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A unified model for the implementation of both ISO 9001:2000 and CMMI by ISO-certified organizations

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Abstract

ISO 9001 is a standard for quality management systems and CMMI is a model for process improvement. If an ISO-certified organization wishes to improve its processes continuously, implementing CMMI would be a good choice, as it provides more detailed practices for process improvement than the ISO standards. However, there are two issues that need to be resolved when an ISO-certified organization implements CMMI. First, it is not easy to identify any reusable parts of the ISO standards, and it would be advantageous to be able to reuse selected portions of the ISO standards during CMMI adoption in order to use existing resources to their best advantage. Second, it is difficult for an ISO-certified organization to implement CMMI in a straightforward, easy manner because of the differences in the language, structure, and details of the two sets of documents. In this paper, we present our unified model for ISO 9001:2000 and CMMI that resolves these two issues. Our model would be an extremely useful tool for ISO-certified organizations that plan to implement CMMI.

Keywords: ISO 9001:2000; CMMI; Mapping; Unified model

1. Introduction

ISO 9001:2000 requires that an organization's processes undergo continuous improvement even after ISO certification has been achieved. CMMI provides an organization with a means to accomplish further process improvement. CMMI is a very detailed set of documents that contain many more of the basic concepts for process improvement than can be found in ISO 9001:2000. In the past, several ISO 9001:2000-certified organizations have attempted to embrace CMMI concepts by implementing SW-CMM, which is only one part of the CMMI set of documents (Mutafelija and Stromberg, 2003b; Paulk et al., 1995).

To implement CMMI in an ISO-certified organization efficiently and effectively, both the common and different parts of the ISO standards and CMMI documents must be identified. ISO 9001:2000 requirements can be mapped to CMMI practices (Mutafelija and Stromberg, 2003a,b). However, the following limits have been identified in this mapping process:

First, a requirement of ISO 9001:2000 can be mapped to many CMMI practices. Conversely, a CMMI practice can be mapped to many ISO 9001:2000 requirements. These mappings are useful for comparing these two frameworks, but they may cause confusion during the decision-making process.

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Second, it is difficult for organizations to understand and apply these mappings during CMMI implementation because they only describe the degree of the correlation between ISO and CMMI without providing any explanation of these mappings.

Third, the mappings do not describe CMMI from an ISO viewpoint. The structure and words that are used by CMMI are not familiar to ISO-certified organizations, which makes it more complicated for an ISO-certified organization to implement CMMI.

This paper proposes a model in which the contents of ISO and CMMI are unified. Our unified model provides a solution that allows us to deal with the limitations noted above.

The remainder of this paper is organized as follows: Section 2 gives a brief explanation of ISO 9001:2000 and CMMI. Section 3 discusses related works. Section 4 presents our unified model of ISO 9001:2000 and CMMI. Section 5 compares our model with related works. Finally, Section 6 provides our conclusions.

2. ISO 9001:2000 and CMMI

2.1. ISO 9001:2000

ISO 9001:2000 is a necessary requirement for a quality management system. It is a part of the ISO 9000 family that consists of ISO 9000 (Fundamentals and Vocabulary) (ISO, 2000a; Ketola and Roberts, 2000), ISO 9001 (Requirements) (ISO, 2000c), ISO 9004 (Guidelines for Performance Improvements) (ISO, 2000b), and ISO 19011 (Guidelines for Quality and Environmental Management Systems Auditing). ISO 9001:2000 is an abstract and is a sparse document that can be applied to any category of business. When it is to be applied to organizations in the software industry, ISO 9001 can be further interpreted by using either ISO 9000-3 (ISO, 1997) or TickIT (British Standards Institute, 2001). To achieve an ISO certification, organizations must be compliant with every clause of ISO 9001:2000 (Cianfrani et al., 2001). Compared with ISO 9001:2000, ISO 9004:2000 is not a requirements document. Rather, it is a document that provides guidance for further process improvement. ISO 9001:2000 and ISO 9004:2000 are similar in terms of both the structure and terminology that they use in order to facilitate their application as a consistent pair (ISO, 2000b; ISO, 2000c) of standards.

2.2. CMMI

Capability Maturity Model Integration (CMMI) is an integrated model of many Capability Maturity Models that consist of best process practices (Chrissis et al., 2003).

CMMI has 25 process areas (PA). A process area is a set of practices in specific areas which, when implemented collectively, satisfy a set of goals, resulting in a considerable improvement in that area. (CMMI Product Team, 2001a,b).

Goals are classified as generic and specific goals. A generic goal (GG) describes the characteristics that must be implemented to adopt the processes that will satisfy a process area. A specific goal (SG) describes the characteristics that must be implemented to satisfy the process area.

Practices are expected components for achieving goals. Practices are classified as generic and specific practices. A generic practice (GP) is an essential activity for achieving the associated generic goal. A specific practice (SP) is an essential activity for achieving the associated specific goal.

3. Related works

Only a few studies have compared ISO 9001:2000 and CMMI (Mutafelija, 2001; Mutafelija and Stromberg, 2003a,b; Stromberg and Mutafelija, 2002) compared with the number of studies comparing ISO 9001:1994 and SW-CMM (Bamford and Deibler, 1993; Jalote, 1999; Paulk, 1993, 1994, 1995). Since the latter set of studies provides strong hints that are useful for understanding the relationships between ISO 9001:2000 and CMMI, we present some of these related studies below.

Paulk (1993, 1994, 1995) compared ISO 9001:1994 with SW-CMM to answer the following questions: "What is an appropriate CMM level for an ISO 9001-compliant organization?" "Can a CMM level 2 (or 3) organization be considered compliant with ISO 9001?" "Should software quality management and process improvement efforts be based on ISO 9001 or CMM?"

This study showed that SW-CMM has more requirements than ISO 9001:1994 when ISO 9001:1994 is mapped to SW-CMM. It further stated that an ISO 9001:1994-compliant organization would satisfy most of the level 2 and many of the level 3 goals of SW-CMM.

Jalote (1999) proposed a way for transitioning from ISO 9001:1994 to SW-CMM level 4, based on an actual organization's transitioning experience. He pointed out that a simple mapping between ISO 9001:1994 and SW-CMM is not helpful to field staff. Furthermore, it is useful to describe what additional actions must be accomplished for a typical ISO 9001-compliant organization that is transitioning to SW-CMM.

Studies have examined simultaneous implementations of ISO and CMMI with a view to achieving a synergy between them (Mutafelija, 2001; Mutafelija and Stromberg, 2003a,b; Stromberg and Mutafelija, 2002). These studies stated that organizations at CMMI level 3 will be ready for ISO 9001:2000 certification with only minor adjustments. Consequently they proposed a method to implement both frameworks by initially implementing CMMI and adding further requirements for ISO 9001:2000. Since they used CMMI to interpret ISO, this method is better suited to a CMMI organization that is adopting ISO 9001:2000 than it is to an ISO-certified organization that is adopting CMMI.