



Bring Goal Question Metric (GQM) To Life with MKS Portfolios

An MKS White Paper

Introduction

As key members of the executive team, CIOs, CTOs and VPs of Engineering must align the activities of their software development teams to the priorities of the business. Findings from several key research studies indicate that IT organizations lack visibility and clear measurement and monitoring that would enable them to do this. This impediment has a direct impact on the ability of IT to meet its objectives and align innovation with business goals and serve their customers better.

According to a recent CIO survey by IDG Research Services and MKS, slightly fewer than half of the respondents (45%) report they have *complete visibility* into every IT dollar spent on application development and application management activities, while 30% report *visibility for new application development*. Only 4% have *visibility into their application maintenance* activities yet on average, respondents allocate the largest share of spending, 43%, to application maintenance activities.

Similar findings have been reported by Forrester Research, which states that in spite of the recognized need for visibility into the breadth of IT, only one third of the organizations have a measurement initiative underway. Technology executives are clearly responding to the need to improve visibility across IT and software engineering organizations. The drivers for improved measurement within IT vary, but key reasons include performance improvement, demonstration of value, and cost reduction.

As well, in a recent survey of over 7,000 respondents by the IT Governance Institute, 40 % of IT leaders admit to having serious problems with IT failures and poor visibility into performance. Another 75 percent of respondents know they need to improve IT governance.

The solution – that organizations must do a better job of measuring application development and software engineering effectiveness – is clear. However, the specific measurement approach, and the means and process of measurement remain a sticking point for some organizations. One of these approaches that is steadily gaining industry acceptance is the Goal Question Metrics (GQM) methodology. GQM is a pragmatic approach geared towards identifying metrics that line up to the strategic objectives of the business and how track and monitor these metrics over time.

For IT and software engineering organizations, GQM's prescriptive methodology defines a focused measurement plan to optimize the business value of development data collection. Through a robust metrics framework that maximizes metric alignment with the organization's goals, GQM can assist IT and development managers in improving software development processes, managing risk and improving product quality. GQM is equally applicable to other areas of IT management and its framework can be consistently applied across the business.

This paper will show how GQM, in combination with a process-centric enterprise solution for complete IT and application lifecycle management, can help organizations achieve the visibility necessary to effectively make decisions and govern their business.

Background of GQM

The GQM methodology was developed in the 1980s by Dr. Victor Basili and his team at the NASA Software Engineering Laboratory (SEL). Since then, the approach has been refined and is applicable to other areas of systematic process improvement, such as Carnegie Mellon's CMMI model, and business optimization processes within organizations.

Main Benefits of GQM

GQM proponents cite four key benefits:

1. Developing an understanding an organization's application development practices and establishing appropriate baseline and benchmark levels
2. Managing and assessing application development processes
3. Evaluating the effectiveness of new software engineering processes
4. Validating, assessing and implementing process and practice improvements

Six GQM Steps

Implementation of GQM involves six defined steps that are divided into two parts. The first part of the methodology centers on involving the right people to identify the metrics that will demonstrate alignment with business goals. The second part focuses on how the data is collected, analyzed, validated and then interpreted to make decisions and improvements. Dr. Basili¹ prescribes the following six steps:

1. **Goal Development:** Develop a set of corporate, division and project business goals and associated measurement goals for productivity and quality.
2. **Goal Definition:** Generate questions (based on models) that define those goals as completely as possible in a quantifiable way.
3. **Measure Definition:** Specify the measures that need to be collected to answer those questions and track process and product conformance to the goals.
4. **Data Capture Creation :** Develop mechanisms for data collection.
5. **Data Collection, Validation and Analysis:** Collect, validate and analyze the data in real-time to provide feedback to projects for corrective action.
6. **Data Interpretation, Goal Evaluation and Recommendation Formation:** Analyze the data in a post mortem fashion to assess conformance to the goals and to make recommendations for future improvements.

How MKS Integrity supports the GQM Methodology

For each of the six steps identified by Basili, MKS Integrity's application lifecycle management solution can be a critical enabler to engage stakeholders at all levels within the organization, from IT executives to managers to developers. Throughout the development and implementation of the GQM methodology, MKS Integrity provides complete visibility and transparency into the process and the progress toward goals.

¹ Basili, Victor R., "Using Measurement to Build Core Competencies in Software", Seminar sponsored by Data and Analysis Center for Software, 2005.

1. Goal development

In this first step of the GQM methodology, MKS Integrity enables the business to map multiple processes that are inclusive of the various stakeholders. Project leaders can facilitate a clear and common understanding of the overall project goals whether at the business, division or company level and show the alignment. The traceability and automatic communication of changes to the artifacts flowing through the process ensures shared buy-in among key stakeholders and the development of precise terms to define the scope of measurement — what product or process is being examined, why, in terms of which outcomes, from whose perspective and within which context.

2. Goal definition

Once a goal has been developed, project leaders need to track progression toward the goal, and be able to recognize when the goal has been achieved. MKS Portfolios can facilitate the process of generating measures that qualitatively define the success indicators. Through the tracking of ongoing and real time lifecycle data, MKS Portfolios can immediately provide organizations with the ability to report on historical data and expose trends that may provide a valuable benchmark and basis point for goal setting and measurement.

3. Measure definition

Once qualitative outcomes are defined, MKS Integrity can document and create specific categories and metrics for the capture of empirical information that will quantify the progress towards the goal. As a by product of daily activity data is entered into the system which enables developers to be involved as well as – IT managers and IT executives – in defining the specific quantitative measures. This level of visibility delegates the decision making ability down through the organization and improves the ability of the business to stay on course. The MKS solution allows for the creation of any number of metrics at whatever level of detail is required to demonstrate successful progression towards the goals. MKS itself prescribes five critical metric categories for success: team efficiency, process efficiency, project efficiency, quality, value & effectiveness. Each category is then broken down into discreet measurable indicators such as defects fixed rate (by phase, by application and by component) as an indicator of team efficiency.

Figure 1 depicts the goals, measures and data utilized by a software development team. This team works on ongoing product enhancements and increased functionality. The main goal of this team's leader is to keep the ongoing work in progress to a minimum and to ensure that the application is always stable. Data is harvested via an integrated application lifecycle management solution with inputs from all sub-teams and project teams displayed through a configured dashboard view.

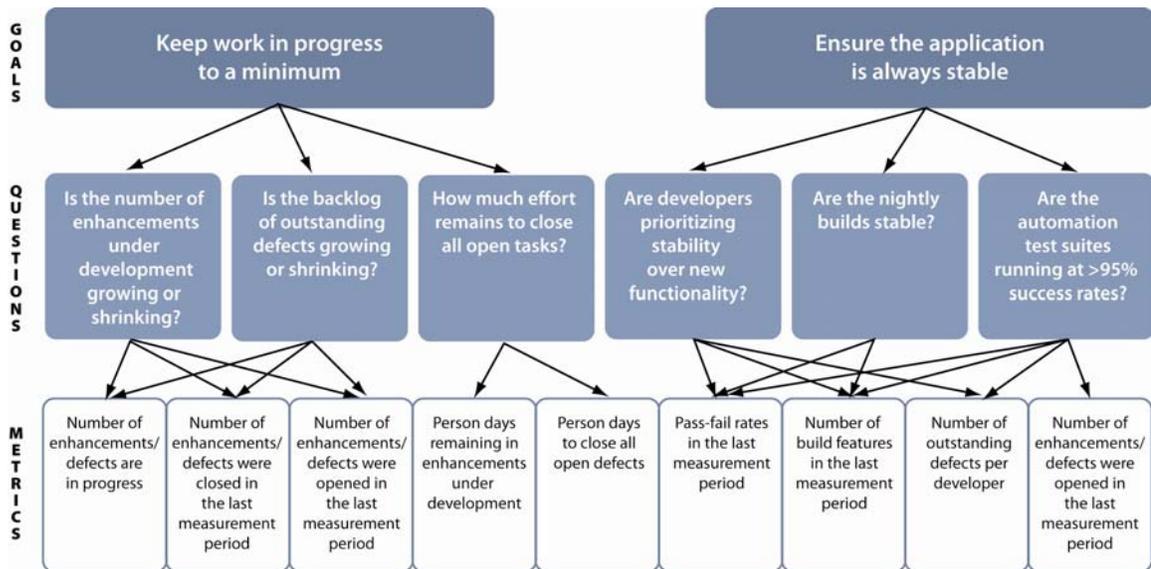


Figure 1: Some of the Goals, Questions and Metrics Utilized by A Software Development Team

If Goal 1 was expressed in GQM terms, it would be stated as:

Analyze: [Work in progress.](#)
 For the purpose of: [Keeping the work in progress to a minimum.](#)
 With respect to: [Number of enhancements, backlog of outstanding defects, prioritization of developers, stability of nightly builds and the pass rate of the automation test suites.](#)
 From the viewpoint of: [Software application development team.](#)
 In the context of: [Overall projects within the software application development team.](#)

4. Data Capture Creation

MKS Integrity enables manual and automatic data collection and for triangulation of various data sources and the Portfolios features which are an integral part of the solution automates the roll-up calculations and exposure of that data. For example, if measuring time per specific activity, a developer could manually enter in the time estimated, while the actual time spent by the developer on the task is automatically captured within the data repository based on that developer's actions within the system. A discrepancy between the estimated time spent on an activity and the actual time spent can provide meaningful insight into some potential areas of process improvement. Within MKS Integrity, data can be captured in a number of ways and metrics and trends derived at the individual developer level, team level, and at the project and application level.

5. Data Capture, Analysis and Validation

With MKS Integrity, data is collected in real-time, as a by-product of day-to-day activities, within a single repository, accessible to all levels of the organization. This automatic capture eliminates the potential for subjectivity or time delays common to external portfolio solutions which require manual data entry or integrations to separate repositories. The process driven MKS solution also allows for the data to be collected at the appropriate time in the development cycle and is therefore available for metrics calculation and analysis in a timely and context appropriate manner.

Using this solution, developers, their managers and IT executives are able to view and extract information and metrics relevant to their roles, their projects or their domain of responsibility on demand with the assurance that it is an accurate reflection of the activities within IT.

6. Data Interpretation, Goal Evaluation and Recommendations

MKS Integrity offers a number of rich presentation vehicles, such as reports, charts, dashboards and notifications, to collate and communicate the information within the system. Benchmarking, trending and the ability to compare projects, applications and services across the business and over time provides the visibility necessary to make high-level business decisions. Further, unlike static reports, through these dynamic views, IT managers can drill down to very granular information, such as business requirements, action items, logged defects or features, development tasks and through to the source code itself to find answers to areas of interest found in the report, chart or dashboard. This mechanism fosters a "manage by exception" paradigm to be adopted within the organization, thereby streamlining and improving the efficiencies of the group as a whole.

With the unobtrusive open access to real-time information that the MKS solution provides you get greater participation in the data collection and metrics management process and instant translation of metrics to activities, making it possible for managers to assess and implement immediate improvements and mid-course corrections once a project is underway.

Conclusion

The two most critical components for bringing any management framework such as GQM to life is a solid process based methodology and a robust portfolios solution that enables businesses to use real-time metrics and trends to continuously improve. Increasingly, IT departments must demonstrate their value to the organization and account for the effectiveness of both application development and project maintenance. With a solid measurement program in place, IT executives are equipped with fact-based information and can make decisions in line with their business's overall goals. The GQM methodology and the measures derived from its adoption provide insight into the business while MKS Integrity and its integrated Portfolio Management capabilities support IT organizations in capturing and reporting on those metrics that truly matter.

Other References

The Goal Question Metric Approach by Basili, Caldiera and Rimback:

<http://www.wagse.informatik.uni-kl.de/pubs/repository/basili94b/encyclo.gqm.pdf>

Experiences in using the Goal/Question/Metric Paradigm Presentation by van Solingen:

http://sel.gsfc.nasa.gov/website/sew/1999/topics/solingen_SEW99slides.PDF

DACS Gold Practices Website:

<http://www.goldpractices.com/practices/gqm/index.php>