Case Study of CMMI implementation at Bank of Montreal (BMO) Financial Group

Background

Started in 1817, Bank of Montreal - BMO Financial Group (NYSE, TSX: BMO) is a highly diversified financial services provider and one of the ten largest such organizations in North America. The Group has more than 33,000 employees and assets of $196 billion, and provides a broad range of retail banking, wealth management and investment banking products and solutions to clients across Canada and in the United States. The BMO Financial Group is made up of three client groups including Personal and Commercial Client Group (P&C), Private Client Group (PCG), and Investment Banking Group (IBG).

The Bank of Montreal is known for innovation and continually develops and integrates new software solutions, to maintain a competitive position and provide enhanced services to its customers. Its ongoing commitment to improved productivity has led it to adopt the Carnegie Mellon CMMI (Capability Maturity Model Integration) approach[1], which it believes enhances its effectiveness, decision-making process and overall operational effectiveness. The issues, impact and benefits of this adoption are discussed herein.

The Challenge

Many corporations have been forced to reevaluate their IT initiatives and seek the advantage of lower labor costs provided by offshore development centres. The fear, and sometimes reality, which these companies experience is that quality and accountability may be sacrificed as larger, more complex projects are sent overseas. What safeguards exist to provide a predictably successful project outcome? Can these safeguards be applied to improve performance of in-house resources in order to reduce the risks of outsourcing?

BMO faced many of the issues identified by the Software Engineering Institute in sub-optimization of internal software development. Specific issues at BMO were identified in the software development process, where "fire fighting" was a way of life and cost and schedule estimations were unreliable. Further the resources required to manage the number of change orders coming through on a specific project were enormous, resulting in cost overruns and longer lead times. Whilst some project-related data was available around the software development process, it was neither collected nor systematically analyzed. A few procedures and software processes were available but not established, controlled and fully documented.

"Even though there was some attempt to organize the development process, in certain areas of the bank, it was also evident that there were significant problems with documentation (hard to find, incomplete, different forms (layouts) and standards). Separately, in another CMM-based improvement initiative, peer reviews were encouraged, but it was difficult to convince people to use such reviews and overcome their fear of being used as the basis of individual performance ratings. There was also the generally held belief that BMO software development teams did not have the time or resources to do reviews." Gordana Kis, CSQA, Sr. QA Specialist, BMO.

Solution

The first issue in implementing a solution was both recognition of the problem and an identification of a structured quality process to address it. Ki Leung, Senior Vice President at BMO, spearheaded the piloting of the CMM and set the stage for activities such as the provision of CMM training, formal and informal CMM assessments and driving out action plans at regular intervals. Verification activities performed by an independent Software Quality Assurance Group also helped ensure improvements to processes would be institutionalized. This strategy soon spread to other business units in the bank.

---

[1] BMO has also adopted other process improvement models and standards such as ISO 9001, 6 Sigma, and ITIL.

Mutually, Jesse Hanspal, Director of Development Technology Services at BMO, decided to create an enterprise Requirements Management process by combining pieces of existing requirements techniques and adding a quality assurance process for verification as well. The bank built this process around responsibility and job roles in order to guarantee that all necessary stakeholders had a say. For instance, he says, for a given project, you need representation of the end user role, of course, but also of the application administrator role, not to mention roles related to security and regulatory compliance. And Hanspal says the new process has produced results. For instance, the number of software defects related to requirements has dropped by some 50 percent since implementing the new controls.

Combining the ISO certification with first the CMM and then the CMMI from the Software Engineering Institute has helped institutionalize a quality approach. Having ISO certifications and attaining CMM and CMMI maturity levels lets people know what is required of them. It also gives the bank a chance to evaluate effectiveness of each process and initiate further improvements.

Role of CMMI

Introduction of the CMMI Process is based on the premise that the quality of a system is highly influenced by the quality of the process used to acquire, develop, and maintain it. This premise implies a focus on processes as well as on products and is a long-established Total Quality Management (TQM) premise in manufacturing.

CMMI in a Nutshell

A CMMI model provides a structured view of process improvement across an organization.
CMMI can help
• integrate traditionally separate organizations
• set process improvement goals and priorities
• provide guidance for quality processes
• provide a yardstick for appraising current practices

The original Capability Maturity Model for Software (SW-CMM) is the creation of the Software Engineering Institute (SEI), which is operated by Carnegie Mellon University. The SEI established the SW-CMM as a framework for organizational process improvement and a model for measuring the process maturity of an organization. It quickly became the de facto, internationally recognized standard for assessing and improving software development processes and has been successfully adopted by more than 1,800 organizations worldwide.

CMMI has five levels of maturity (Figure 1). Level 1 characterizes organizations operating at an unpredictable, poorly controlled and reactive process. Organizations operating at Level 2 have a process characterized for individual projects and often reactive. Organizations operating at Level 3 have defined a proactive organizational process. Organizations operating at Level 4 apply greater control and measurement to their processes. Finally, organizations operating at Level 5 are continuously enhancing their process and adopting an organizational focus to look for opportunities for overall process improvement.
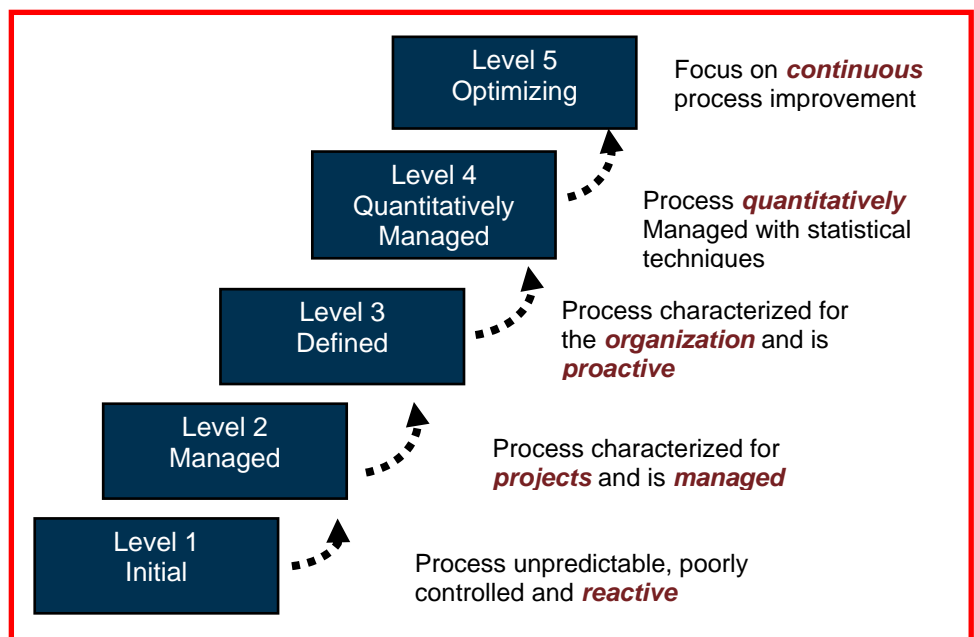

Level 5
Optimizing — Focus on *continuous* process improvement

Level 4
Quantitatively Managed — Process *quantitatively* Managed with statistical techniques

Level 3
Defined — Process characterized for the *organization* and is *proactive*

Level 2
Managed — Process characterized for *projects* and is *managed*

Level 1
Initial — Process unpredictable, poorly controlled and *reactive*

Figure 1: Characteristics of 5 Levels of CMMI Implementation

> "*The CMMI requires that real people in management, engineering, and infrastructure adopt new behaviors and beliefs. In this environment, two lessons have emerged: Core culture is a principal factor in achieving success, and "change leadership" is as important as "change management.*"   - Dutton

Implementation Partner

In choosing to implement the CMM and subsequently CMMI models, BMO chose to work with Certified consultants, who could both train and audit their practices to help them improve its processes, ultimately, enhancing BMO's performance. Identifying a local partner, with extensive reputation and experience in the Canadian environment, was a key to successful implementation and GRafP Technologies met these requirements.

From a base in Canada, **GRafP Technologies** provides services to IT enterprises in Asia, Europe, North America and South America to model and assess their processes, and to optimize their operations. GRafP helps:

- Managers efficiently monitor the risks facing their projects and take appropriate action to prevent these risks from materializing;

- Process Specialists conduct SEI-Authorized or informal CMMI®-Based Appraisals to identify where productivity can be increased;

- IT Auditors and Software Quality Assurance Analysts collect and analyze the information that will help them fulfill their verification responsibilities;

- Investment Specialists assess the risk of investing in IT ventures, manage their investment portfolios and negotiate fair conditions with their clients.

Based on this engagement, an organization is then in a better position to gain a precise understanding of its IT processes, an essential component of the corporate knowledge base which will constitute the success factor of the IT enterprises and organizations of the XXIst century.

As part of the services provided to BMO Financial Group since July 2000, GRafP Technologies has helped this Canadian Bank achieve CMMI Maturity Level 4 in 2006 and CMMI Maturity Level 5 in 2009.

Implementation

The first step taken to adapt and implement the new models was training. Such training helped diminish suspicion and resistance often encountered with a cultural change in the approach to the way in which software development was traditionally approached. This role was led by GRafP Technologies, who conducted a series of related training sessions for the software development staff.
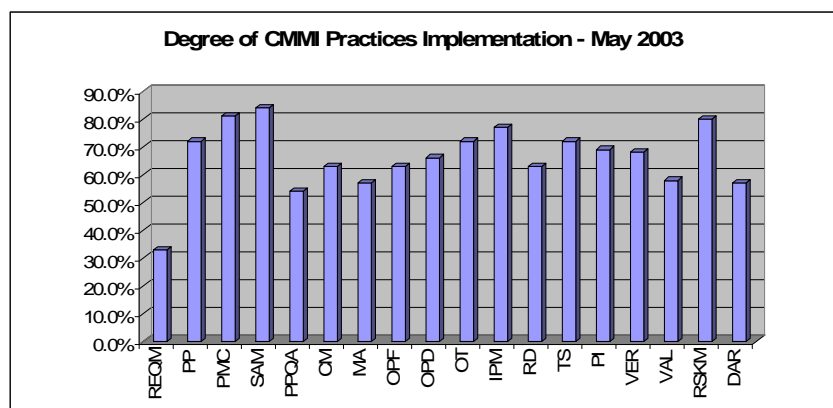

Degree of CMMI Practices Implementation - May 2003

Figure 2: Initial Assessment Results of One Business Unit

® CMMI and Capability Maturity Model Integration are registered by Carnegie Mellon University

GRafP then performed an initial assessment (see Figure 2 above) and needs-gap analysis to assess the current position of the firm in relation to what was expected by the CMMI. Established policies, processes, procedures and artifacts were analyzed to ensure that they supported the practices and process areas of the CMMI model. The findings of this initial assessment formed the basis of a detailed activity and training plan. An enterprise requirements management process was released along with the formation of an independent Quality Assurance group. Training was also undertaken in areas such as configuration management, peer reviews, and function point analysis and tool sets.

To accurately measure the progress achieved in one of the bank's Business Units, GRafP performed a subsequent assessment two years later, showing impressive increases in CMMI practice implementation (see Figure 3 below) in all evaluated process areas.

The successful implementation of a Capability Maturity Model® Integration (CMMI®) process improvement effort does not just depend on an understanding of the CMMI, and the process innovations, but also on the endorsement of senior management, and the core culture of the company. At BMO, senior management endorsement of the CMM and CMMI has been reflected in successive BMO annual reports.

Outcomes

Measuring the effects of process improvement activities takes years of gathering and analyzing measurements around increased productivity, shorter cycle times, increased quality and improved customer and employee satisfaction. The achievement of a CMMI Level 5 rating through SEI provides concrete and validated data showing the improvements in productivity.
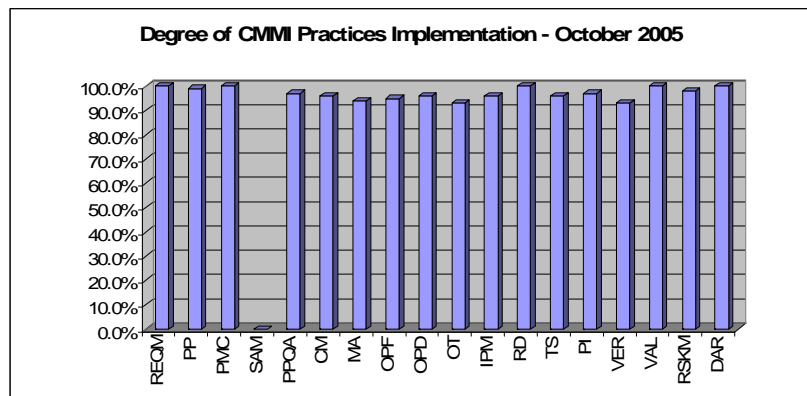
Figure 3: Subsequent Assessment Results of One Business Unit

Qualitative benefits include the impact on the organizational culture and advances in the services that the firm can deliver to clients. The CMMI framework ensures employees understand their roles and responsibilities commit to owning those responsibilities and rely on a disciplined mechanism by which to monitor their execution. Appraisal team members specifically gain process improvement insight. They carry that knowledge and insight into the new projects impacting the way these projects are conducted, and extending that insight to the project team members. An organization undertaking a SCAMPI appraisal reaps the qualitative benefit of having instilled or encouraged an approach to continuously looking for better ways to improve the software development process into their culture. Organizational predictability, accountability and delivery excellence just gets easier as it is ingrained into the culture.

Success Factors
- Senior management support
- Independent Software Quality Assurance (SQA) group

Leads To
- Integrate traditionally separate organizations
- Sets process
- Improved quality of deliverables
- Greater visibility into development process
- Improved customer relationships
- Improved employee morale and retention

Measuring ROI

In introducing process improvement and quality tools to the software development process, it is important to measure the impact of such an investment in both financial and non-financial terms. The Return-On-Investment

(ROI) is the quantification of the financial return of an investment and is the actual value derived by comparing program costs to benefits, measuring the magnitude of benefits relative to costs, the net benefit after expending some level of resources, or profit computed by dividing net income by assets used.

In the case of BMO, the organization applied these measurement techniques to the ongoing development of a specific software Derivative System application. As a result of their implementation of quality processes in the ongoing development this application over a number of releases, BMO was able to:

- Achieve maintenance support productivity 3.8 times the industry average.
- Increased enhancement support productivity to more than 2 times industry average.
- Reduced the defects per release from an industry average 6 -12 to 2.
- Increased the delivery performance of function points per employee to significantly above industry averages.

In a separate study at BMO, the organization also set out to measure the impact of CMMI implementation on project indicators such as On Time and Within Budget. The results of this study, presented in Figure 4, further corroborated a noticeable return on investment.
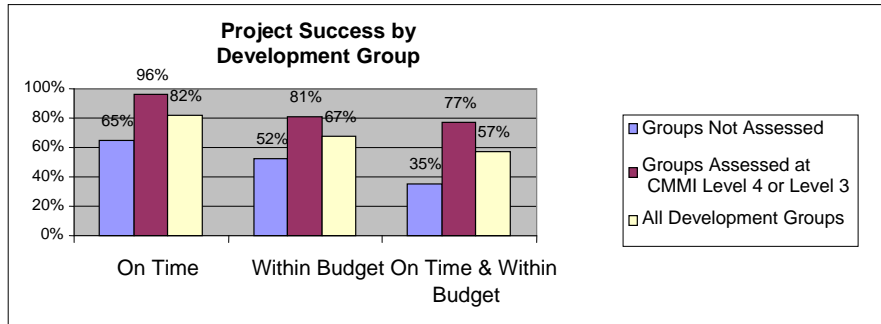
Project Success by Development Group

On Time: Groups Not Assessed 65%, Groups Assessed at CMMI Level 4 or Level 3 96%, All Development Groups 82%
Within Budget: Groups Not Assessed 52%, Groups Assessed at CMMI Level 4 or Level 3 81%, All Development Groups 67%
On Time & Within Budget: Groups Not Assessed 35%, Groups Assessed at CMMI Level 4 or Level 3 77%, All Development Groups 57%

- Groups Not Assessed
- Groups Assessed at CMMI Level 4 or Level 3
- All Development Groups

Figure 4: On Time & Within Budget – Comparative Results at BMO

These direct measurements of quality improvement, in line with the findings of many of the other companies implementing CMMI, provide a valuable insight into the benefits of CMMI implementation. With this level of return and the added non-financial benefits, the returns from a formal engagement of this sort can be seen to be very beneficial to companies looking to enhance their software development effectiveness.

Comments

Successful implementation of the CMMI, in a staged approach, increasing maturity levels over time, can create many benefits for companies. There is a need for strong leadership and a cultural change in performance measurement to achieve the returns possible. Successful implementation also provides several non-financial benefits, which can have even more profound impact.

The quality improvement process cannot be attempted in a halfhearted manner, and requires the assignment of dedicated resources with a focused mandate. SQA specialists at BMO also act as consultants who advise the development team in order to enhance the effectiveness of the development process.

Independent Verification and Validation enhances the likelihood of long term success, especially given the need for continual increase in performance expectations.

BMO is only the second Canadian company to achieve CMMI level 3 (following IBM) and the first Canadian bank to achieve CMM and CMMI level 4. Its ability to see demonstrable benefits of such a wide scale implementation, enabled by its internal vision and leadership, and the availability of a local third party partner, gives it continual feedback on the real bottom line benefits derived from its investment in CMMI process improvements.

References

[CMU/SEI 01] Members of the Assessment Method Integrated Team Standard CMMISM Appraisal Method for Process Improvement (SCAMPISM), Version 1.1: Method Definition Document (CMU/SEI-2001-HB-001). Pittsburgh, PA: Software Engineering Institute, Carnegie Mellon University, 2001. http://www.sei.cmu.edu/publications/documents/01.reports/01hb001.html.

"A CMMI Case Study: Process Engineering vs. Culture and Leadership"
Jeffrey L. Dutton, Technical Director, Engineering Performance Improvement Centre, Jacobs Sverdrup

"Function Point Pilot Results in IBG and RMG", Internal BMO Report, Alfred Allik, Director of Quality, BMO, September 2005

"Leveraging best practices", Board Report, BMO, November 2005, R. Dhillon, Snr. manager IT Best Practices, BMO

Beyond PMO, Creating Business Value, J. Hanspal, BMO, Presentation to Projectworld, May 2006

Ottawa Software Quality Association &ASQ 0407 Software Focus Group November 2003
Process Improvement Experience: CMM Level 3 Best Practices, Gordana Kis, CSQA Sr. QA Specialist BMO

Capability Maturity Model® Integration
(CMMI®) Overview 2005 by Carnegie Mellon University