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SELECTED PAPERS BOOK

A number of selected papers presented at ICSOFT 2011 will be published by Springer-Verlag in a CCIS Series book. This selection will be done by the Conference Co-chairs and Program Chair, among the papers actually presented at the conference, based on a rigorous review by the ICSOFT 2011 Program Committee members.

FOREWORD

This volume contains the proceedings of the Sixth International Conference on Software and Data Technologies - ICSOFT 2011. The conference is sponsored by the Institute for Systems and Technologies of Information, Control and Communication (INSTICC), held in collaboration with the University of Seville and the Escuela Técnica Superior de Ingeniería Informática (ETSII) at the University of Seville, and organized in cooperation with IICREST (Interdisciplinary Institute for Collaboration and Research on Enterprise Systems and Technology), CEPIS (Council of European Professional Informatics Societies), ATI (Asociación de Técnicos de Informática), FIDETIA (Fundación para la Investigación y el Desarollo de las Tecnologías de la Información en Andalucía) and INES (Iniciativa Española de Software y Servicios).

The purpose of ICSOFT is to bring together researchers and practitioners interested in information technology and software development. The conference tracks are "Enterprise Software Technology", "Software Engineering", "Distributed Systems", "Data Management" and "Knowledge-Based Systems".

Software and data technologies are essential for developing any computer information system, encompassing a large number of research topics and applications: from programming issues to the more abstract theoretical aspects of software engineering; from databases and data-warehouses to the most complex management information systems; knowledge-base systems; distributed systems, ubiquity, data quality and many other topics are included in the scope of ICSOFT.

ICSOFT 2011 received 220 paper submissions from 48 countries. To evaluate each submission, a double-blind paper evaluation method was used: each paper was reviewed by at least two internationally known experts from the ICSOFT Program Committee. Only 27 papers were selected to be published and presented as full papers, i.e. completed work (10 pages in proceedings / 30' oral presentation). Additionally, 62 papers were accepted as short papers (6 pages / 20' oral presentation), - for a total of 89 oral presentations – and 33 papers as posters. The full-paper acceptance ratio was thus 12.3%, while the total oral paper acceptance ratio was 40.4%. As in previous editions of the conference, based on the reviewers' evaluations and on the presentations, a short list of authors will be invited to submit extended versions of their papers for a book which will be published by Springer with the best papers of ICSOFT 2011.

ICSOFT's program includes panels to discuss aspects of software development from both theoretical and practical perspectives, with the participation of distinguished world-class researchers and practitioners; furthermore, the program is enriched by several keynote lectures delivered by renowned experts in their areas of knowledge. These high points in the conference program definitely contribute to reinforce the overall quality of the ICSOFT conference, which is already becoming one of the most prestigious yearly events in its area.

The program for this conference required the dedicated effort of many people. Firstly, we must thank the authors, whose research efforts are herewith recorded. Secondly, we thank the members of the Program Committee and the additional reviewers for their diligent and professional reviewing. Next, we would like to personally thank the local organizers for all their hard work to provide smooth logistics and a friendly environment. Last but not least, we thank the invited speakers for their invaluable contribution and for taking the time to synthesize and prepare their talks.

A successful conference involves more than paper presentations; it is also a meeting place, where ideas about new research projects and other ventures are discussed and debated. Therefore, a social event - including dinner - has been arranged for the evening of July 19 (Tuesday) in order to promote this kind of social networking.

We wish you all an exciting conference and an unforgettable stay in the city of Seville. We hope to meet you again next year for the 7th ICSOFT, to be held in Rome, details of which will shortly be made available at http://www.icsoft.org.

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University of Seville, Spain

Boris Shishkov
IICREST, Bulgaria

José Cordeiro
Polytechnic Institute of Setúbal / INSTICC, Portugal

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Abstract: Organizations are currently concerned about the importance of establishing software measurement programs. They do not, however, obtain all the benefit expected from them. This is, in some cases, owing to the lack of alignment between these measurement programs and organizations' business goals. The objective of this paper is to attempt to identify all existing works concerning the alignment of measurement programs and business goals, with the aim of identifying future work lines. This has been done by carrying out a systematic literature review that provides 26 primary studies, found in six digital libraries until January 2010. These studies were classified according to: the technique or techniques used in them, whether they propose a measurement method or also include a list of measures, the existence of support tools, and the validation of the proposal. After analyzing these papers, we discovered that the techniques most frequently used are GQM and BSC, and also that the majority of the papers propose a measurement method and are validated with real experiences.

1 INTRODUCTION

The motivation of this paper is to study the current situation with regard to the alignment of measurement and business goals in software development organizations, with the aim of identifying future research lines in this field. We therefore decided to carry out a systematic literature review (SLR) (Kitchenham and Charters, 2007), which would allow us to identify all the papers published in a systematic and reproducible manner. The SLR-Tool (Fernandez-Saez et al., 2010) was used to support the different stages of the review process.

This paper is structured as follows: Section 2 describes the activities carried out in the planning and execution of the SLR, and also presents the results obtained. Finally, Section 3 presents our conclusions and future work.

2 DESCRIPTION OF SLR

The following sub-sections describe the different steps performed to carry out the SLR, considering the guidelines proposed in (Kitchenham and Charters, 2007).

2.1 Planning the Review

This SLR was developed with the aim of discovering all the relevant information concerning the alignment of measurement programs with business goals. This objective led us to develop a series of questions that we hope answer with the results of this research (see Table 1).

Table 1: Research questions.

Research question
RQ1. Which techniques or methods to align measurement and business goals are used?
RQ2. What are the proposals?
RQ3. Are the proposals validated in any way?
RQ4. Are the proposed techniques supported with a tool?

The searches were made in the following electronic sources: IEEE, ACM, Scopus, Science Direct, Springer Link, and Wiley Interscience.

Other papers were provided by experts (the last two authors of this article). These papers were considered as "grey literature", as is suggested in (Kitchenham and Charters, 2007).

The next step was to identify the search string. This was done by identifying the major terms and their synonyms or related words and combining them using the logic operators "OR" and "AND".

The string obtained is as follows:

(measure or measurement or metric) and (business or organization or company) and (goal or need or requirement or strategy)) and software.

The search was carried out in the title, abstract and keywords, when the sources had this facility. Otherwise, the search was carried out in the full text.

The following inclusion and exclusion criteria were defined in order to facilitate the selection of primary studies:

- Papers can only be written in English or Spanish.
- Papers cannot belong to other research fields such as robotics or systems control.
- Abstracts, conference summaries, or documents that are not accessible are not included.
- Those papers that do not match the search string in the title key words, abstract, or full text, cannot be included as primary studies.

We also defined some guidelines were used to avoid problems concerning the repetition of papers.

In order to answer the research questions identified in Table 1 we have considered four dimensions: technique used, type of proposal, validation method, and existence of a tool.

The values for each dimension are listed below:

- Technique used (a paper may use several techniques):
  - BSC (Balanced Score Card), (Kaplan and Norton, 1996)
  - GQM (Goal, Question, Metric), (Basili et al., 1994), (Basili and Weiss, 1984)
  - AMI (Assess, Analyze, Metricate, Improve), (Pulford and Kuntzmann-Combelles, 1996)
  - KPI (Key Performance Indicators), (Parmenter, 2007)
  - Cobit (Control Objectives for Information and related Technology), (Information Systems Audit and Control Association 2007)
  - CMM (Capability Maturity Model) (Paulk et al., 1995)
  - GDM (Goal Driven Measurement), (Park, 1996)
  - No determined technique
- Type of proposal: measurement method, list of metrics and related goals.
- Validation method: only proposal, example, and real experience.
- Existence of a tool: Yes, No.

2.2 Execution of the SLR

This systematic literature review was carried out until January 2010. Table 2 shows statistics concerning those papers that were found and accepted through the different steps of the review execution.

The primary studies obtained have been organized by the search source in which they were found. The full list of papers is presented in Appendix 1. There is also included a short view of the classification.

Table 2: Distribution of papers per source.

Source	Found	Repeated	Ex. 1st	Ex. 2nd	Total
Grey literature	7	4	0	0	3
SCOPUS	95	21	70	4	0
ACM	8	0	8	0	0
IEEE Computer	98	1	56	25	16
Science Direct	69	0	36	28	5
SpringerLink	6	0	3	2	1
Wiley InterScience	69	0	67	1	1
Total	352	26	240	60	26

2.3 Results Obtained

The results are structured on the basis of the research questions stated above. The data extracted from the papers reviewed was analyzed both quantitatively and qualitatively to answer the research questions.

2.3.1 RQ1. Techniques Used

The first research question consisted of identifying which existent techniques are used or adapted to relate both fields. We also wished to identify any new technique or method.

We found that most of the papers use or adapt BSC, GQM or both together. This is because BSC is a tool with which to identify business goals that is very well known in business management, and GQM allows software measurement to be planned and implemented. The alignment of software measurement and business goals can thus be achieved by combining these two techniques.

In "No determined technique" we have included those primary studies that do not use an existing technique and do not propose a new one, but nevertheless provide guidelines to define a new measurement program or to define business goals.

The most valuable proposal for us is GQM+ [EP-1, EP-2 and EP-3]. This is an adaptation of

GMQ designed to take into account business goals. However, from our point of view this technique is not yet complete, since it is centered on the passage from business goals to measurement goals but does not explain issues such as measurement execution and the presentation of results.

2.3.2 RQ2. Type of Proposal

The next step was to discover what they proposed. In this case, we distinguished between papers that centered on explaining a measurement process (16 studies, 62%), and those that are centered on the measures instead of the process or proposed a predefined list of goals and their related measures (10 studies, 38%).

2.3.3 RQ3. Validation Method

The number of primary studies that present case studies is greater than those that present imaginary examples, and practically double the number of simple proposals.

2.3.4 RQ4. Existing Tools

The last research question made reference to the existence of support tools for the techniques mentioned in the primary studies. There is only a 15% of studies (4 studies) that mention a support tool.

2.3.5 Other Results

This review has allowed us to obtain other conclusions, and is not limited solely to the knowledge provided by the primary studies. An example is the maturity of the research filed according to the kind of publications found. The percentage of papers published in conferences is greater than the number of papers published in journals (50% of conference papers, 42% of journal papers), and only 8% are presented in workshops. We did not find any other kinds of document, such as books or book sections.

3 CONCLUSIONS AND FUTURE WORK

This paper presents an analysis of the state of the art in the alignment of measurement programs and business goals that was obtained by carrying out an SLR. Between October 2009 and January 2010 we carried out a systematic literature review, obtaining 26 primary studies. These papers were classified according to four different dimensions. In the first we considered the techniques used to carry out the measurement. Most of the studies used GQM, BSC or a mixture of both. With regard to the second dimension (the kind of proposal presented in the study) it was observed that 62% of the studies presented a measurement method, in comparison to 32% of metric-centered studies. With regard to the validation of proposes, 58% were supported by real cases. Finally, only 15% of the methods mentioned have a support tool. We have reached the conclusion that this research is extremely important to companies, there being a high percentage (58%) that presented case studies and real experiences.

Moreover, the technique that best aligns the measurement with business goals is GQM +, proposed in studies [EP-1, EP-2 and EP-3]. However, other papers also suggest interesting aspects to consider. One possible line for future work might therefore be to attempt to unify all the proposals into a single technique for measuring programs aligned with business goals. Having defined this new technique, the following step would be the development of a tool to support it.

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APPENDIX

1. List and Classification of primary studies

Table 3 shows the classification of each primary study, with a brief comment on each proposal. Classification column is codified as follow: Techniques; Propose (M=Method, L=List); Validation (P=Proposal, E=Example, R = Real experience); Tool (Y=yes, N=no).

Table 3: Classification of the primary studies.

Id	Reference	Classif.	Comments
EP 1	Basili, V., Heidrich, J., Lindvall, M., Munch, J., Regardie, M., Trendowicz, A.: Brinding the Gap Between Business Strategy and Software Development. International Conference on Information Systems (2007)	GQM; M; E; N	Very detailed example of a new method called GQM+
EP 2	Basili, V., Heidrich, J., Lindvall, M., Munch, J., Regardie, M., Trendowicz, A.: Determining the Impact of Business Strategies Using Principles from Goal-Oriented Measurement. Wirtschaftsinformatik (2009)	GQM; M; E; N	Detailed description of GQM+. This is a method for defining measurement programs taking into account business goals.
EP 3	Barthel, H., Heidrich, J., Munch, J., Trendowicz, A.: GQM+ Strategies: Experiences from Industrial Case Studies and Visualization Needs. International Software Engineering Research Network (2009)	GQM; M; R; Y	Real application of GQM+ and description of its support tool.
EP 4	Xiaodong Guo, Li Meng: Organization Application Oriented Software Process Measurement Model. International Symposium on Computer Science and Computational Technology (2008)	GDM; M; P; N	Integrated measurement process model and application algorithm.
EP 5	Kulic, P.: A Practical Approach to Software Metrics. IT Pro Software Development, Volume 2 (1), pp. 38-42 (2000)	None; L; P; N	List the steps needed to define a good measurement program. It doesn't explain how to link business goals and measures.
EP 6	Patton, J.: Ambiguous Business Value Harms Software Products. IEEE Software. Volume 25 (1), pp. 50-51 (2008)	None; M; P; N	Gives some guidelines for identify measures from business goals.
EP 7	Becker, S. A., Bostelman, M. L.: Aligning Strategic and Project Measurement Systems. IEEE Software, Volume 16 (3), pp. 46-51 (1999)	BSC, GQM; M; R; N	Applies GQM, but separating goals depending on the perspective of BSC they belong.
EP 8	Offen, R., J.; Jeffery, R.: Establishing Software Measurement Programs. IEEE Software, Volume 14 (2), pp. 45-53 (1997)	GQM; M; R; N	Uses the definition of business goals by expert meetings, and after defines GQM measurement goals.
EP 9	Vardangalos, G; Pantelis, A.: A Performance System Based on the Balanced Scorecard Approach for Measuring Performance in a Business Environment. International Symposium on Computers and Communications (2000)	BSC, QGM, KPI; M; P; Y	Combines BSC, KPI and PSM, but the paper doesn't specify how to change from one to another.
EP 10	Van Grembergen, W.: Aligning Business and Information Technology through the Balanced Scorecard at a Major Canadian Financial Group: its Status Measured with an IT BSC Maturity Model. Hawaii International Conference on System Sciences (2001)	BSC; L; R; N	Adaptation of BSC for IT. Each perspective is translated into predefined measures. It can be breaking down in levels, and it also includes maturity levels.
EP 11	Briand, L. C., Morasca, S., Basili, V. R.: An Operational Process for Goal-Driven Definition of Measures. IEEE Transactions on Software Engineering, Volume 28 (12), pp. 1106-1125 (2002)	GQM; M; R; N	The pass from business goals to measurement goals is done thanks to the knowledge of company experts
EP 12	Ki-won Song, Soo-Hwan Lee, Young-Gyun Jang, Il-Seok Suh, Jin-Soo Kim: Framework for Quantitative S/W Development Performance Measurement and Analysis in Semiconductor Industry. International Conference on Convergence and Hybrid Information Technology (2008)	GQM, KPI; L; R; N	List of measures.
EP 13	Yan Xu, Chung-Hsing Yeh: Evaluating Critical Strategies for Enterprise Resource Planning Systems Implementation. International Symposium on Electronic Commerce and Security (2009)	BSC; L; R; N	Proposes a list of goals and strategies and an algorithm to calculate the aggregated value.
EP 14	Jahankhani, H., Ekeigwe, J.: Adaptation of the balanced scorecard model to the IT functions. International Conference on Information Technology and Applications (2005)	BSC; M; P; N	Explain how to apply BSC to IT. It does not explicitly how to align business goals and measurement.

Table 3: Classification of the primary studies (cont.).

EP 15	Van Grembergen, W., Amelinckx, I.: Measuring and Managing E-business Projects through the Balanced Scorecard. Hawaii International Conference on System Sciences (2002)	BSC; L; P; N	Proposes a generic BSC for e-business. It includes the list of metrics that results of the application of the technique.
EP 16	List, B., Bruckner, R., Kapaun, J.: Holistic Software Process Performance Measurement From the Stakeholders' Perspective. International Workshop on Database and expert Systems Applications (2005)	KPI; L; R; N	Framework for defining measures for process measurement that considers the perspective of each stakeholder.
EP 17	Oinas, A.: Defining Goal-driven Fault Management Metrics in a Real World Environment: A Case-Study from Nokia. Conference on Software Maintenance and Reengineering (2000)	GQM, AMI; M; R; N	Application of a combination of GQM and AMI at Nokia.
EP 18	Kopanas, V., Sylaidis, V., Nanakis, I.: GQM-based Improvement of Embedded, Real-time Software Development Practices. International Workshop on Software Technology and Engineering Practice (1997)	GQM, AMI; M; R; N	Application of a combination of GQM and AMI at a company.
EP 19	Van Grembergen, W., De Haes, S., Van Brempt, H.: Prioritising and Linking Business and IT Goals in the Financial Sector. Hawaii International Conference on System Sciences (2007)	Cobit; L; P; N	Proposes a guide with a cascade of business goals, IT goals and IT processes, based on Cobit.
EP 20	Martinsons, M., Davison, R., Tse, D.: The balanced scorecard: a foundation for the strategic management of information systems. Decision Support Systems, Volume 25, pp. 71-88(1999)	BSC; L; R; N	Framework for the evaluation of IT and IS base don BSC.
EP 21	Roche, J., Jackson, M.: Software measurement methods: recipes for success? Information and Software Technology Volume 36 (3), pp. 173-189 (1994)	None; M; P; N	Review of several measurement methods.
EP 22	Aversano, L., Bodhuin, T., Canfora, G., Tortorella, M.: Technology-driven business evolution. Journal of Systems and Software, Volume 79, pp. 314-338 (2006)	BSC, GQM; L; R; Y	In the measurement section it applies GQM using goals identified with BSC.
EP 23	Trienekens, J., Kusters, R., Rendering, B., Stokla, K.: Business-oriented process improvement: practices and experiences at Thales Naval The Netherlands (TNNL). Information and Software Technology, Volume 45, pp. 67-79 (2005)	GQM; M; R; Y	Proposes a framework for process improvement, where a very important part is the alignment of business goals.
EP 24	Lawrence Pfleeger, S.: Maturity, Models, and Goals: How to Build a Metrics Plan. Journal of Systems and Software, Volume 31, pp- 143-155 (1995)	GQM; M; R; N	Presents an example of how to apply GQM taking into account business goals.
EP 25	Kuntzmann-Combelles, A.: Quantitative Approach to Software Process Improvement. Symposium on Software Quality Techniques and Acquisition Criteria on Software Quality Techniques and Acquisition Criteria (1995)	AMI, CMM; M; R; N	Describes AMI and how it has been applied together with CMM in an industrial environment.
EP 26	Savioja, E., Tukiainen, M.: Measurement Practices in Financial Software Industry. Software Process Improvement and Practice, Volume 12 (6), pp. 585-595 (2007)	BSC; L; R; N	Example of how to apply a measurement program. It shows the obtained measures.