
CHAPTER 5: Conclusion

5.1 Recommendations

This research showed quite a long list of weaknesses in the existing quality models. One of the main recommendation will be to overcome these weaknesses. In addition, the existing organization structure were reviewed and should to be unsuitable to handle the software quality initiative along with business need, effectively. The STARO model is a recommended alternative.

Recommendations for software quality builders

One of the first and most important recommendation for the software quality models designers/builders (such as the SEI and ISO organizations) is for them to make the current software quality models to be in line with the business requirement, instead of just looking software quality from the technical point of view. In addition, they (quality designers) are recommended to be flexible to recognize human skills as add advantage to business. They are also recommended to have a moving quality level implementation for firms (example non-IT organization, that require low information service need not implement all the quality processes). Another recommendation for quality builders is to consider involving technology innovation more actively. It is also recommendation for quality builders is to reduce the bureaucracy in IT processes and focus on how the software product can be delivered in a shorter cycle time. They should also define method to measure quality. The manufacturing products' quality measurement has somewhat taken a firmer and more organized and standard format as compared to IT. The IT measuring standards has still not taken a universal step and is still in transition. Some of the existing set of quality guidelines tend to look at the final product. One such guidelines are that produced by Pollitt and Bouchaert (1995) 3 sets of conditions that can be used to measure quality which are : Validity and reliability, (b) Functionality versus disfunctionality (c) Legitimacy and ownership.

ISO and SEI are recommended to recognize RAD ("Rapid Application Development") is a new software development methodology of the 90's to address "ad-hoc" urgent request. Morton (1994) introduces RAD methodology pretty well in his book "Rapid Application Development: A Brief Overview" use of evolutionary prototypes, and rigid limits on development time frames. As per Morton, the goals of RAD are: faster, better, cheaper. The methodology goals and approach is out of scope of this thesis

Recommendation for Firms/companies

The recommendation for the firm is to get their software certified for CMM/SEI and must be at the least at SEI level 3 (or above). Though the current quality standards have long list of weaknesses, it is never denied that the software quality model are obsolete. Most of the firms that have undertaken quality initiative have benefited from it. It is a proven fact and is supported by many documented facts, that SEI/CMM has moved the IT organization to a better managed level. For instance Motorola (Diaz, Sligo, 1997) has benefited from this initiative. The writers provide metrics and data that demonstrate the benefits that Motorola's Government Electronics Division in Scottsdale, Arizona, has experienced as a result of employing the capability maturity model (CMM). Motorola, which has long believed in the SEI's CMM as a way of furthering software process improvement, was independently assessed at SEI level 4 in November 1995. It was determined that at each level of SEI CMM maturity lowers a defect density by a factor of 2.

There may be business reason to get ISO or CMM certification but in general SEI certification attempt to put in place a better continuous improvement process in place and compared to ISO. ISO is often viewed as more a documented process that takes a passive approach as compared to SEI which is more pro-active in nature. Documented procedure is the key to some of the software quality standards, but SEI puts an additional rule to the documented procedures to make it more practical. The Malaysian organizations are strongly urged to move their organizations to at least SEI

Level 3 . Paulk (1995) study says that an SEI level 3 organization is ready for ISO certification is almost immediately.

It is recommended that firm understands the limitation of the SEI/CMM models and understand that they do not map the SEI level to the nature of the company – for instance a Law Firm or a Private Clinic may require 'hard copies " from a legal point of view may not require to be even at level 2. On the other hand a courier service company that is highly dependant on electronic information that may need to be at level 3 at least. There is no match between business dependency (need toward IT and fails to isolate this fact. ISO and SEI tends to "wrongly" assume that all companies must be at the same level of IT quality standards fail to recognize that some business may be 'over-equipment' a firm with IT quality standard to which they have no need to utilize it. This could be one factor that contributes to the low usage of the SEI/ISO standard by medium or small size companies – the standard can be customized to their needs.

The final suggestion for the firms to use the STARO model as their foundation for the organizational structure, to support their quality initiatives.

5.2 The answer to thesis questions

Base on the analysis we can now answer the question raised in section 1.3. The answers can be summarized as follows:

The existing standard are bureaucratic and over-defined but does meet

- current needs to some extend, but have couple of weakness in that it does not in line with business needs. If these weaknesses (such as in its inability to handle new programming paradigm and tool) are not looked at the quality model will may become obsolete in the next millennium. The current quality model are not design to handle precision and speed and the quality designer must seriously into ways to overcome this limitations.

Finally the answer to the 2 main questions of the thesis which are listed as below is as follows:

Questions:

1. Are the current software quality standards, namely ISO9000, SEI & SPICE, obsolete?
2. What is the suitable IT position within an organizational decision structure to meet these new challenges of IT?

The answer to the first question is "no" - the ISO, SEI and SPICE are not obsolete as at now, however if no immediate actions are taken these quality standard may loose its objective by the next millennium. Both SEI and ISO have invested lost of money to make the standard compatible and this continuous effort will ensure that these standards stay competitive for quite some time.

The answer to the second question is however not as positive as the first. There is no standard defined by the software quality model for the organization structure. This thesis proposes the STARA organization model to be used to support the quality initiatives. STARA model proposes 5 main functions in the IT department namely: Software Quality Function, Technology function, Operations function, Rapid development function and, Approach development function. The 2 new functions proposed in this model is the Technology function and Rapid development function, and these 2 department eliminate the 2 limitations of the current existing quality standards.

5.3 Summary

The business of tomorrow is measured on "who's on First", quality will be taken for granted. Tools like SEI/ISO/SPICE or RAD will ensure quality is consistent " but the standards will be required to be defined in the IT world as how to be the fastest in development.

The future software quality standard in its IT strategic planning process should incorporate the perspective of a future orientation (Bommer,92) . According to Bommer and DeLaOorte (92) the several areas to determine their degree of future orientation, including are:

- degree of functional integration,
- participation in strategic planning,
- organizational structures,
- employee development opportunities,
- new product development,
- product development time,
- customer orientation,
- market orientation,
- manufacturing flexibility,
- production quality,
- information technology,

- attitude toward risk, and
- environmental awareness.

SEI and ISO can form a good foundation framework for the future quality standards, and currently it is the 'only' few 'accepted software qualities standards that can meet our immediate need.

This thesis propose number of future research and surveys. One of the first is to test for the practical application of the STARO model. The number of surveys study are also proposed for the future, one of them is survey on the type of organization model and issues with the existing organization structure will provide a good base for the STARO model analysis. A survey to determine the ROI (return on investment) that have been obtained by moving to practicing the quality models will provide the return of the existing quality model. Finally the survey companies that have already embark on the SEI initiative is recommended. The survey should be focus to determine if the IT have met the business need or not.

Achieving higher levels of software process maturity is incremental and requires a long-term commitment to continuous process improvement. Software organizations may take ten years or more to build the foundation for, and a culture oriented toward, continuous process improvement. Although a decade-long process improvement program is foreign to most U.S. companies, this level of effort is required to produce mature software organizations. This time frame is consistent with experience from other industries, such as the U.S. automotive industry, that have achieved significant gains in process maturity (Gabor,90).

In conclusion there is one thing to say, quality standard will long be around in the 21st century making an impact maybe under the banner of a different name. It will definitely take up a new look with the emergence of a new technology/IT.

Glossary

Abbreviation

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| 1. ABC-Malaysia | A firm that referred to in this research |
| 2. AI | Artificial Intelligence |
| 3. ANL Skills | Analytical skill |
| 4. BUS Skill | Business skills |
| 5. CASE | Computer-Aided Software Engineering |
| 6. CMM | Capability Maturity Model (CMM) |
| 7. CMP Skills | Competitor skills |
| 8. DEF-Corp | A firm that referred to in this research |
| 9. DOS | Desktop Operating System |
| 10. GAME Theory | Game |
| 11. GHI-Corp | A firm that referred to in this research |
| 12. I.T. | IT : Information Technology |
| 13. IEC | ISO/IEC is a set of guidelines for management of software documentation |
| 14. IEEE | IEEE are standards are US Standards |
| 15. ISO | Organization International Standards |
| 16. IT | Information Technology |
| 17. JIS X | JIS X is a user documentation and cover information standard for consumer software packages. |
| 18. JKL-Malaysia | A firm that referred to in this research |
| 19. KPA | Key Process Area |
| 20. KPA: | Key Process Area (equivalent to ISO's elements) |
| 21. MNO-Corp | A firm that referred to in this research |
| 22. OOD | Object Oriented Design |
| 23. OOP | Object Oriented Program |
| 24. OTH Skill | Personal Skill |
| 25. R&D | Research and Development |

26. RAD	Rapid Application Development
27. Rapid Dept	A new Rapid development functions
28. SCM	Software Configuration Management
29. SEI	Software Engineering Institute's, Carnegie Mellon's
30. SPICE	Software Process Improvement and Capability dEtermination
31. SQA	Software Quality Assurance
32. SQS Skills	Software Quality Standard & Process Skills
33. STARO	Software Quality – Technology – Approach –Rapid – Operations functions (organizational structure model)
34. sw-CMM	software CMM
35. SWOT	Strength, Weakness, Opportunities and Threats
36. TECH Skills	Technology skills
37. TQM	Total Quality Management
38. WIN95	Windows 95:Microsoft's operating system for PC's
39. WWW	World-Wide-Web

Definition of Terms

40. Accumulative skills	Accumulated Individual Skills
41. Individual skills	Staff Personal skills.
42. Rapid Functions	Rapid software Development functions
43. Organization structure	Organization Power structure