience and training experience of allocated staff is to be displayed in the project plan.			

Table-19: Servicing Check List

Table-19: Servicing Check List	Score	Weighting	Result
A guideline exists which provides advice on the development of a service plan based tier on purchaser requirements			
Procedures exist which deal with the processing of problem reports from the purchaser			
Standards and procedures exist which specify how communication is to be organised e of between the supplier and the purchaser during servicing			
Procedures exist which specify how data is to be collected during servicing			
Standards exist which specify how the data collected during servicing is to be presented			
Procedures exist which specify how staff's carrying out the servicing function interacts with the configuration management system adopted for servicing			
Procedures exist that describe how a project is to be set up which implements enhancements to a system			
Procedures exist that describe how enhancements to a system are to have costs assigned.			
Procedures for regression testing exist for use during servicing			

Table-20: Statistical Techniques Check List

Table-20: Statistical Techniques Check List	Score	Weighting	Result

A guideline exists which provides advice on the collection of error statistics			
Standards and procedures exist for gathering and presentation of error statistics for errors, which are generated during development			
Standards and procedures exist for gathering and presentation or error statistics for errors, which are notified to the developer after delivery			
As part of the project planning standards and procedures, a project manager is instructed to include information about the timing of tasks and resources needed in the project plan			
Standards exist for the documentation generated when a task has been completed			
Procedures exist which ask staff to fill in a task completion document when a task has been completed			
Guidelines exist which detail the possible uses of well-tried product metrics			

Table-21: Suppliers Total Score

Table	Table-20: Statistical Techniques Check List	Score
1	**Management Responsibility**	
2	**Quality Systems**	
3	**Contract Review Process**	
4	**Design Controls**	
5	**Documentation Control**	
6	**Purchasing Controls**	
7	**Customer Supplied Products**	
8	**Product Identification and Tracing**	
9	**Process Controls**	
10	**Inspection and Test**	
11	**Inspection, Measurement and Test Equipment**	
12	**Inspection and Testing Status Results**	
13	**Control of Non-Conforming Products**	
14	**Corrective Actions Check List**	
15	**Handling, Storage, Packaging and Delivery**	
16	**Quality Records**	
17	**Internal Quality Records**	

18	**Training Check List**	
19	**Servicing Check List**	
20	**Statistical Techniques**	
	Total Score	