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Aligning Organizations Through Measurement

The GQM^{+}Strategies Approach

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GQM⁺Strategies®

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About this Series

Whereas software engineering has been a growing area in the field of computer science for many years, systems engineering has its roots in traditional engineering. On the one hand, we still see many challenges in both disciplines. On the other hand, we can observe a trend to build systems that combine software, microelectronic components, and mechanical parts. The integration of information systems and embedded systems leads to so-called cyber-physical systems.

Software and systems engineering comprise many aspects and views. From a technical standpoint, they are concerned with individual techniques, methods, and tools, as well as with integrated development processes, architectural issues, quality management and improvement, and certification. In addition, they are also concerned with organizational, business, and human views. Software and systems engineering treat development activities as steps in a continuous evolution over time and space.

Software and systems are developed by humans, so the effects of applying techniques, methods, and tools cannot be determined independent of context. A thorough understanding of their effects in different organizational and technical contexts is essential if these effects are to be predictable and repeatable under varying conditions. Such process-product effects are best determined empirically. Empirical engineering develops the basic methodology for conducting empirical studies, and uses it to advance the understanding for the effects of various engineering approaches.

The series presents engineering-style methods and techniques that foster the development of systems that are reliable in every aspect. All the books in the series emphasize the quick delivery of state-of-the-art results and empirical proof from academic research to industrial practitioners and students. Their presentation style is designed to enable the reader to quickly grasp both the essentials of a methodology and how to apply it successfully.

I do not believe you can do today's job with yesterday's methods and be in business tomorrow.

—Nelson Jackson

Foreword

A highly recommended practice for controlling software and other projects is the Earned Value Management System (EVMS). The EVMS approach involves developing a complete set of budgets and schedules for a project's tasks. As the project proceeds, the completion of each task adds its allocated budget to the project's accumulated earned value, even though the actual expenditures on the task were higher or lower. At any time, one can compare the accumulated earned value with its scheduled earned value and with its actual expenditures at that point in time and determine whether the project is underrunning or overrunning its planned schedule or budget.

Unfortunately, however, the "earned value" method says nothing about the actual contribution to the business, mission, or multistakeholder values that the system being developed is intended to earn. If the system definition is off target with respect to its ability to earn those values, or is not modified to reflect changes in those values, a project perfectly accumulating its "earned value" will find that it has likely achieved the on-budget, on-schedule delivery of a useless or obsolete system.

The Goal-Question-Metric plus Strategies (GQM$^+$Strategies) approach presented in this book enables organizations to avoid such unfortunate outcomes. It extends the widely used GQM approach to include a project's strategies to achieve its goals; connects the questions and metrics to the strategies and goals via a GQM$^+$Strategies grid; and provides guidance on evolving the grid to accommodate changes in the goals, the environment, and the key technologies.

In doing so, it capitalizes on the decades of experience in applying GQM artifacts and processes across a wide variety of organizations and enterprise sectors. It is being presented in this book after several years of lessons learned from pilot applications of its evolving nature and from workshop interactions with the empirical methods community.

Based on these foundations and this experience, the book provides an accessible and logical pathway to understanding and applying the GQM$^+$Strategies approach. It starts off by providing clear definitions that can be used to represent organizational goals and define a GQM$^+$Strategies grid that links the goals to the strategies, questions, and metrics. It uses the GQM-adjunct, plan-do-check-act, spiral-type Quality Improvement Paradigm to establish an iterative Develop–Implement–Learn cycle aimed at converging on an initial GQM$^+$Strategies grid and evolving it based on experience.

The next seven chapters cover the initialization phase (How do projects get started), the two Develop phases (Characterize Environment; Define Goals, Strategies, and Measurement), the two Implement phases (Plan Grid Implementation; Execute Plans), and the two Learn phases (Analyze Outcomes; Package Improvements). The chapters use a common-thread example from the financial services sector and include numerous templates and subprocesses. These also draw on external best practices, for example, the Strengths-Weaknesses-Opportunities-Threats (SWOT) method and the Porter's Five Forces method for the Define Goals and Strategies activity.

Part II of the book provides examples of GQM⁺Strategies usage. It begins with a discussion of the major challenges in applying GQM⁺Strategies in practice: (1) aligning goals and strategies; (2) establishing mechanisms for measurement-based decision-making; and (3) communicating goals, strategies, and measurement data for evaluation and consistent decision-making across the success-critical implementation groups. It then summarizes GQM⁺Strategies usage to date and lessons learned across applications in the telecom, automotive, insurance, space agency, banking, energy, and embedded systems research sectors. These show the versatility of the GQM⁺Strategies approach and provide specifics of use for organizations in similar sectors.

A particularly attractive aspect of the GQM⁺Strategies movement is shown at the end of the book, in which it applies its methods to itself. One example is the SWOT-type analysis of future trends offering opportunities to improve GQM⁺Strategies and the approach for exploring value-based approaches to strategies, questions, and metrics. Many of the current GQM⁺Strategies metrics are value-neutral, in terms of the assumption—when counting and managing numbers and percentages of defects—that all defects are equally important. Our research in value-based inspections and testing indicates that prioritizing these activities by business value and criticality will often double the cost-effectiveness of these practices, based on the frequently encountered Pareto distribution (meaning that 20 % of the defects account for 80 % of the business value).

Another good example of GQM⁺Strategies applying its methods to itself is the inclusion of an Appendix, which provides a GQM⁺Strategies Evaluation Questionnaire asking users of the method to evaluate how well it satisfies its own goals and strategies and building in a commitment to act on the evaluations. Given the challenges of the rapid pace of change in technology, competition in products and services, and workforce skills (in 2012, over 20 countries had over 83 % of their population using the Internet, as compared to 1 in 2005), this adds confidence that GQM⁺Strategies will continue to evolve to meet the challenges.

As a bottom line, I would subscribe to GQM⁺Strategies' self-assessment that its strongest contributions to current enterprises are its provision of more consistent alignment of an enterprise's goals with its management metrics and its use of feasibility evidence metrics rather than the mere existence of artifacts and assertions as a basis of decision-making in a project. Beyond this, though, I believe that GQM⁺Strategies' consistent commitment to self-improvement is the strongest recommendation for using GQM⁺Strategies to manage current and future initiatives.

Los Angeles, CA   Barry Boehm

Quotes from Industry

"*With GQM+Strategies, we were able to make the contribution of the information management strategy to the business goals explicit.*"

<div align="right">
Dr. Alexis Ocampo
Group Leader Enterprise Architecture
ECOPETROL, Columbia
</div>

"*GQM+Strategies supported us and multiple other Japanese organizations in aligning IT- and software-related activities to the strategic needs of our business.*"

<div align="right">
Katsutoshi Shintani
Former Senior Adviser, Software Engineering Center
Information-technology Promotion Agency, Japan
</div>

"*The experience of using the GQM+Strategies approach at JAXA shows that the approach helps to clarify the relationship between activities of different organizational units on different levels of the organization, as well as to explicitly show the contributions of those activities to the attainment of top-level business goals.*"

<div align="right">
Masafumi Katahira, Yuko Miyamoto, Tatsuya Kaneko
Japan Aerospace Exploration Agency (JAXA)
</div>

"*The collaboration helped us to formulate action plans that align with both our business objectives and industry best practices. A critical ingredient for success was Fraunhofer IESE's ability to quickly grasp our business mode and challenges, establish credibility with our internal teams, and provide concrete recommendations and results.*"

<div align="right">
Jean-Pierre Dacher
COO and Head of Software Engineering
Murex S.A.S., France
</div>

Preface

Building the right products and services as well as building products and services right is the key to the success of most organizations. This requires that an organization is able to establish well-suited goals and strategies, connect and communicate them to assure that all parts of the organization are working in the same direction, recognize when goals or strategies need to be changed, and understand the effects of those changes. Aligning and integrating goals and strategies in an organization helps direct all resources, competencies, and activities towards value creation.

Aligning an organization's goals and strategies requires specifying the connections between them so that the links are explicit and allow for analytic reasoning about what is successful and where change is necessary. Applying measurement principles can support this analytic reasoning. In particular, goal-oriented measurement helps organizations analyze if and where they should preserve or change their goals or strategies. This book presents innovative steps on how to align organizations to achieve sustainable success by applying principles from goal-oriented measurement.

Why a Book on Aligning Organizations Through Measurement?

There is a tremendous need to better align organizations so that everyone is pulling in the same direction. If an organization is unable to integrate business-critical competencies such as system and software development, IT, product innovation, or customer advocacy into its overall goals and strategies and use them to shape its business strategies, it is risking its competitive advantage and market position. At the same time, it is necessary to translate a company's vision into a hierarchy of operational and actionable goals and strategies to achieve sustainable success for this organization. This book provides comprehensive information on how to do this alignment, how to control for the success of goals and strategies and recognize potential failures through measurement, and how to close alignment gaps.

Although there are many books on performance management frameworks and strategy-driven organizations, a method that aligns goals and strategies across different units of an organization in a seamless, rationale-based, and measurable way does not exist yet. This book gives structure and clarity to what is typically informal and fuzzy. It presents the GQM⁺Strategies approach, which provides

concepts and actionable steps for creating the link between goals and strategies across different units of an organization and allows for measurement-based decision-making.

Who Should Read This Book?

This book is aimed at organizational leaders, managers, decision-makers, and other professionals interested in aligning their organization's goals and strategies and establishing an efficient strategic measurement program. Practitioners should find the book useful for improving the understanding of their role in supporting the top-level goals of the organization and for getting advice on how to control the successful implementation of business strategies. The book enables all members in the organizational hierarchy to integrate all kinds of goals, strategies, and activities in an organization in a way that is clearly motivated by rationales and directed towards organizational success. Besides enterprise managers and their staff, the book is especially relevant for project and quality managers, members of improvement groups, measurement experts, system engineers and developers, and consultants. The book is also interesting for academic faculty researchers looking for mechanisms to integrate their research results into organizational environments.

What Are the Benefits for the Reader?

Readers will gain the knowledge and skills needed for aligning an organization through measurement. This will enable them to consistently align their organizational goals and strategies across different units, make informed decisions based on measurement, transparently communicate goals and strategies within the organization, and objectively monitor goal attainment and the success/failure of defined strategies.

- Enterprise managers and their staff will be supported in steering the organizations based on an aligned set of goals and strategies and the required data for decision-making.
- Project and quality managers in an organization will be supported in demonstrating the value of their activities in terms of the larger organizational goals and strategies.
- Members of improvement groups will be supported in objectively evaluating the impact and success of improvement programs.
- Measurement experts will be supported in setting up a strategic measurement program in which all collected data has a clear linkage to organizational goals and strategies.
- Systems engineers and developers will gain greater insight into the goals and strategies of the organization and the purpose for which the data collected from the development process is actually needed.

- Consultants will be supported with a structured model and process regarding how to set up strategic measurement programs.
- Researchers will be supported with a collection of best practices in setting up a strategic measurement program incorporated into the GQM$^+$Strategies approach.

How Is the Book Organized?

After giving a general motivation for the issue of aligning organizations through measurement, the GQM$^+$Strategies approach is described in a nutshell, with a focus on the basic model that is created and the process for creating and using this model. Afterwards, the recommended steps of all six phases of the process are described in detail with the help of a comprehensive application example. Finally, industrial challenges and application cases of the method are presented, and the relation to other approaches, such as Balanced Scorecard, is described. The book concludes with supplementary material, such as checklists and guidelines, to support the application of the method.

Who Are the Authors?

The foci of this book were selected based on the comprehensive experience of the authors. The authors have defined and established many organizational measurement programs. They have supported many organizations in aligning goals and strategies and have been involved in a multitude of international industrial improvement programs. The coauthors include the inventors of the GQM$^+$Strategies.

We wish you an interesting reading experience—hoping it will give you insights and support you in using measurement-based alignment to achieve sustainable organizational success.

College Park, MD   Victor Basili
Kaiserslautern, Germany   Adam Trendowicz
Darmstadt, Germany   Martin Kowalczyk
Kaiserslautern, Germany   Jens Heidrich
Baltimore, MD   Carolyn Seaman
Helsinki, Finland   Jürgen Münch
Kaiserslautern, Germany   Dieter Rombach

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ITIL®	Information Technology Infrastructure Library	Office of Government Commerce (OGC)
MS Office®	MS Word®, MS Excel®, and MS PowerPoint®	Microsoft® Corporation
PMBOOK®	Project Management Body of Knowledge Guide	Project Management Institute (PMI)
PRINCE2™	Projects in Controlled Environments 2	Office of Government Commerce (OGC)

GQM$^+$Strategies is registered trademark no. 302008021763 at the German Patent and Trade Mark Office; international registration number IR992843.

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