

Process Assessment in ISO/ TS 16949: A Case Study

Bradley A. Pritts

Consulting Engineer, Ann Arbor, Michigan, U.S.A.

Email: bpitts@pritts.com

ABSTRACT

ISO 9001:2000 and ISO TS 16949 emphasize a “process approach”. Yet while the International Automotive Task Force (IATF) has made “process approach” a major priority, little has been done to rigorously define this principle. Additionally, process capability assessment outside of direct manufacturing is challenging. Manufacturing processes lend themselves to objective measurement, while many indirect processes defy capability assessment. ISO standard (ISO/ IEC 15504) for assessment of process capability has been published to address this need. While originally designed for assessment of software engineering processes, this approach provides a useful model for measuring the process capability of other management processes.

The author assessed the firm’s quality management system in conjunction with an internal audit. Overall, the ISO IEC 15504 provided a consistent and objective framework for process assessment. Previous efforts by this firm had been limited to determining compliance vs. noncompliance. The maturity level assessment provided a more descriptive report of process implementation. When coupled with management evaluation of the importance of process performance to the firm’s strategic goals, it was possible to develop more specific goals for future process improvement.

Keywords: Process Approach, ISO 9001:2008, ISO TS 16949, Process Capability Assessment

1.0 Project Background & Goals

Since the 2000 release of ISO 9001, both ISO 9001 and TS 16949 have placed an emphasis on auditing, and managing, using a “process approach”. Yet while the International Automotive Oversight Board (IAOB) has made “process approach” a major priority, little has been done to specify what is meant. A particular concern observed by the author is that “de facto” the quality management system auditors place equal priority on all processes in their audit and corrective action procedures. Instead, I recommend consideration of costs and benefits (i.e., considering “the status and importance of the processes and areas to be audited.” (ISO, 2008, 8.2.2) . The process approach can make a contribution, but intelligent application is important!

Away from the manufacturing shop floor, process management is even more challenging. Manufacturing processes lend themselves to objective measurement, making statistical management of manufacturing processes possible for nearly a century.

One industry which has made particular strides in assessment of professional service processes is the information systems development industry. These efforts (led by the Software Process Improvement Laboratory in Johannesburg, South Africa) have sponsored the development of an ISO standard (ISO/ IEC 15504) for assessment of process capability. While originally designed for assessment of software engineering processes, this approach provides a useful model for measuring the process capability of other management processes. Another expert (Hammer, 2007) promoting the process approach has independently developed a framework for assessment of process maturity, from the perspective of readiness and effective implementation of the process approach to management, rather than the performance of the process itself. This work is recommended for those implementing the process approach as a useful diagnostic tool.

2.0 Background- ISO/IEC 15504 Process Capability Assessment Approach

Central to this approach is a six level model for process capability, summarized as follows. These capability characteristics build on each other. (See Figure 1.)

Level	Characteristics
0 Incomplete	Incomplete or ineffective implementation of a process
1 Performed	General agreement on the essential elements of a process, with identifiable work products which usually achieve the desired purpose
2 Managed	Specifications and standards for work products exist, and are generally met. The process execution is planned, tracked and monitored.
3 Established	The process is performed and managed using defined procedures following good professional practices.
4 Predictable	Objective measurements of process performance exist, and these demonstrate that the process consistently achieves its purpose.
5 Optimizing	Evidence demonstrates a history of performance improvements, coupling process improvement activities to objective results.

Figure 1: Process Capability Levels and Their Characteristics

3.0 Application

How can this approach be put into practice in conjunction with ISO 9001 and ISO TS 16949? The following Plan-Do-Check-Act (P-D-C-A) cycle is proposed.

1. Assess process performance using the process capability measurement approach. This can be done in the context of an internal systems audit and/or management review.
2. Set targets for desired process capability, based on the business importance of the process. The primary value creation production and/or service processes deserve priority. Consider three groups of processes:
 - Value-adding production processes – cold heading, stamping, heat treating, etc. The processes whereby the company “earns its living” obviously need first priority.
 - Critical indirect processes – e.g. quoting, tooling management, production scheduling. Which processes, while subsidiary to the primary production processes, can nonetheless help achieve world class performance, or if ineffective doom the company to failure?
 - Administrative/ support processes – e.g. document control, gage calibration. Which processes must be done to a reasonable threshold level of performance, but won’t propel the company to peak performance?
3. Consider the ease and value of establishing objective performance measurements. Some support processes lend themselves to numerical measurements of process quality, delivery and cost while others are quite difficult. For example, Nonconforming Material control can be measured in many ways, including volume generated, location where caused, location where detected, inventory accumulation/ aging, and recurrence. By contrast, the quality, efficiency and effectiveness of processes like Management Review are much more difficult to determine.
4. Set management goals for improvement based on the gap between desirable and current performance. Which process improvements will likely have the greatest leverage? Which processes give the opportunity for achieving competitive advantage?

5. The means for improvement will vary based on the current process capability. For ineffective or marginal processes, it may be a simple matter of reviewing the literature to identify industry standard practices and implement them. However, where the company already excels, it may be challenging to find incremental improvements. For industry leaders, this will require advancing the state of the art.
6. From this point, the normal continuous improvement cycle can take over. Track the improvement plan and the results.

4.0 Minimum expectations for process capability

What is the minimum acceptable level of process capability? What level is desirable? Consider the definitions of process capability levels in the context of QMS registration.

1. The minimum performance level for any process required by ISO 9001 is, by default, level 2 (“Managed”). The very existence of this implicit customer requirement for the process and disciplined execution sets this level as the minimal bar.
2. The minimum performance level for a manufacturing process should be level 4, “Predictable”. This is clearly implied by the requirement for statistical process capability as required by the PPAP procedure.
3. For competitive advantage, the organization should consider level 5, “Optimizing” as the minimum level of performance for selected processes, given the ISO 9001 and ISO TS 16949 expectations for continual improvement.

5.0 Case Study

5.1 Company Introduction

A practical example can illustrate the application of the approach.

HFF Company (identity is disguised by company request) is a manufacturer of high quality fasteners for automotive application, serving several North American automakers. HFF operates a single plant in Michigan. While the fastener industry is often thought of as a low cost, commodity industry, HFF prides itself on excellent quality for demanding applications (particularly in powertrain applications.) HFF is proud of its PPM ratings (in the single digits). HFF has operated under a disciplined management system since the days of QS-9000; it obtained registration to the ISO TS 16949 automotive system quality management standard in 2006.

Following the general practice of the “automotive process approach”, HFF has organized its internal audit system around broadly defined management processes. This includes six direct manufacturing processes (Cold Heading, Heat Treating, Thread Rolling, Straightening, Plating, and Packaging) and eighteen support processes (Contract Review/Quoting, Purchasing, Receiving Inspection, Document Control, etc.)

Not surprisingly, many of these processes are rigorously implemented. HFF has used a “management by facts and data” approach for many years. Based on the initial assessment, the following process capability levels have been determined.

5.2 Assessment Process

The assessment was performed by the author in conjunction with an internal systems audit. In prior years, the author has performed five previous assessments of this firm, as well as several other quality system related projects. At least two samples (i.e. two machines or jobs in each production process) were audited, while the amount of sampling of support processes varied.

Previous document-oriented assessments have reviewed the written procedures and work instructions and established that these meet ISO 9001/ ISO TS 16949 requirements. For economy, it was assumed that each process attained (at a minimum) a level 2, “Managed” process. Background in the previous assessments of these processes had provided historical data to support this baseline rating. The criteria for past audits included verification of the following attributes for each process.

- (a) Written procedures, work instructions and job standards exist to support each process
- (b) These processes have been validated in previous audits by internal and external auditors and consistently been found to perform effectively
- (c) An extensive monitoring and management system exists
- (d) When nonconformities arose, the organization itself generally detected these internally and took corrective actions, containing any risk to the customer.

During the course of the assessment, no evidence that the assumptions were invalid was discovered. Process executions followed a disciplined approach. An assessment checklist based on the Table 4, “Process Capability Levels and their Characteristics” was created as a tool for the assessment. To briefly summarize the initial assessment: All six manufacturing processes were assessed as “4”, “Predictable”. Of the 16 supporting processes, 13 were assessed as “3”, “Established”, with the remaining 3 assessed as “4”, “Predictable”

5.3 Setting Improvement Targets

Prior internal quality audits had shown evidence of well-defined processes with consistent, disciplined execution. Setting improvement goals and suggesting improvement methods were the next critical step of the process.

The author developed improvement recommendations summarized in Figure 2. As of this writing, the HFF company management are reviewing the process assessment and finalizing their improvement goals.

Process	Current Rating	Proposed Target	Justification
Cold Heading	4	5	This is the primary production process of the firm. While it is already highly capable, continual improvement of this process will create further long term competitive advantage. (Collins, 2001)
Heat Treating	4	5	This production process is also utilized for 100% of production; it is crucial for product quality and costly by its nature.
Contract Review	3	4	The Quoting process is a “make-or-break” business function for any automotive supplier, because of its long term impact on supplier profitability. The current process capability is “3” – “Established”. In order to move beyond this, more systematic assessment and measurement of the process is recommended.

Supplier Development	3	4	The company's supplier management approach includes the selection of a small number of critical suppliers providing raw material and production services (plating/coating). Supplier performance is generally effective, but supplier quality performance has been a constraint on the company's own performance.
Tooling Management	4	5	The company has considerable strength in this area, with history of improvements. Additionally, a wealth of historical data exists, providing an opportunity for study and increased deployment of statistical methods.

Figure 2. Improvement Goals Proposed

6.0 Evaluation of the assessment exercise

Overall, the ISO IEC 15504 provided a consistent and objective framework for process assessment in this case. Previous efforts by this firm had been limited to objective evidence of compliance vs. noncompliance. With the maturity level assessment, it was possible to provide more descriptive report of process implementation. When coupled with management evaluation of the importance of process performance to the firm's strategic goals, it was possible to develop more specific goals for future process improvement.

7.0 Future areas for consideration

In the course of the project, several questions were raised; these are recommended for future study

Area	Questions for Study
Improvement Methods	How can information on the process capability be used to select improvement methods? (One obvious indication: if a process falls below the "Established" capability level, capability can be improved by adopting standard industry practices, while incremental improvements become more challenging when performance levels are higher.)
Level of Detail for Process Analysis	When conducting process assessments, what level of detail should be considered in developing the process map? Current automotive industry practice has led to a small number of "macro" level processes – typically seven to twelve. The author's opinion is that this may be too general a level of study to drive meaningful assessments and improvements. For the current case, the firm's process map included 24 processes. Walker proposes 39 processes for use with software development firms; this level of detail provides for more meaningful analysis of specific activities.
Process Capability Assessment Methods	Which assessment techniques and tools can make the process capability assessment method more effective? (In the current case, the author used a simple one page checklist based on the process capability definitions. Others in the profession have been working to develop audit/ assessment tools for more rigorous assessments.

Figure 3. Future Considerations

References

Chrysler Corporation, Ford Motor Company, and General Motors Corporation. (1995), *Advanced Product Quality Planning and Control Plan – APQP Reference Manual* Chrysler, Ford, General Motors, Southfield, Michigan

Chrysler Corporation, Ford Motor Company, and General Motors Corporation. (2007), *Production Part Approval Process – PPAP*. Fourth Edition. Chrysler, Ford, General Motors, Southfield, Michigan

Collins, J.(2001), *Good to Great*, Harper Business, New York

Hammer, M., and Champy, J. (2004), *Reengineering the Corporation: A Manifesto for Business Improvement*, Harper Collins, New York

Hammer, M., (2007),, “Process Audit”, *Harvard Business Review*, April, 2007,

International Organization for Standardization (ISO),(2004),, *Information technology -- Process assessment -- ISO/IEC 15504* (2004) (note: document published in separate parts, 1-7) ISO, Geneva

International Organization for Standardization (ISO) (2008),, *Quality management systems – Requirements*, ISO, Geneva

International Organization for Standardization (ISO), (2009), *Quality management systems -- Particular requirements for the application of ISO 9001:2008 for automotive production and relevant service part organizations* (ISO TS 16949:2009). ISO

ISO/TC 176 (2009), *Introduction and support package: Guidance on the concept and use of the process approach for management systems* (2008), document ISO/TC 176/SC 2/N544R3, ISO, Geneva, Available from:

<http://isotc.iso.org/livelink/livelink/fetch/2000/2122/138402/138403/3541460/customview.html?func=ll&objId=3541460&objAction=browse&sort=name>

[accessed 11/15/2009].

Porter, M. E. (1985), *Competitive Advantage: Creating and Sustaining Superior Performance*, The Free Press, New York

Walker, Alistair. (2008), “The Development of a South African national standard for ISO 9001:2000 process auditing”. *Proceedings of the 13th International Conference on ISO 9000 and TQM*. ICIT, Hong Kong

Author's Background

Bradley A. Pritts has been a consulting engineer specializing in quality and project management in the automotive industry for twenty-seven years. His experience includes:

Project Manager for new product/process launches at several automotive parts suppliers and vehicle OEM's in North America and the People's Republic of China. Personally led Advanced Quality Planning teams from project conception through successful launch programs for five major product programs representing over fifty (50) product part numbers.

Leadership of ISO 9000, QS-9000, ISO/TS 16949, and customer specific quality system implementations with over twenty-five client plant sites.

Consultation in problem-solving efforts involving customer complaints, in many cases combining multiple players in automotive supply chains.

Six years tenure as an RAB certified QMS Lead Auditor

Pritts' academic qualifications include the M.B.A., University of Michigan; and B.S., Ohio State University. He is an ASQ Certified Six Sigma Black Belt.