Foreword 2

MIMOS Berhad (MIMOS), an applied research and development (R&D) centre under the Ministry of Science, Technology and Innovation (MOSTI) conducts pioneering research in information and communication technologies for the government of Malaysia. MIMOS demonstrated Level 5 process maturity on Capability Maturity Model Integration-Development constellation (CMMI-DEV 1.2), in October 2009. High-maturity practices of the CMMI-DEV were institutionalized using a multi-model strategy combining CMMI-DEV, the People Capability Maturity Model (PCMM) and Six-Sigma to leapfrog the organization towards global competitiveness. It was a deliberate four-year roadmap which began in 2006 that finally reached its fruition to prepare MIMOS for product commercialization in 2010. This journey is marked by significant milestones within such a multi-model context. On the CMMI framework, MIMOS first achieved maturity Level 3 (Defined Maturity), in September 2007 and it took two more years to grow this maturity to Level 5 (Optimizing Maturity) in October 2009. The PCMM program, which was initiated in parallel, resulted in a Level 2 (Managed Maturity) in September 2007. The Six Sigma program was conceived in January 2007 with the specific objective of introducing problem-solving methodologies to support process adoption in the research and development context. This journey continues as we go about institutionalizing the high-maturity PCMM process areas described by Raghav Nandyal in this book on *'Building and Sustaining High-maturity Software Organizations'.*

The Motivation

Just as MIMOS was deciding the best approach to adopt for their organization development strategy, Raghav convinced the senior leadership and sponsors that, as much as building capable processes was important, growing competencies and capable people was necessary. As he would emphasize throughout this journey, "*it is only when competent people use a capable process, can one institutionalize a predictable process*"! The senior leadership was completely committed to embrace CMMI-DEV for the process framework with which process improvements would be engineered. The software engineering competencies of the organization were made robust as a result, by using industry best practices to make processes optimal and to improve business performance. PCMM served as a maturity framework that emphasized on continuous improvement of workforce practices and competencies required for management and development of the human assets. Being an R&D organization, MIMOS felt that PCMM was most appropriate to address its needs for developing people and improving their competencies so they become contributing members of the organization. Six Sigma offered a rigorous and disciplined methodology that kept track of the quantitative progress of the improvement process, by emphasizing data management and statistical analysis to measure and improve the operational performance, practices and systems at MIMOS. MIMOS inculcates this discipline as a business improvement strategy, not only for software engineering alone but across all other business areas within the scope of MIMOS work execution.

Soon, the wisdom of using a multi-model strategy became evident when practitioners found many similarities and a complementary nature among these three programs. By the late 2007, when the high-maturity implementation on CMMI-DEV was underway, these three programs were integrated into multi-model strategy. Running each program separately would duplicate effort and require significant resources. By employing a multi-model strategy, repetition to define and maintain processes was considerably minimized, since, where one model lacked something, the other would make up for it, as this book will highlight. We soon realized that an integrated multi-model approach reduced the effort required to institutionalize practices that were common to several of the overlapping areas. In turn, each program would help make the others robust by exploiting the complementary nature of performance improvements. This was a great learning for us.

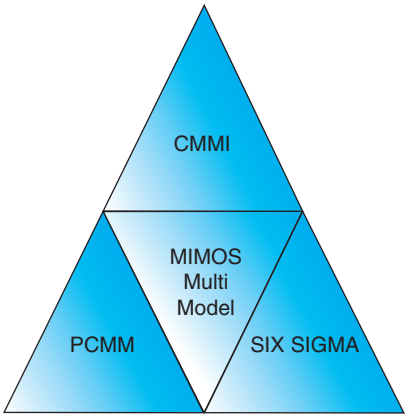

Figure 1 Inter-dependence among programs in a Multi-Model Strategy.

As illustrated in Figure 1, the output from the activity of process mapping in CMMI-DEV provides Six Sigma with the overview to identify the sub-processes for further analysis and scrutiny. In turn, CMMI tools are used to capture the necessary raw data mandated by the Measurement and Analysis process area. This same data become the input for the Six Sigma Define-Measure-Analyze-Improve-Control (DMAIC) methodology, minimizing the effort required to execute the Measure phase of DMAIC. The same data are also used for verifications in the Improve phase. Deliverables from many CMMI process areas provide the necessary environment, background information, and metrics baselines that Six Sigma projects would require to establish before entering the Measure phase. Likewise PCMM data can also be used in Six Sigma projects to measure effectiveness of workforce practices and to monitor the performances of existing processes. This integration permits the inclusion of Human Resource department to methodically identify opportunities and to systematically improve their performance when Level 2 is being institutionalized, and gain their crucial support as a contributor towards sustaining MIMOS' business performance. From the PCMM perspective, Training and Development process area helps in institutionalizing the CMMI-DEV process area of Organization Training. Meeting PCMM Training and Development requirements would automatically fulfill the requirements of CMMI-DEV Organizational Training process area besides addressing a generic practice (GP 2.5: *Train the people*

performing or supporting the process as needed) across all of the CMMI-DEV process areas. Unlike a direct overlapping relationship between PCMM and CMMI-DEV, Six Sigma and CMMI-DEV have a cyclical relationship for attaining CMMI Levels 4 and 5. Many of the high-maturity practices at Levels 4 and 5 of both the CMMI-DEV and the PCMM need Six Sigma support in terms of quantification and to establish proof of evidence of the improvement. The Six Sigma program provides problem-solving skills for analyzing process and facilitates idea generation towards improving processes for CMMI-DEV and PCMM. Where CMMI-DEV and PCMM articulate the needs to establish high-maturity practices, Six Sigma provides the tools to analyze data, and to determine stability of sub-processes, and indicate if the improvements are statistically significant, as claimed. This book shows us the path to do this effectively. Raghav dedicates two valuable chapters on *"Software Measurement System"* and on the *"Structure of a Process Capability Baseline Report"* for gaining the necessary understanding. These are topics which are seldom documented in any book of this kind, and MIMOS has benefited by using concepts described by Raghav in these chapters. Raghav chooses to use the term multi-disciplinary in his book, instead of multi-model, since his consulting competencies go way beyond these three models to include a wide variety of strategies including acquisition engineering, service establishment and delivery, Information Technology Infrastructure Library (ITIL), family therapy and his beliefs in systems thinking and a systems approach for performance improvement.

Gains from Multi-Model Implementation

This multi-model strategy used in MIMOS had a three-fold impact:

- **Effort:** Both institutionalization and appraisal effort was brought down significantly by exploiting the commonalities.
- **Cost Benefit:** The multi-model approach eventually reduces cost as compared to implementing each model one-at-a-time. Cost in terms of implementation, appraisals and consultancy can be minimized.
- **High-maturity Support:** Besides the commonalities within the models, the statistical element that supports the implementation and analysis of the effectiveness of high-maturity practices requires Six Sigma strategies to be conceived.

To inculcate a culture of continuous renewal and high-maturity thinking, several tactical tools such as the SITARA TQI for TQA[sm] (Ten Question Indicator for Total Quality Assurance) were introduced systematically by Raghav during his appraisal consulting. This high-maturity probe devised by SITARA Technologies helped MIMOS in creating the necessary focus on high-maturity thinking. Organizational performance portals were created to evaluate the trends in the organization metrics and process performance using the format of the process capability baseline (PCB) report suggested in this book. This book illustrates several examples from the PCB reports of MIMOS which are being shared willingly with the community to improve the overall knowledge base and to provide thought leadership to the industry on the application of Six Sigma strategies as we know it, to software.

I am sure that following the recommendations in this book by Raghav Nandyal will go a long way in reducing the cycle time for implementing high-process maturity practices. Concepts in this book have been tried and tested by him in other high-maturity organizational settings before they were released to

MIMOS from the SITARA Process JewelBox™. Ideas presented here will streamline organizational thinking by getting organizations to do the right things right the first time thereby minimizing the cost of rework on performance improvement programs. More importantly, the principal message contained in this book, *"There are more human factors than process factors, for building and sustaining high-maturity software organizations"*, is best understood by reading the works of someone who has had two decades of rich experience reflecting and thinking about solutions while working all his life in high-maturity settings. Raghav brings out a very refreshingly different approach to help us appreciate the importance of both process improvement and competency development for the building and sustaining of high-process maturity by citing the example of Bruce Lee. We are reminded that going beyond building high-process maturity with CMMI-DEV is to secure it with adequate practices from the PCMM to sustain this capability by creating the Bruce Lee effect. To end with a quote from this book: *"Process predictability is possible if and only if both process capability and workforce capability are improved to realize the Bruce Lee Effect!"*

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