

# Ansökan

KK-stiftelsens utlysning HÖG 2005

## Diarieinformation

**Diarienummer**

2005/0218

**Avsänd av sökande**

2005-09-05

**Diarieförd**

2005-09-05

**Utlysning**

HÖG 2005

## 1. Applicant

**Surname \***

Löwe

**Forename(s) \***

Welf

**Academic degree \***

Professor

**Position held \***Professor in Computer Science,  
Head of Applied Research in System Analysis  
group**Sex \***

Male

**Tel. No. \***

+46 470 708495

**Fax \***

+46 470 84004

**Mobile Tel. No. \***

+46 768820916

**E-mail \***

Welf.Lowe@msi.vxu.se

**Host higher education institution  
(HEI) \***

Växjö universitet

**Department \***

MSI

**Company Reg. No. \***

202100-3187

**P.O. Box**

Vejdes plats 6-7

**Postcode \***

351 95

**Town/City \***

Växjö

**Website \***<http://www.msi.vxu.se/~wlo>

## 2. Project supervisor

<b>Surname *</b>	<b>Forename(s) *</b>
<input type="text" value="Löwe"/>	<input type="text" value="Welf"/>
<b>Academic degree *</b>	<b>Position held *</b>
<input type="text" value="Professor"/>	<input type="text" value="Professor in Computer Science,&lt;br/&gt;Head of Applied Research in System Analysis&lt;br/&gt;group"/>
<b>Sex *</b>	
<input type="text" value="Male"/>	
<b>Tel. No. *</b>	<b>Fax *</b>
<input type="text" value="+46 470 708495"/>	<input type="text" value="+46 470 84004"/>
<b>Mobile Tel. No. *</b>	<b>E-mail *</b>
<input type="text" value="+46 768820916"/>	<input type="text" value="Welf.Lowe@msi.vxu.se"/>
<b>Host higher education institution (HEI) *</b>	<b>Department *</b>
<input type="text" value="Växjö universitet"/>	<input type="text" value="MSI"/>
<b>Company Reg. No. *</b>	<b>P.O. Box</b>
<input type="text" value="202100-3187"/>	<input type="text" value="Vejdes plats 6-7"/>
<b>Postcode *</b>	<b>Town/City *</b>
<input type="text" value="351 95"/>	<input type="text" value="Växjö"/>
<b>Website *</b>	
<input type="text" value="http://www.msi.vxu.se/~wlo"/>	

## 3. Basic information

### 3.1 Project Title in Swedish and English

**Swedish title (max. 125 characters per title) \***

**English title (max. 125 characters per title) \***

### 3.2 Project dates: start and end dates for proposed project

**Start date (yyyy-mm-dd) \***

**End date (yyyy-mm-dd) \***

### 3.3 Abstract

**Outline of common goals and approaches of the project for the research group and companies involved, and expected results (max. 650 characters) \***

software measurement (metrics). The research goal is the validation of this method in industry projects. The goal for the partner companies is an improved quality management.

In selected development projects, partner companies assess quality characteristics suggested in ISO/IEC 9126 using automated and manual means. We try to validate statistically the significance of the automated approach.

The expected result is a service assessing industrially standardized software qualities in an effective (since significant) and efficient (since automated) way.

### 3.4 Parties' commitments in the project, excluding financial contributions

#### HEIs' commitments (max. 350 characters) \*

The Applied Research in System Analysis (ARiSA) group at Växjö University is responsible for the definition of a Quality Model and its implementation in a measurement tool. ARiSA defines data required for validation and performs the statistical evaluations. ARiSA is responsible for feedback seminars with the partners and for research publications.

#### Companies' commitments (max. 350 characters) \*

The industrial partners are responsible for selecting a software development project each and for performing both automated and manual measurement of quality attributes in the software under development. Moreover, they are responsible for documenting the development process and propagating quality data to ARiSA in defined intervals.

#### Commitments of other HEIs (max. 350 characters) \*

We use metrics collected / defined at FZI Karlsruhe and Cottbus University. For the experimental validation, we re-apply the scientific methods already used in our collaboration with the Systems and Software Engineering group at BTH. Although these groups are not directly involved, we will discuss our approach with them and consider their advices.

### 3.5 Connections with other projects currently or previously funded by the Knowledge Foundation

**Is your project connected in any way with other projects currently or previously funded by the Knowledge Foundation? \***

No

**If so, please provide the Knowledge Foundation's reference number(s) for the original project (s), project title(s), names of participating companies and planned start and end dates.**

Project reference number	Project title	Start year	Final year	Participating companies
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## 4. Funding

### 4.1 Grant applied from the Knowledge Foundation

Year 1 *	Year 2	Year 3	Total
579	577	579	1.735

## 4.2 Project grants from companies

Name of company	Year 1	Year 2	Year 3	Total
AerotechTelub	150	150	150	450
Alstom Power Sweden	163	162	163	488
Artisan Global Media	201	200	201	602
Windh	65	65	65	195

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<b>Summa</b>	<b>579</b>	<b>577</b>	<b>579</b>	<b>1.735</b>
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## 4.3 Funding from the host HEI

Year 1	Year 2	Year 3	Total
93	87	98	278

### Itemised HEI funding (as proportions of research positions) (max. 350 characters)

Växjö University covers half of the costs for Professor Welf Löwe's contribution to research and dissemination (7,5%).

## 4.4 Any other funding

Have you made or do you intend to make a similar application to another funder? \*

No

If so, please provide details:

Project title	Source of funding	Amount	Expected decision date
---------------	-------------------	--------	------------------------

Other funds granted that supplement the proposed project \*

Not applicable

If applicable, please provide details:

Project title	Source of funding	Amount	Decision date
---------------	-------------------	--------	---------------

## 4.5 Financial and/or personal links

Are there any financial and/or personal links among the companies involved in the project (For example, between a company and the host HEI and/or between a company and an individual researcher)? \*

Yes

If so, specify shareholdings, directorships or employment/consulting positions held and intellectual property rights (IPR) agreements signed, regardless of scope. (max. 700 characters)

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VizzAnalyzer and Vizz3D, the tools for performing the automated software measurements and visualizing their results, are copyright protected by their developers. Free licenses are granted for each industrial software development project investigated in the proposed research project.

## 5. Project proposal

### **Project objective (max. 700 characters) \***

The objective is a standard- and metrics-based assessment of internal software qualities with validated significance. From the ISO/IEC 9126 standard, we select the characteristics: (re-)usability, efficiency, maintainability, and portability and their sub-characteristics.

We define a Quality Model numerically connecting the above quality characteristics to software metrics established in the research community. (These metrics themselves are already implemented in the VizzAnalyzer tool for software measurement.)

By comparing automatically measured and manually documented quality assessments statistically in selected software development projects, we validate the Quality Model.

### **Measurable targets for the project period covered by the application (max. 700 characters) \***

The Quality Model will be formally defined and documented in a compendium of software quality standards and metrics, [www.arisa.se/compendium/](http://www.arisa.se/compendium/).

Four industrial software development projects will be assessed both with automatic quality measurement and manual quality assessment (over 1-2 years). Both kinds of assessments will be documented.

Significance of the automatic quality measurement will be verified or falsified statistically.

Results of research and industrial relevance will be published at conferences, in a journal, online, and on a public quality workshop. If the project is successful, a consultancy service will provide tools, methods and experiences of automated quality assessment.

### **Other expected outcomes of the project (max. 700 characters) \***

Current standard approaches to quality management are manual and, hence, error-prone, time consuming, and can cause tensions in organizations. Automatic approaches are objective and more efficient but not accepted in industry since not proved applicable and significant. By validating automated quality assessment as practicable and significant, the project contributes to an improved quality management in software developing companies.

This is expected to have positive effects on software quality as such, especially in projects with outsourced or open source software components. Higher software quality leads to higher usability, security, and safety of products and services based on software.

### **Description of the scientific approach to the problem addressed (max. 700 characters) \***

We construct a Quality Model (QM), which numerically connects standard quality characteristics to software metrics.

For validating the significance of QM for assessing quality, we apply the Goal-Question-Metric

approach refining a goal into questions and sub-questions, which are then directly assessed by metrics. The goal is the validation of the QM, questions and sub-questions are derived from characteristics and sub-characteristics of the ISO/IEC 9126 standard, and metrics are both automatic quality metrics and manually derived quality assessments. Answers to the questions are derived from statistical correlations of automatic metrics and manual assessments.

**How will the project affect and interact with the host HEI's undergraduate and Master's degree programmes? (max. 700 characters) \***

Give an account of the course programmes, their levels, the degrees awarded and the numbers of students.

There are two D-level courses given by the applicant which the project will directly affect: Advanced Program Analyses (APA) and Software from Components (SoC).

APA introduces automated quality analyses and assigns an analysis of an open source project to the students. It is based on the VizzAnalyzer tool and well-known metrics, but not on industrial standards so far. This will change since the project will provide such a connection.

SoC discusses composition technologies and discusses issues regarding the system functionality in the first place. A successful project would allow including a lecture dealing with non-functional aspects like qualities when integrating third party components.

**Research in the field (max. 1400 characters) \***

Current research in the project field, in Sweden and other countries

Quality Models have existed for quite a while, e.g. the Factor-Criteria-Metric [1] model and the Goal-Question-Metric model [2]. However, their implementations, e.g. ISO/IEC 9126, fail in integrating easily assessable metrics.

There exists a rich body of metrics and tools for automated measurement [3]. Significance of individual metrics is mainly supported by intuition or case studies; few are validated in experiments. A mapping to a generally accepted Quality Model is lacking. However, the Guide to the Software Engineering Body of Knowledge emphasizes that measurement is a foundation for software engineering, especially for quality management [4].

With the success and size of open source projects and the availability of databases of source codes, design documents, and process data for researchers, 'multi-version program analysis' has emerged [5,6]. It allows investigating the quality of development projects over time, as opposed to the once-in-time analyses of Quality Models and metrics an approach that we will exploit as well.

Still experimentation is underrepresented in Computer Science: surveys show that 30-40% of scientific papers do not include experimentation and they need it [7,8]. A good overview of theories, methods and tools for quantitative/statistical evaluation of experiments in software engineering is given in [9].

**Publications or websites (max. 10) that provide an overview of the research field and report on frontline international research (max. 900 characters) \***

1. McCall, Richards, Walter. Factors in Software Quality, Tech. Rep. NTIS AD/A-049 014,015,055, US Rome Air Development Center, '77
2. Basili, Rombach. The TAME project: Towards improvement-oriented software environments. IEEE Trans. Software Engineering 14(6), '88

3. Bär et al. The FAMOOS Object-Oriented Reengineering Handbook, <http://www.iam.unibe.ch/~famoos/handbook>, '99
4. SWEBOOK. IEEE Computer Society, [www.swebok.org](http://www.swebok.org), '05
5. Int. Workshops on Mining Software Repositories, '04, '05
6. Dagstuhl Workshop on Multi-Version Program Analysis, 05.
7. Tichy, L. Prechelt, Heinz. Experimental Evaluation in Computer Science: A Quantitative Study, Journal of Systems and Software, 28(1), '95
8. Zelkowitz, Wallace. Experimental Validation in Software Engineering. Information & Software Technology 39(11), '97
9. Wohlin et al. Experimentation in software engineering - An Introduction, Kluwer. '00

**Collaboration with other research groups that is essential to the completion of the project (max. 700 characters) \***

Specify the HEI, department, research supervisor, research field, etc.

Software metrics:

- Bauer\*\*\*, FZI Karlsruhe, Program Structures
- Lewerentz\*\*, University Cottbus, Software Engineering.

Experiments in Software Engineering:

- Kuzniarz, Mattsson\*\*, Systems and Software Engineering, BTH

Meta-programming & Compiler Construction to extract basic information from software:

- Assmann\*, TU Dresden, Software Tech
- Kessler\*\*, Fritzson, Linköping University
- Goos\*\*\*, TU Karlsruhe, IPD

Software analyses, Multi-version analyses and Software visualization:

- Diehl\*\*, KU Eichstätt, Informatik
- Zimmermann\*\*, University Halle, Software Tech.

\* Mutual research visits and talks.

\*\* Common research block courses (1-2 weeks).

\*\*\* Common research projects (applications).

**Strategic collaboration (max. 700 characters) \***

Describe future strategic collaboration with other HEIs and research institutes, and its potential interaction with the project.

The applicant is observer of the IFIP working group 2.4 on compilation / software analysis bringing together researchers in these fields from all over the world.

Further collaboration platforms are the National Graduate School in Computer Science (CUGS) and the KK-foundation's IT-improvement program with 2 respectively 3 of our PhD students involved.

There is an exchange with the other software engineering groups in Sweden due to the annual SERPS conference and with other research groups due to international conferences.

**Collaboration with companies (max. 700 characters) \***

Describe in brief any collaboration with companies to date and any contracts or agreements signed

by the parties (company, host HEI, individual researcher) including, in particular, any contracts or agreements among the parties relating to the research field.

The Web Services Competence Center is a Network of Excellence with about 50 industrial and administrative partners that jointly work with research, education and knowledge transfer to leverage Web Services. The applicant is one of three initiators. Among others we are organizing an annual conference: the IEEE European Conference on Web Services.

The Center for Information Exchange and System Collaboration is a research initiative of the applicant and a number of external parties, together representing several hundred private and public organizations. Our vision is multidisciplinary research enabling and supporting the efficient collaboration of both organizations and technical systems.

### **Publications (max. 1400 characters) \***

The research group (including company participants) applying for funds should list up to 10 selected publications or copublications that substantiate the group's proficiency for the proposed project.

1. Löwe, Ericsson, Lundberg, Panas, and Pettersson. VizzAnalyzer - A Software Comprehension Framework. 3rd Conference on Software Engineering Research and Practise in Sweden, 2003
2. Panas. Towards a Generic Architecture for Reverse Engineering. Licentiate Thesis, Växjö Sweden, 2003
3. Heuzeroth, Löwe. Generating Structure and Behavior Visualizations of Systems to Understand their Architecture. Chapter 9 in book: Software-Visualization - From Theory to Practice, Kluwer, 2003
4. Löwe. VizzAnalyzer - A Reverse Engineering Framework. In workshop proceedings: 11th IEEE Working Conf. on Reverse Engineering, 2004
5. Panas, Lincke, Lundberg, Löwe. A Qualitative Evaluation of a Software Development and Re-Engineering Project, 29th IEEE/NASA Software Engineering Workshop, 2005
6. Panas, Lincke, Löwe. Online-Configuration of Software Visualizations with Vizz3D, ACM Software Visualization, 2005
7. Panas, Staron. Evaluation of a Framework for Reverse Engineering Tool Construction. IEEE Int. Conf. on Software Maintenance, 2005
8. Löwe, Panas. Rapid Construction of Software Comprehension Tools, Int Journal of Software Engineering and Knowledge Engineering. Special Issue on Maturing the Practice of Software Artifacts Comprehension (accepted), 2005
9. Lincke, Löwe. Compendium of Software Quality Standards and Metrics. [www.arisa.se/compendium/](http://www.arisa.se/compendium/), 2005

## **6. Project staff (researchers)**

### **6.1 Project supervisor**

% \* 1)

10

### **6.2 Person responsible for communication**

**Surname and**

**Department \***

**Academic degree \***

**forename(s) \***

Löwe, Welf	MSI	Professor
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**E-mail \***

Welf.Lowe@msi.vxu.se

**Position held \***

Professor

**% \* 1)**

5

## 6.3 Researchers

### Researchers and other project participants

**Surname and****forename(s) \*****Department \*****Academic degree \* Position held \*****% \* 1)**

Lincke, Rüdiger	MSI	MSc	PhD Student	80
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1) Full-time or part-time (percentage of full position)

## 7. Project staff (companies)

### 7.1 Staff members

**Surname and****forename(s) \*****Employer \*****Academic degree \* Position held \*****% \* 1)**

Karlsson, Kjell	AerotechTelub	Civilingenjör	Kvalitetskonsult	1
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Ranstad, Per	Alstom Power Sweden	Tech.Lic	RD Manager	1
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Strömberg, Sören	Artisan Global Media		CEO	1
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Eifrem, Emil	Windh	MSc	CTO	6
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1) Full-time or part-time (percentage of full position)

## 8. Annexes

**Project plan \***
[ProjectPlan.pdf](#)
**Project budget \***
[ProjectBudget.pdf](#)
**Communication plan \***
[CommunicationPlan.pdf](#)
**CVs (researchers and other project participants) \***
[CVresearcherParticipant\\_1.pdf](#)
[CVresearcherParticipant\\_2.pdf](#)

**CVs (company participants) \***[CVcompanyParticipants\\_1.pdf](#)[CVcompanyParticipants\\_2.pdf](#)[CVcompanyParticipants\\_3.pdf](#)[CVcompanyParticipants\\_4.pdf](#)**Company commitments \***[CompanyCommitments\\_1.pdf](#)[CompanyCommitments\\_2.pdf](#)[CompanyCommitments\\_3.pdf](#)[CompanyCommitments\\_4.pdf](#)[CompanyCommitments\\_5.pdf](#)**Signatures \***[Signatures.pdf](#)**Official covering letter \***[OfficialCoveringLetter.pdf](#)

## Insänt av

**Förnamn**

Welf

**Efternamn**

Löwe

**E-postadress**[Welf.Lowe@msi.vxu.se](mailto:Welf.Lowe@msi.vxu.se)**Universitet/Högskola/Institut/Företag etc**

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**Webbplats**

<http://www.msi.vxu.se/~wlo>

# Curriculum Vitae

Welf Löwe

## Academic Degrees

- Ph.D. in Computer Science, Summa cum laude, University of Karlsruhe (TH), Germany, 05/1996.
- M.Sc. in Computer Science, Technical University of Dresden, Germany, 04/1992.

## Employment

- Research Assistant, Computer Architecture and Parallel Computing Group, Technical University of Dresden, 04/1992 – 03/1993.
- Doctoral Student, Graduate School "Complex Systems", University of Karlsruhe (TH), 04/1993 – 05/1996.
- Post-Doctoral Researcher, Program Structures and Innovative Computing Group, University of Karlsruhe (TH), 06/1996 – 10/1999. In between:
  - Post-Doctoral Researcher, International Computer Science Institute (ICSI), Berkeley, USA, 06/1997 – 9/1997.
  - Guest Lecturer, Technical University Budapest, Hungary, 09/1998 – 10/1998 and 09/1999 – 10/1999.
- Assistant Professor (C1), Program Structures and Innovative Computing Group, University of Karlsruhe (TH), 10/1999 – 01/2002.
- **Professor in Computer Science**, Head of Software Technology Group, Växjö University, School of Mathematics and System Engineering **since 02/2002**.

## Fellowships and Awards

- Graduate School Fellowship, Karlsruhe, 1993.
- International Computer Science Institute Fellowship Award, Berkeley, 1997.
- Fellowship from "Tore Danielsson" research fond of Växjö University, Växjö 2004.
- Fellowship from "Teknikcentrum Kronoberg" foundation, Växjö 2004.

## **Granted Projects**

- Virtual University Karlsruhe (ViKar), Country of Baden-Württemberg:  
2 Ph.D. Students (part time), 1998 – 2002.
- Industrial project, Daimler-Chrysler AG:  
5 Ph.D. Students (part time), 2000 – 2002.
- Industrial project, MOST Cooperation:  
1 Ph.D. Student, 5 Ph.D. Students (part time), 2000 – 2002.
- Component Analysis and Transformation Engine (CATE), German Research Society (DFG): 2 Ph.D. Students, since 2002.
- Specification of Services and Components (SoSaC), Vinnova:  
2 Ph.D. Students, since 2002.
- Adaptive GRID Architecture, Vinnova:  
2 Ph.D. Students, since 2003.

## **Programm Committees of Conferences and Workshops**

- ETAPS – Software Composition Workshop (SC) 2002 – 2005.
- ECOOP – Composition Languages Workshop (WCL) 2003.
- Int. Workshop on Program Comprehension (IWPC) 2004.
- ICSE – Workshop on Dynamic Analysis (WODA) 2004, 2005.
- European Conference on Web Services (ECOWS) 2004.

## **General Chair of Conferences and Workshops**

- Nordic Conference on Web Services (NCWS) 2003, 2004.
- IEEE European Conference on Web Services (ECOWS) 2005.
- ETAPS – Software Composition (SC) 2006.

## **Organizations**

Co-founder and Scientific Coordinator of the Web Services Competence Center (WSCC, <http://wscc.info>). Co-initiator of the NCWS conference series.

## **Thesis Supervision**

Since 2002, I have been supervising 8 Ph.D. Students (theses in progress). Meanwhile, 4 Ph.D. Students have successfully defended their Licentiate theses.

# Curriculum Vitae

of

Rüdiger Lincke

## PERSONAL INFORMATION

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Date of Birth: 18th of April 1978 in Nürnberg  
Marital status: unmarried  
Nationality: German  
Personal number: 780418-0979

## EDUCATION (GERMANY)

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1984 – 1988 Volksschule Nürnberg, Röthenbacher Hauptstraße 74  
1988 – 1991 Hauptschule Nürnberg, Herriedener Straße 29  
1991 – 1995 Staatliche Realschule Nbg., Pommernstraße 10  
**Mittlere Reife Juni 1995**  
1995 – 1997 Städtische Fachoberschule Nbg., Rollnerstraße 17  
**Fachhochschulreife Juni 1997**

## MILITARY SERVICE

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1997 – 1998 Basic service at the Air Force, Patriot Missile Air Defense System; Group leader

## UNIVERSITY EDUCATION (GERMANY/SWEDEN)

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10/1998 – 07/2001 Study of Computer Science, Georg-Simon-Ohm Fachhochschule Nürnberg (Germany), Kesslerplatz 12, Department of Computer Science  
**Vordiplom April 2000**  
09/2001 – 07/2003 Study of Computer Science (Datalogi), Växjö University (Sweden), School of Mathematics & Systems Engineering (MSI), Department of Computer Science  
**Master of Science in Computer Science October 2003; Refactoring of a Software Visualization Tool/VizzAnalyzer**  
09/2003 – 04/2005 Study of Computer Science at PhD level, Växjö University, MSI, Department of Computer Science  
04/2004 – 06/2004 Study of Software Quality and Metrics, BTU Cottbus (Germany), Department of Computer Science, Software Systems Engineering Research Group  
since 05/2005 PhD student, Software Quality, Växjö University, MSI, Department of Computer Science

## INTERNSHIPS

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09/1999 – 01/2000 IBM Deutschland Entwicklung GmbH, Entwicklungslabor Böblingen;  
Department: Enterprise Solution Development; Integration of License Management into Content Management solution  
03/2001 – 07/2001 Department: SWSD CM Archive Solutions; Development of Client Software for a Content Management solution  
07/2004 Department: SS&S WebSphere Banking Solutions Development; Performance and Proof of Concept study (Cost reduction through externalized parsing)

## PROFESSIONAL EXPERIENCE

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10/00 – 02/01 Software Developer, Datev eG (Germany); Development of Net and System Management tools  
10/03 – 04/05 Research and teaching assistant at Växjö University, Department of Computer Science; emphasis on Software Analysis, Quality, Metrics and Visualization

## EDP-KNOWLEDGE

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Object-oriented Software Development with corresponding techniques, tools and programming and script languages, diverse API, UML, C/C++/MFC, Visual Basic, VBA, VBScript, Java, Swing, Java 3D, OpenGL, different software development and reverse engineering tools, in particular Rational Rose, Relational Database Management Systems, SQL; Software Analysis techniques, Visualization, Quality and Metrics, Compiler construction, Programming Language Theory

## LANGUAGES

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Mother tongue German, good spoken and written English, Swedish (SAS grund)

## **PUBLICATIONS**

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Thomas Panas, Rüdiger Lincke, Welf Löwe. A qualitative evaluation of a software development and reengineering project. SEW-29, the 29<sup>th</sup> Annual NASA/IEEE Software Engineering Workshop. Washington DC, USA, April 2005.

Thomas Panas, Rüdiger Lincke, Welf Löwe. Online-Configuration of Software Visualizations with Vizz3D. SoftVis05, the 2<sup>nd</sup> ACM Symposium on Software Visualization. St. Louis, USA, May 2005.

## ANNEX – Signatures

(Submitted in the form of a scanned annex)

### 1. Project title

Validation of Metrics-Based Quality Control

### 2. Applicant (The applicant must approve and sign the application)

Surname, Forename(s) for Applicant

Löwe, Welf

E-mail

Welf.Lowe@msi.vxu.se

Telephone number

+46 (470) 70 8495

### 2.1 Signature

Date

2005-08-26

Signature



Clarification of Signature

Welf Löwe

### 3. Host higher education institution (HEI)

Surname, Forename(s) - Vice-Chancellor/Principal

Sterte, Johan

E-mail

Johan.Sterte@adm.vxu.se

Telephone number

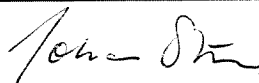
+46 (470) 70 8000

### 3.1 Signature

Date

2005-08-31

Signature



Clarification of Signature

Johan Sterte

KK-stiftelsen  
Box 3222  
103 64 Stockholm

COVERING LETTER  
2005-08-31  
Dnr 362/2005-22

### Application for project grants - HÖG 2005

Växjö University hereby approves the applications to the Knowledge Foundation for project grants – HÖG 2005 as listed below (without priority order):

1. Thermal/moisture-related elasto-plastic behaviour of curved veneered and solid wood products during hot-press forming. Applicant: Dick Sandberg
2. Development of a new production system and new products for improved competitiveness within the mechanical hardwood industry. Applicant: Dick Sandberg
3. Oil heat-treated wood for furniture, flooring and panelling. Applicant: Thomas Thörnqvist
4. Nondestructive testing of wood with applications in forestry. Applicant: Sven Nordebo
5. Heavy Vehicles – Ride Comfort Optimization. Applicant: Torbjörn Ekevid
6. Fault Localization in Power Networks. Applicant: Sven Nordebo
7. Validation of Metrics-Based Quality Control. Applicant: Welf Löwe

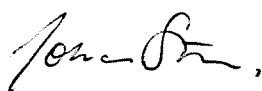
During the last year the Faculty for Mathematics, Natural sciences and Technology has initiated and accomplished a process to further stimulate and incite the profiling of the faculty's research areas. This process was finalised through the acceptance and decision of the University Board in June 2005. During this process two strategic research areas were pointed out, based on the potential development of already established research areas. A substantial part of the internal faculty allowance will be allocated towards those two research areas, starting in January 2006. The two areas are: "Wood and Energy Technology" and "Mathematical Modelling and System Collaboration".

The research area "Wood and Energy Technology" will be directed towards streamlining of the production-chain with wood as a raw-material for manufacturing of buildings as well as carpentry and production of fibres for energy and alternative fuels.

**Vice Chancellor**

The second research area, "Mathematical Modelling and System Collaboration" is based on already established research within Mathematical Modelling, Computer Sciences and Information Technology, with emphasis on possible industrial applications of existing, more basic competences within the faculty's research field.

All the applications submitted form integral parts of the two research areas and would strongly facilitate to develop existent research as well as to focus harder on industrially related research issues. The applications also represent varying degrees of collaboration between different research disciplines within the faculty, all in line with the aim of the newly settled profiling policy at Växjö University. Investments from the Knowledge Foundation in any of the applications listed above, would distinctly contribute to the development of those two strategic research areas at Växjö University.



Johan Sterte  
Vice Chancellor

**ANNEX  
– Budgeted expenditure using  
funds from the Foundation**

**Instructions**

A year-by-year budget following the budget model provided below.

A detailed budget for the planned use of the Knowledge Foundation funds that have been applied for. Costs should be detailed under the headings of salaries, equipment, materials, travel, communication activities and other costs. Salary costs and financial support for students should be broken down under the following headings: employment (description), extent/portion of financial support for students (in %), salary costs (annual salary x social welfare charges x level of employment), names (if it is known who will be engaged) and qualifications.

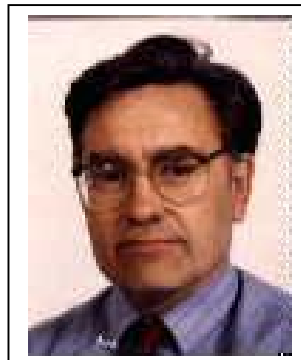
Fill in the grey fields. Yellow-coloured fields are calculated automatically when you fill in the form.



## Kompetensprofil - Curriculum Vitae (CV)

Namn: Kjell Karlsson  
 Adress: AerotechTelub AB  
 351 80 VÄXJÖ

Telefon: 0470 – 42167  
 Fax: 0470 – 19405  
 Mobiltelefon:  
 E-post: kjell.karlsson@aerotechtelub.se  
 Födelsedatum: 1949-11-19



Yrke/Titel: Civilingenjör - Kvalitetskonsult

Kvalitet Systemintegration/LQ	2004-	Kvalitetsstöd, Kvalitetsrev, Proj.utv.
Stab Kvalitet Sensorsystem/GQ	2001-2004	Kvalitetsansvarig
Stab Kvalitet /GQ och LQ	2000-2001	Kvalitetsstöd, Kvalitetsrev. Proj.utv.
Stab Kvalitet/LQ	1998-1999	TickIT-certifiering m.m.
Affärsområde Informationssystem	1985-1997	Kvalitetskonsult programvara

**Skolutbildning:** Studentexamen: Reallinjen, matematisk gren, 1968, Växjö  
 Civilingenjörsexamen: Lunds Tekniska Högskola, Elektroteknik 1973 (efter studier där 1969-1973).

**Arbetslivserfarenhet:**

1. **Eldon AB, Nässjö 1974**, Produktion. Elektroteknik.
2. **LM Ericsson, Stockholm 1974-1985:**
  - Produktionsteknik Elektronik 1974-75
  - 1-årig Rotationsingenjörutbildning för civilingenjörer
  - Programutveckling, testprogram AXE (Ellemtel)
  - Produktionsutveckling AXE (Elektronik)
  - Sverige 1977-79 Uppbyggande av testplattformar
  - Frankrike 1979-80. Teknisk expert och koordinator för Ericsson med ansvar för uppstartningen av AXE-produktion i Frankrike.
  - Provningskvalitet, Testmetodik AXE 1980-84.
  - Stab Kvalitet Ericsson Telecom 1984-85. Framtagande av kvalitetsmått SW, Introducering av Kvalitetsmätning. Ansvar för kvalitetsrapportering till ledning, åtgärder för problemlösning, driftstatistik, kvalitetskostnader m.m. i första hand inom programvaru – och tjänsteområdet.



**Arbetslivserfarenhet  
forts:**

**3. AerotechTelub AB fr.om. 1985  
(1985-1999 Telub AB o Enator Telub AB).**

**1985-1998 Kvalitetskonsult. Externa uppdrag.**

Områden: Programvara, Hårdvara och Tjänster.  
Metodik inom områdena: Programvaruutveckling, programvaruunderhåll, Datasäkerhet, Konstruktion och tillverkning maskinvara, Konfigurationsstyrning, Projekt- och systemsamordning samt Verifiering och Validering.

Huvudsakliga konsultuppgifter:

- Upphandling av system innehållande nyutveckling av programvara och/eller maskinvara inkl leverantörsbedömningar (av kvalitetssystem).
  - Specificering av krav inom ovanstående områden.
  - Upprättande och granskningar av kvalitetsprogram och utvecklingsplaner
  - Genomfört externa kvalitetsrevisioner (200 – 300 st) i ett 50-tal olika projekt (de flesta försvarsinriktade) innehållande programvaruutveckling.
  - Deltar i granskningar, leveranskontroller, projektutvärderingar och andra kvalitetsaktiviteter
  - Deltagit i framtagande av ett flertal handböcker och instruktioner för internt och externt bruk (bl.a. Kockums handbok för programvaruutveckling, FMV handbok för kravspecifiering KRAVDOK, intern avdelningshandbok och delar av AerotechTelub regelverk, LFV Q-handbok och CM-handbok för projekt).
- Handplockad för Kvalitetssäkring av upphandling av skattesystem till Norska Skattedirektoratet. (miljardprojekt)

**Fr.om 1998 Kvalitetssamordnare/Kvalitetsansv. internt**

1/5 1998-31/12 1999: Kvalitetsstab Enator Telub AB arbetande i TickIT-projektet för certifiering av Enator Telub AB (halvtid). Framtagande av regelverk (bl.a. ny Projekthandbok), och implementering genom utbildning och kvalitetsutvärderingar i projekt fram till certifieringen.

1/3 2000-15/2 2001: Kvalitetsstaberna vid divisionerna Sensorsystem (div G) och Systemintegration (div L) vid AT. Ansvar för kvalitetsstöd, kvalitetsrevisioner och projektutvärderingar i ett stort antal verksamheter.

15/2 2001-28/2 2004: Kvalitetsansvarig div Sensorsystem. Upprättande av Verksamhetssystem, Kvalitetsstöd till projekt/uppdrag, Kvalitetsrevisioner (även div L), Kvalitetsmätningar, Utbildning av personal, RML, Hantering av kundklagomål, Processetablering m.m.

Fr.om. 1/3 2004. Kvalitetsrevisioner, Kvalitetsstöd och Verksamhetssystem vid div L, div G och div N inom AT.

**AerotechTelub AB**  
Division Systemintegration



- Fackutbildning:** Trainee Course-Rotationsutbildning, Ericsson 1975 (1 år)  
 QA Auditor Training Course and Examination, 1985 (2 dgr)  
 Programvaruutveckling kravspec och test, 1985 (4 dgr)  
 Programvarukvalitet i teori o praktik, 1986 (1 dgr)  
 Programvarukvalitet och test, 1988 (3 dgr)  
 MIL-STD 498 Software Development & Documentation  
 1995 (2 dgr).  
 Konsultrollen (2 kurser 1986 och 1991)  
 Kurs för TickIT-revisorer för certifikat (april 2000)
- Språkförmåga:** Engelska, Franska, något Norska  
 (kurser i franska och spanska).
- Huvudarbetsområden:** Kvalitetssäkring (i alla dess former).  
 Rutiner för Konstruktion och Tillverkning (speciellt  
 Programvaruutveckling), Konfigurationsstyrning,  
 Projektledning, Systemsamordning samt Verifiering och  
 Validering
- Referensverksamhet:** AerotechTelub internt: Uppföljning av ca 150 projekt/  
 uppdrag. Utvecklingsprojekt inom Q-området.  
 Kvalitetsansvarig på Sensorsystem. Ca 300 Q-revisioner  
FMV; ett 30-tal projekt.  
Försvarsmakten; 3 projekt.  
Norska Skattedirektoratet; 1 projekt.  
Norska Kystartilleriet; 1 projekt.  
Luftfartsverket, Kockums; några projekt  
Vägverket: VTC/CTS (Dennispaketet)  
OKG Alladin Granskning o Kvalitetsutvärdering
- Speciella erfarenheter:**
- Följt internationell standard inom kvalitets -/programvaru-området.
  - Stor erfarenhet av att anpassa planering och kvalitetsinsatser till olika typer av projekt/uppdrag, även små.
  - Genomfört 600-700 kvalitetsrevisioner internt och externt.

# Curriculum Vitae

Per Ranstad

## **Academic Degrees**

Tech.Lic in Power Electronics, KTH 2004

M.Sc. in electrical engineering, LTH -87

## **Employment**

R&D engineer, SATT Control AB, 83-85

R&D engineer, electronics, Alstom Power Sweden, 85-95

R&D manager, electronics, Alstom Power Sweden, since-95

**Name:** Sören Strömberg  
Senior Quality Consultant

**Date of birth:** May 10, 1955

**Date started IT career:** 1986

1986 – 1990

Project Manager for a research project “Implementing Computers in small and medium size Companies”. This project was an action oriented where we implemented different advanced computer technology in 16 different companies.

1989- 1991

Director for “Centre for Small Business Development” at VÄXJÖ University. One of the main activities for the Center was different advanced courses in computer skill.

1990 –1995

European COMETT – program. Managing Director for South Swedish University Enterprise Training Partnership (UETP). One of the main activities was development and implement of “South-Net” – which was a company/university network based on mainframe program PortaCOM.

1986 –1995

VÄXJÖ University, Teacher in Business Administration. Leading the development of computer based training and development with spreadsheets program at the faculty.

1996-

CEO Artisan Global Media. Main tasks: Consulting, developing strategies for practical Internet solutions in organisations and companies.

#### **SUMMARY:**

Sören Strömberg is today working as the CEO of Artisan Global Media. His main tasks are to take part in the strategic discussions with our customers and their projects, and to develop the company strategies. Among the company strategies we find quality oriented work methods, the Artologik concept, and to develop the company in an economically very sound way, with no large sums from risk capitalists, but from a firm solid economical ground.

Sören Strömberg is a very communicative person, working as a lecturer for many years, and working with international projects in his own company for the last ten years keeps this knowledge up to date.

He was among the first Swedes to start using e-mail and the Internet when working at VÄXJÖ University in the 80's, and has followed the development in the IT sector very closely, in his working context, since then.

He has a broad experience in the field of Internet, software and computer development, both in the private and official sector.

Sören Strömberg is a visionary personality, with a large amount of enthusiasm and practical ideas that is the background to the success so far for than Artisan Global Media company. He brings a team of well-educated ambitious people to do things that nobody knew was possible.

Working with ISO 9000 implementation in the organisation, and used to demands on quality standards.

# CURRICULUM VITAE

Emil Eifrém  
Rydsvägen 162A  
58432 Linköping  
780523-2951  
emil@eifrem.com

5th September 2005

## 1 EDUCATION

1994-1998	<b>Oscarsgymnasiet</b> , studies in science and music
1996-1997	<b>Newport High</b> , Bellevue, WA, studies in science
2002-2003	<b>Glimåkra Folkhögskola</b> , studies in music
2003-2005	<b>Linköpings Universitet</b> , Master of Science and Engineering in Computer Science

## 2 EXPERIENCE

1999-2000	<b>Windh AB</b> , Java developer. One of five developers that built a content management system from scratch. Took active part in all phases of the project, from requirements gathering through object-oriented analysis and design to implementation, testing and deployment. Reference: Tobias Södergren, tso@scancoin.se
2000-2002	<b>EyeQnet AB</b> , Chief Architect. Oversaw a development team of 15 people. My main responsibility was the overall architecture of the company's software platform, with a focus on scalability and availability. Roughly half my time was spent translating business requirements to functional specifications, while the rest focused on designing infrastructure for high availability and scalability. Reference: Peter Neubauer, peter@neubauer.se
2002-present	<b>Windh Technologies</b> , Chief Technical Officer. As the CTO, I have full responsibility of all development and technical activities. I provide a technical strategy, gather business requirements and set guidelines and policies for development. I also represent Windh Technologies in standards bodies, form technical partnerships and participate in research projects. Reference: Stefan Windh, stefan@windh.com

### 3 SKILLS

- Programming languages
  - **Excellent:** Java, C
  - **Very good:** Lisp/Scheme, Python, SQL.
  - **Proficient:** Perl, PHP, C++, Unix shell scripts, and others.
- Object-oriented analysis and design.
- Project management and leadership.

### 4 MISCELLANEOUS

- Active member of the Java Community Process (<http://jcp.org>) working on several existing and emerging Java standards.
- Former board member of Windh AB and Glimåkra Folkhögskola. Board member of EyeQnet AB and Institutionen för Datavetenskap at Linköping Universitet (<http://www.ida.liu.se>).
- Developed a 200 000 line text-based roleplaying game in C during 1994-1996. It was made public in 1995 and quickly turned into one of the most popular text based games on the internet. It is still running ten years later on <http://mud.lu> although I'm not actively involved anymore.
- I've played the piano (classical music) since I was 8 years old.

## ANNEX – Company commitments

One complete page for each company taking part, submitted in the form of scanned annexes. The questions below should be answered by one or more persons authorised to do so by the company.

### 1. Project title

Validation of Metrics-Based Quality Control
---

### 2. Company's project supervisor

Surname, Forename(s) Karlsson, Kjell	Company AerotechTelub AB
Title Quality Engineer	E-mail kjell.karlsson@aerotechtelub.se
Website www.aerotechtelub.se	Telephone number 0470/42167
Time allocated for the project 50	No. of employees 2000
Company Reg No. 556218-6790	SNI* code 35300

\* Swedish Standard for Industrial Classification of Economic Activities

### 3. Company's project grant

(Project expenditure should be itemised in the company's books to permit auditing of the project accounts if the Knowledge Foundation so requests. Internal resources should be valued according to the company's usual internal billing routines.)

	Hours	SEK/Hour	Total SEK '000
Cash payment to host HEI			
Internal resources: working hours	ca 170/år	850	450.000
Internal resources			
<b>Total project funding</b>			450.000

NB state the company's total contribution to the project (not annual grants).

#### 4. Collaboration with HEI and project supervisor

*Describe previous collaboration with HEI and/or project supervisor (max. 700 characters)*

AerotechTelub has collaborated with universities and institutes many times in different studies and projects, e.g. with University of Göteborg, Borlänge, different University of Technologies. Topics included both communication and software development.

We have supported the project "An Adaptive GRID-Service Architecture for a Distributed, Time-coherent Radio/IT-Network" (Vinnova 24091) - also supervised by Welf Löwe - with in-kind contribution. We even have supported a previous version of the present application.

#### 5. Company's own aims for the project

*Max. 700 characters*

AerotechTelub's overall objective with this project is to implement methods, standards, and the VizzAnalyzer tool to measure and visualize the quality of codes. Another objective is to get code reviews, module tests, and design more effective. As a potential next step after our certifications in ISO 9001:2000 and TickIT (1998), it will help to achieve an even higher software quality and to continuously work on quality improvements.

We have several software development projects (objects) suitable for the proposed research. Our long-term goal is to implement the tool for at least three objects in different program languages; the object we propose to start with (C++) has been developed already

#### 6. Company's role and functions in the project

*Max. 700 characters*

1. We support the project with different parameters and data from our objects to make it possible to apply and validate quality measurements on the objects.
2. We participate in the validation of the results, discuss conclusions, potentially implement changes in the objects and make new measurements. We will use our processes and rules during the work.
3. We give feedback and propose improvements in the methods and tools, validate again until we have an acceptable functionality in the tool.

This work will be done by different persons in the organisation (170 tim/år).

#### 7. Company's plan

*Company's plan to ensure continuous benefit from, and disseminate in-house information about, the project (max. 700 characters)*

On the long view, we will implement the tool, method and standard in our working process and our Development Handbook (on intranet), which compulsory to use when we develop software. Also, it will be useful to visualize the code structure and connect it to the design documentation. When we use COTS, we plan to measure the reusability. The approach will also be a way to certificate the software products to fulfil a certain quality level. Therefore, we will distribute information and have demonstrations of the new tool in the organisation in later project phases.

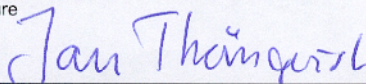
## 8. Approving parties

We have examined, and assisted in drawing up, this application. If the Knowledge Foundation awards a grant for the project, we shall fulfil our commitments as described above.

### 8.1 Chief Executive Officer/Head of research

Surname, Forename(s) Thörnqvist, Jan	
E-mail jan.thornqvist@aerotechtelub.se	Telephone number 0470/42759

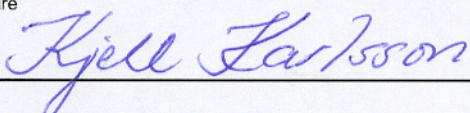
#### 8.1.1 Signature

Date 2005-09-02	
Signature 	Clarification of Signature Jan Thörnqvist

### 8.2 Project supervisor

Surname, Forename(s) Karlsson, Kjell	
Adress AerotechTelub	Postnummer 351 80 Växjö

#### 8.2.1 Signature

Date 2005-09-02	
Signature 	Clarification of Signature Kjell Karlsson

## ANNEX – Company commitments

One complete page for each company taking part, submitted in the form of scanned annexes. The questions below should be answered by one or more persons authorised to do so by the company.

### 1. Project title

Validation of Metrics-Based Quality Control
---

### 2. Company's project supervisor

Surname, Forename(s) Ranstad, Per	Company Alstom Power Sweden
Title RD Manager	E-mail per.ranstad@power.alstom.com
Website	Telephone number 0470-711024
Time allocated for the project 50 h	No. of employees 650
Company Reg No. 556011-4224	SNI* code

\* Swedish Standard for Industrial Classification of Economic Activities

### 3. Company's project grant

(Project expenditure should be itemised in the company's books to permit auditing of the project accounts if the Knowledge Foundation so requests. Internal resources should be valued according to the company's usual internal billing routines.)

	Hours	SEK/Hour	Total SEK '000
Cash payment to host HEI			
Internal resources: working hours	750	650	488
Internal resources			
<b>Total project funding</b>			488

NB state the company's total contribution to the project (not annual grants).

#### 4. Collaboration with HEI and project supervisor

*Describe previous collaboration with HEI and/or project supervisor (max. 700 characters)*

-Viggen CM project with Växjö University (subproject with supervisor), 2001-2003, Vinnova  
-Project application "Quality Control" 2004, KK foundation  
-Quality Workshop 2005, Växjö University

#### 5. Company's own aims for the project

*Max. 700 characters*

-To penetrate quality issues on software in our embedded systems.  
-To reduce time and cost in software development and maintenance processes.  
-To define metrics on software quality.  
-To evaluate metrics and methods on existing software development projects.

#### 6. Company's role and functions in the project

*Max. 700 characters*

-To provide software systems for analyses (develop and existing).  
-To support the installation of quality measurement (VizzAnalyzer tool).  
-To collect, document, and report quality and development process data.  
-To discuss on aspects on software quality and metrics.

#### 7. Company's plan

*Company's plan to ensure continuous benefit from, and disseminate in-house information about, the project (max. 700 characters)*

Trough instructions on working processes, VLS.  
Seminars and workshops, jointly University and Company.

#### 8. Approving parties

We have examined, and assisted in drawing up, this application. If the Knowledge Foundation awards a grant for the project, we shall fulfil our commitments as described above.

##### 8.1 Chief Executive Officer/Head of research

Surname, Forename(s)

Ranstad, Per

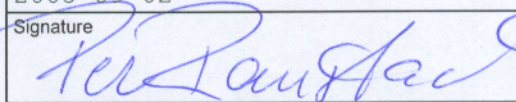
E-mail

per.ranstad@power.alstom.com

Telephone number

0470-711024

### 8.1.1 Signature

Date	
2005-09-02	
Signature	Clarification of Signature
	Per Ranstad

### 8.2 Project supervisor

Surname, Forname(s)	
Löwe, Welf	
Adress	Postnummer
Växjö, Växjö University, MSI	351 95

### 8.2.1 Signature

Date	
2005-09-02	
Signature	Clarification of Signature
	Welf Löwe

## ANNEX – Company commitments

One complete page for each company taking part, submitted in the form of scanned annexes. The questions below should be answered by one or more persons authorised to do so by the company.

### 1. Project title

Validation of Metrics-Based Quality Control
---

### 2. Company's project supervisor

Surname, Forename(s) Strömberg, Sören	Company Artisan Global Media
Title CEO	E-mail soren.stromberg@artisan.se
Website www.artisan.se	Telephone number 0470-778580
Time allocated for the project 50 h	No. of employees 20
Company Reg No. 556 326-6104	SNI* code 72220, 74140

\* Swedish Standard for Industrial Classification of Economic Activities

### 3. Company's project grant

(Project expenditure should be itemised in the company's books to permit auditing of the project accounts if the Knowledge Foundation so requests. Internal resources should be valued according to the company's usual internal billing routines.)

	Hours	SEK/Hour	Total SEK '000
Cash payment to host HEI			
Internal resources: working hours	420	745	312
Internal resources			290
<b>Total project funding</b>			<b>602</b>

NB state the company's total contribution to the project (not annual grants).

#### 4. Collaboration with HEI and project supervisor

*Describe previous collaboration with HEI and/or project supervisor (max. 700 characters)*

Artisan has collaborated with Växjö University in the Viggen content management project in terms of in-kind contributions. The project was co-funded by Vinnova and the participating companies. Artisan and the project supervisor Welf Löwe were active in the work package on content management tools and integrated product development. We have even contributed to a number of follow-up project applications that unfortunately haven't been granted support. We are member of the Web Services Competence Center, a network of excellence co-initiated by Växjö University and Welf Löwe. Artisan has also contributed to Welf Löwe's 2004 KK application for supporting research in Software Quality Management.

#### 5. Company's own aims for the project

*Max. 700 characters*

Currently, Artisan undertakes a larger quality project. Its goal is an ISO 9000 certification according to the TickIT standard. Core business of the company is web-based application development. After our transition to a new development platform, we are even aiming for new internal development standards. Our goal is to adapt the new platform to fit the VizzAnalyzer tool in order to achieve higher quality in software development. Being able to evaluate quality even visually opens up a new dimension in quality management.

#### 6. Company's role and functions in the project

*Max. 700 characters*

Artisan supports the installation of the VizzAnalyser in the development process. We continuously collect and document metric and process information, and report it to the researchers at Växjö University and evaluate results of the measurements reported back to us. Artisan will contribute with licenses for its web-based project, questionnair and publishing systems, which will constitute the software infrastructure for the project management.

#### 7. Company's plan

*Company's plan to ensure continuous benefit from, and disseminate in-house information about, the project (max. 700 characters)*

The method of quality assessment developed and validated in the project will be implemented and promoted as an internal standard for our software development. Continuously, we train our employees on the deveopment standards and the platform; this training will contain the VizzAnalyzer based quality management as a component.


#### 8. Approving parties

We have examined, and assisted in drawing up, this application. If the Knowledge Foundation awards a grant for the project, we shall fulfil our commitments as described above.

### 8.1 Chief Executive Officer/Head of research

Surname, Forename(s) Strömberg, Sören	
E-mail soren.stromberg@artisan.se	Telephone number 0470-778580

#### 8.1.1 Signature

Date 2005-09-01	
Signature 	Clarification of Signature Sören Strömberg

### 8.2 Project supervisor

Surname, Forename(s)	
Adress	Postnummer

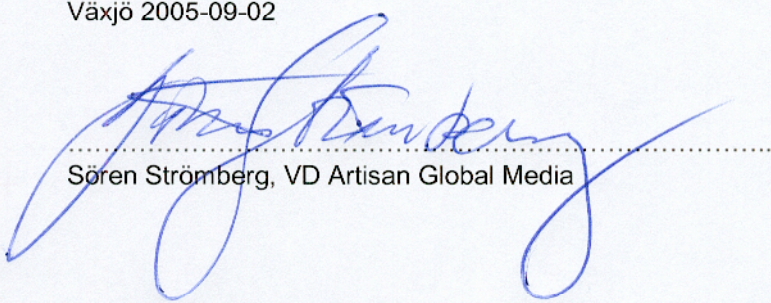
#### 8.2.1 Signature

Date	
Signature	Clarification of Signature

## Artisans Interna resurser

	Licens	Servicavtal
Artologik Query&Report	25 500,00 kr	22 680,00 kr
Artologik WebPublish	48 500,00 kr	45 900,00 kr
Artologik ProjectManager	25 500,00 kr	22 680,00 kr
Webbplatshyror 3 år	66 600,00 kr	
	166 100,00 kr	91 260,00 kr
Totalt bidrag	290 080,00 kr	

Växjö 2005-09-02

  
Sören Strömberg, VD Artisan Global Media

## ANNEX – Company commitments

One complete page for each company taking part, submitted in the form of scanned annexes. The questions below should be answered by one or more persons authorised to do so by the company.

### 1. Project title

Validation of Metrics-Based Quality Control
---

### 2. Company's project supervisor

Surname, Forename(s) Eifrem, Emil	Company Windh
Title CTO	E-mail Emil@windh.com
Website <a href="http://www.windh.com">http://www.windh.com</a>	Telephone number 0733-462271
Time allocated for the project 300	No. of employees 10
Company Reg No. 556338-6878	SNI* code 92400

\* Swedish Standard for Industrial Classification of Economic Activities

### 3. Company's project grant

(Project expenditure should be itemised in the company's books to permit auditing of the project accounts if the Knowledge Foundation so requests. Internal resources should be valued according to the company's usual internal billing routines.)

	Hours	SEK/Hour	Total SEK '000
Cash payment to host HEI			
Internal resources: working hours	300	650	195
Internal resources			
<b>Total project funding</b>			195

NB state the company's total contribution to the project (not annual grants).

#### 4. Collaboration with HEI and project supervisor

*Describe previous collaboration with HEI and/or project supervisor (max. 700 characters)*

Windh is member of the Web Services Competence Center (WSCC), a non-profit network of companies, researchers and public authorities; Welf Löwe and Växjö University are co-founders of WSCC. Windh also has collaborated with Welf Löwe in two project applications including the application on "Automated Quality Measurement Control and Improvement in Software Projects" to KK foundation in 2004. Windh has participated in the Quality Workshop at Växjö University in August 2005.

#### 5. Company's own aims for the project

*Max. 700 characters*

Windh's overall objective with the project is to gain a valuable tool for measuring and controlling software quality. In Windh's present process, the development team employs simple automated source code analysis tools for things like coding convention compliance and documentation completeness. It is our hope that the project will result in a standard-based tool and methodology for more sophisticated analysis and higher-level views of the quality of our architecture and design.

#### 6. Company's role and functions in the project

*Max. 700 characters*

Windh runs an agile process with short iterations and frequent builds. We have high demands on our process toolbox, with a focus on open tools and build automation. We hope to bring experience, expertise and real world requirements from a lightweight, test-driven process to the project.

Secondly, Windh has a strong background in Java, with for example staff members active in the development of new Java standards under the Java Community Process (<http://jcp.org>). We hope to bring expertise in the specifics of Java development to the project.

#### 7. Company's plan

*Company's plan to ensure continuous benefit from, and disseminate in-house information about, the project (max. 700 characters)*

In order for the project to have any practical value for us, the resulting tool must be integrated in our automated build process. When it is, it will by necessity stay relevant, as the development staff will interact with it daily.

#### 8. Approving parties

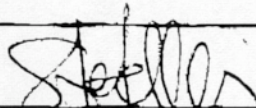
We have examined, and assisted in drawing up, this application. If the Knowledge Foundation awards a

grant for the project, we shall fulfil our commitments as described above.

### 8.1 Chief Executive Officer/Head of research

Surname, Forename(s) Windh, Stefan	
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#### 8.1.1 Signature

Date 2005-09-02	
Signature 	Clarification of Signature Stefan Windh

### 8.2 Project supervisor

Surname, Forename(s) Eifrem, Emil	
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#### 8.2.1 Signature

Date 2005-09-02	
Signature 	Clarification of Signature Emil Eifrem

## ANNEX – Communication plan

For the projects and the Knowledge Foundation's work to succeed, project experience and results must be disseminated in forms that benefit industry and society. The communication plan must be feasible and of practical use to the project. It is essential to plan and schedule concrete activities to reach selected target groups. On approving a grant proposal, the Knowledge Foundation will require a detailed communication plan including the items listed below.

### 1. Project title

Validation of Metrics-Based Quality Control

### 2. Target groups

*What communication and interaction will there be with the partner companies? How will internal data collection take place in the project? What external target groups (e.g. industry, the public sector and other research groups) can benefit from your results and experience? You may wish to rank these groups in importance. (Max. 700 characters)*

Measurements in the partners' projects are communicated to ARiSA. Statistical evaluation by ARiSA based on these data is communicated back. Technically, measurements are obtained from the VizzAnalyzer tool and Artisan's Web questionnaires and stored in Artisan's content management system publishing them on the Web automatically. Conclusions from data and evaluations are discussed between developers, project managers and researchers.

Besides the partner companies, there are other target groups:

1. International research community in Software Quality Management & Metrics
2. Other companies
3. CS students at Växjö University
4. International research community in Program Analysis
5. General Public

(The project plan may include additional information)

### 3. Message

*What specific experience and results do you wish to communicate to the various target groups, and why? Consider the target groups' respective needs. What are they interested in knowing? (Max. 700 characters)*

Continuously, we inform the partners about quality threads avoiding design flaws in early development stages and saving money. Conclusively, we propose qualities that can be supervised automatically to partner and other companies including appropriate tools and methods.

To the research community in Software Quality Management & Metrics we report validated quality models and metrics.

Our students get training in automated quality management since connected jobs remain in Europe even if outsourcing continues.

Researchers should be aware of new validated applications for Program Analysis.

The general public should expect higher quality in software systems and services in the future.

#### 4. Activity plan

*What activities are planned during the project? Specify dates and target groups. Examples of activities: seminars, published reports, web communication, workshops, company visits, newsletters, media contact, lectures, networking with interested companies, etc. Costs of these activities must be specified in the project budget. (Max. 1,400 characters)*

A project web with goals and partners will be up and running at project start 1-06.

The quality model is published as a compendium of software quality standards and metrics ([www.arisa.se/compendium/](http://www.arisa.se/compendium/)) and will be continuously updated. It should serve as a project knowledge base. It is also open for contributions from outside, e.g. for relating new metrics to quality characteristics.

A seminar for selecting appropriate projects, defining feedback forms etc. with all partners is scheduled for 8-06. Feedback meetings (one per month and project, first planned for 3-07) are scheduled individually with the partners.

A first quality workshop has been held 8-05; a follow-up is planned for 12-08. It communicates lessons learned and, maybe, defines continuation projects. Invitation will be distributed through our industry networks Web Services Competence Center and Center for Information Exchange and System Collaboration.

The first conference paper describing experimental setting and first results is due 12-06 (more to follow). A journal paper reporting on the experimental validation is planned for 12-08. Altogether, the work leads to a PhD thesis.

Once the quality monitors run in partner companies, the course on Advanced Program Analyses will be adapted accordingly, effective 12-06.

Press releases will keep the general public informed; the first is issued with project start 1-06.

# Validation of Metrics-Based Quality Control

Welf Löwe

Applied Research in System Analysis (ARiSA) – Växjö University

## 1. Introduction to the research field

More than half of the total costs in ownership of a software system are maintenance costs. Hence, it is important to control software qualities like maintainability, re-usability, and portability directly during the development of a software system.

The ISO/IEC 9126 standard describes internal and external software qualities and their connection to attributes of software in a so-called *Quality Model*, cf. ISO/IEC 9126-1. The Quality Model follows the Factor-Criteria-Metric model and defines six quality characteristics (or factors), which are refined into sub-characteristics (or criteria). Sub-characteristics in turn are assessed by metrics; they measure the design and development process and the software itself. Currently, the proposed measurements need to be performed manually as they require human insights, e.g. due to code reviews. Manual approaches, however, have a series of drawbacks:

- (1) They are error-prone since they highly depend on the subjects performing the measurement. Hence, they are no measurements in the mathematical sense, which are required to be objective and repeatable. Humans might oversee or even deliberately ignore certain problems.
- (2) They are time consuming. When taking, e.g., code reviews seriously, people have to read and understand codes that they haven't created in the first place.
- (3) They might cause tensions in the organizations. There is a conflict of interest when, e.g., the project/quality manager requests reports from a developer, which at the same time is used to evaluate the performance of that developer.

Drawbacks with manual measurements are getting more severe when considering current trends in software development, like outsourcing of development and integration of open source components into proprietary systems. It is essential for a reliable software production to guarantee not only the functional correctness of external components but also their internal qualities. Manual quality measurement is not an option in these settings.

Finally, many customers of software systems, especially governmental organizations or those operating in security and safety critical areas, demand ISO 9000 quality certification from their vendors. ISO 9000 requires quantitative reasonable statistical control over product quality as a basis for continuous quality improvement in the software and the software development process. This is, for the aforementioned reasons, hard to establish with manual quality control.

## 2. Project Proposal

### 2.1. Project Goal

We replace ISO/IEC 9126 metrics manually assessing internal qualities with metrics allowing for automatic measurement. This defines an adapted Quality Model. We validate the significance of this Quality Model with experiments in selected software development projects of our industry partners.

### 2.2. Expected Results

The project will deliver both research insights and practical methods and tool support for participating companies.

On the research side, we expect two major contributions:

- (1) We define a novel Quality Model assessing internal quality (sub-)characteristics as defined by an industry standard with well-established metric analyses as proposed by the research community. This quality model is published as a compendium of software quality standards and metrics (cf. [www.arisa.se/compendium/](http://www.arisa.se/compendium/) for the structure and core of the compendium).
- (2) We statistically validate the significance of that novel Quality Model, i.e. we support or disprove the hypothesis that static metric analyses allow for an assessment of internal qualities of software systems.

Together, (1) and (2) provide the theoretical basis for quality management assessing industrially standardized software qualities in an effective (since significant and objective) and efficient (since automated) way.

On the practical side, we produce tools and methods supporting the quality assessment of software under development having a profound theoretical basis. By implementing them in the participating partner companies, we gain understanding on practicability and usefulness.

- (3) We get insights on how our theory, tools and methods integrate with different quality management processes existing in industry. This includes insights on initial efforts for integration and possible/necessary adaptations of these processes.
- (4) We understand the speed-up in performance of assessing internal quality automatically vs. manually, since we implement both approaches: the manual standard approach for validating the significance of the new automated approach.

As a side effect, we expect a higher awareness of internal quality issues in participating companies as a first result. We even expect improvements of software quality in the companies as well as improvements in their development process. These effects, however, will be evaluated qualitatively and subjectively in the first place and not validated statistically.

Once this project is successfully finished, a spin-off of the project will provide the acquired knowledge in a consulting service for software development companies.

### 2.3. Prerequisites Established Before

For the project to succeed, we have already solved a few practical problems.

The project will relate ISO/IEC 9126 standard and internal quality metrics in a Quality Model. A definition and documentation framework for this Quality Model has been established with a compendium of software quality standards and metrics (cf. [www.arisa.se/compendium/](http://www.arisa.se/compendium/)).

The VizzAnalyzer/Vizz3D framework is instantiated such that the tool already implements the information extraction, the metric analyses and visualizations needed for the project (cf. [www.arisa.se/index\\_tools.html](http://www.arisa.se/index_tools.html)).

Participating companies need to be aware of the standards we address, notions, and the tools in order to speak the same language in the project. It helps speeding up collaboration in general and establishing realistic expectations to the project from all sides. In addition to the project-planning meeting, we have conducted a one-day workshop for developers, internal consultants, and quality managers from partner companies (cf. [www.arisa.se/Workshop-08-05/](http://www.arisa.se/Workshop-08-05/)). Education included introduction to industrial quality standards involved, measurement theory, well established metrics, the compendium, our approach of assessing quality, and a VizzAnalyzer/Vizz3D tool demo.

### 2.4. Project Implementation

In *Work Package 1*, we adjust and formalize the Quality Model of ISO/IEC 9126:

- The characteristics and related sub-characteristics of the standard remain. However, we concentrate of the following characteristics: **(re-)usability**, **efficiency**, **maintainability**, and **portability** and their sub-characteristics excluding compliance. The excluded characteristics

functionality and reliability appear to be only indirectly assessable by means of general static software metrics (if possible at all). The sub-characteristics compliance needs application domain specific information and is, hence, not suitable for a general approach either.

- We map the remaining sub-characteristics to well-known static metrics such as McCabe Cyclomatic Complexity, Weighted Method Count, Lines of Code etc. For each metric, we have a hypothesis (a) whether it is highly or only moderately appropriate for assessing the related sub-characteristics, and (b) whether it is proportionally or inversely proportionally related (cf. [www.arisa.se/compendium/](http://www.arisa.se/compendium/) for examples).
- To assess sub-characteristics numerically, we normalize the metrics between 0 and 1 and multiply them with the weight 1 and  $\frac{1}{2}$ , respectively, according to the classification (a) and additional weights 1 and -1, respectively, according to the classification (b). Finally, the quantitative value of the sub-characteristics is defined as the weighted sum over related metric values. This defines our initial Quality Model, i.e. the assumption on the quantitative connection between metrics and sub-characteristics. It may be adapted during the project, cf. Work package 6, by changing the metrics and/or the weights.

In *Work Package 2*, we define and document the requirements on development processes and quality management in the participating companies needed to perform the validation of the redefined Quality Model. This concerns infrastructure support and additional process data that are needed to validate the conclusions from quality measurements. For instance:

- Sub-characteristics **testability** as assessed by metrics is validated via actual coverage of test cases, which requires a unit test infrastructure in the industrial project.
- Sub-characteristics **changeability** as assessed by metrics is validated via evaluating the actual changes, which requires a version control infrastructure on the one hand and a certain discipline in commenting changes on the other hand.
- Characteristics **maintainability** as assessed by metrics is validated via comparing change requests due to bug reports with actual changes and new bug reports requiring both bug databases and version control infrastructures and process data connecting bug reports to changes in code.

These relations between metrics and validating feedback process data are formally defined in hypotheses to be tested in the actual experiments. This phase also includes the design of feedback forms and setting up an appropriate content management system.

In *Work Package 3*, we carefully document development processes and quality management in the participating companies, select suitable projects and discuss additional documentation requirements for the validation.

In *Work Package 4*, we install a Quality Monitor for the selected project. In practice, this means integrating the VizzAnalyzer software measurement tool in the build process of the software development project. Remember, the VizzAnalyzer implements the metrics in question already. Hence this is more a task of installing than programming. Moreover, a Web questionnaire and a content management system are installed for storing the metrics information and additional process data. Finally, a Web project management system is installed for reporting times spent on the project.

In *Work Package 5*, along with the software development projects, we follow up automated quality measurement as well as quality and process feedback for their validation. Data is reported continuously. This work package is the actual control experiment.

In *Work Package 6*, we evaluate the results statistically. Intermediate results are evaluated continuously. The basis for the statistical analysis is hypothesis testing; the hypotheses have been established in Work Package 2 the required measurements in Work Package 5. If the hypothesis can be rejected then conclusions can be drawn. Otherwise, we need to change the Quality Model, e.g. add/remove/adapt metrics and change their quantitative connection to the sub-characteristics, and adjust the hypotheses.

Finally, in *Work Package 7*, we draw conclusions. Provided validation succeeds, we define and implement a consulting service for installing Quality Monitors in software development projects. In case validation does not succeed, we have reasons for assuming that internal software quality cannot be assessed uniformly with the same static metrics (or not at all with static metrics). This would, however, be a valuable research result too, since it falsifies common assumptions on software metrics in the research community.

### 3. Summary of the Group's Previous Research

The Applied Research in Software Analysis (ARiSA, [www.arisa.se](http://www.arisa.se)) group at Växjö University has contributed to the state-of-the-art in the fields of software analyses and visualization for software engineering purposes. Moreover, we provide flexible software tools, *VizzAnalyzer* and *Vizz3D*, making this state-of-the-art accessible for other researchers and practitioners in software engineering.

We have combined behavioral and structural analyses and showed how these different aspects of software can be visualized [1]. We applied this idea to develop a first analysis and visualization framework for special classes of programs [2]. The synergy between different kinds of analyses and visualizations is a general research theme in our group [3]. Successful applications of this idea have been identified in architecture recovery [4,5,6] and pattern recognition [7,8,12]. Theory and methods of software analysis and visualization constitute the theoretical basis of the proposed project.

In addition to the theory and methods, we are interested in their applicability in practice. Generator technology simplifies the development of analyses [9]. A suitable architecture allows to reuse existing analysis and visualization components [11,13,18]. Our frameworks implementing such an architecture, *VizzAnalyzer* [10,14] and *Vizz3D* [16], prove practicability and put us into the position to integrate quality measurement in industrial production processes as proposed in the project.

In a controlled experiment with students, we have validated improvements in efficiency and quality in software analysis due to the *VizzAnalyzer* framework [17]. As a side effect, this work provides practical experiences in controlled experiments with humans involved and the knowledge of the statistics for profound evaluations. This reduces the learning efforts required for the proposed project.

Meanwhile our frameworks have been successfully applied in a number of architectural analyses and quality assessment scenarios [15,17,18]. The proposed project takes this work one step further and systematically relates metrics to standards for quality assessment.

Finally, we have defined a compendium for software quality standards and metrics [19]. This is the core of an on-line collection of community knowledge mapping metrics proposed in the research community to industrial quality standards and vice versa. It helps defining the hypotheses to validate as well as disseminating validation results of the project.

## 4. Scientific Approach and State of The Art

### 4.1. Scientific Approach

The project goal is a Quality Model allowing for automated, metrics-based quality assessment with validated significance.

We *construct* a Quality Model with required properties, cf. Work Packages 1 – 4.

For *validating* its significance, we apply the Goal-Question-Metric (GQM) approach [20]. GQM suggests defining the experiment goals, to specify questions on how to achieve the goals and to collect a set of metrics, answering the questions in a quantitative way. To avoid confusion, we distinguish *model metrics* and *validation metrics*. The former are static metrics in the new Quality Model mapped to sub-characteristics. The latter are metrics assessing the (sub-)characteristics directly, but with much higher effort, i.e. with dynamic analyses or human involvement, or a posteriori, i.e. by looking backward in the project history. For instance:

- The validation metric of the sub-characteristics **testability** is the actual coverage of test cases, which requires dynamic analyses.
- The validation metric of the sub-characteristics **changeability** is the actual change observable when looking backwards in the project history. It requires human effort in documenting programming time for performing changes.
- The validation metric of the characteristics **maintainability** compares change requests due to bug reports, bug-fixing changes, and new bug reports, which again requires backwards analyses and human annotations.

The *Goal* is to validate the significance of our Quality Model based on the model metrics. *Questions* and sub-questions are derived from the ISO/IEC 9126 directly:

Q1: Can one significantly assess **re-usability** with the model metrics proposed in the Quality Model?

Q1.1 – Q1.4: Can model metrics significantly assess **understandability**, **learnability**, **operability**, and **attractiveness**, respectively, in a reuse context?

Q2: Can one significantly assess **efficiency** with the model metrics proposed in the Quality Model?

Q2.1 – Q2.2: Can model metrics significantly assess **time behavior** and **resource utilization**?

Q3: Can one significantly assess **maintainability** with the model metrics proposed?

Q3.1 – Q3.4: Can model metrics significantly assess **analyzability**, **changeability**, **stability**, and **testability**?

Q4: Can one significantly assess **portability** with the model metrics proposed?

Q4.1 – Q4.2: Can model metrics significantly assess **adaptability**, and **replaceability**?

For answering each sub-question, we need both a number of model metrics (as defined in our Quality Model) and validating metrics (as defined in our experimental setup, cf. examples above).

The basis for the statistical analysis of an experiment is hypothesis testing. A hypothesis is defined formally. The data collected during the course of the experiment is used, if possible, to reject the hypothesis. If the hypothesis can be rejected then conclusions can be drawn. A null hypothesis  $H_0$  states that correlations of model and validation metrics are only coincidental. This hypothesis must be rejected with as high significance as possible. We start for all our analyses with the standard borderline significance level of 0.05, i.e. observations are not coincidental but significant with at most a 5% error possibility, with significance values of  $p < 0.05$ . The alternative hypothesis  $H_1$  is the one that we can assume in case  $H_0$  is rejected.

To define the hypothesis, we classify the measured values as *high*, *average*, and *low*. For this classification, we use a self-reference in the software systems under development: systems are naturally divided in sub-systems, e.g. packages, modules, classes etc. For each (sub-)characteristics  $c$  and each sub-system  $s$ :

1. We perform corresponding measurements of model and validation metrics.
2. The weighted sum as defined in the Quality Model determines aggregated values  $V_M(c,s)$  from values measured with model metrics. We abstract even further from these values and classify them with abstract values  $A_M(c,s)$ . It is:
  - $A_M(c,s) = high$             iff  $V_M(c,s)$  is among the 25% highest values of all sub-systems,
  - $A_M(c,s) = low$             iff  $V_M(c,s)$  is among the 25% lowest values of all sub-systems, and
  - $A_M(c,s) = average$         otherwise.
3. The validation metrics provide values  $V_V(c,s)$  for direct assessment of (sub-)characteristics.
4. Our statistical evaluation studies the effect of changes in  $A_M(c,s)$  (independent variables) on changes in  $V_V(c,s)$  (dependent variables). The hypotheses  $H_0$  and  $H_1$  have the following form:

$H_0$ : There is *no* correlation between  $A_M(c,s)$  and  $V_I(c,s)$ .

$H_1$ : There is a correlation between  $A_M(c,s)$  and  $V_I(c,s)$ .

In order to find out which dependent variables were affected by changes in the independent variables, we may use, e.g., the Univariate General Linear Model [21], as part of the SPSS system [22], provided the obtained data is checked for test condition suitability.

## 4.2. State of the Art

On the one hand, Quality Models have existed for quite a while. The Factor-Criteria-Metric [23] model was developed already in 1977. A further development, the aforementioned Goal-Question-Metric (GQM) approach [20] is not much younger. However, implementations of these models for software quality assessment, e.g. ISO/IEC 9126 from 1991, fail in integrating easily assessable metrics.

On the other hand, there exists a rich body of metrics and tools allowing automated measurement. A good overview of metrics is given in the handbook of the Famoos EU-ESPRIT project [24]. Significance of individual metrics is mainly supported by intuition or case studies; few are validated in experiments. A mapping to a generally accepted Quality Model is lacking. However, the Guide to the Software Engineering Body of Knowledge that emphasizes measurement as a foundation for software engineering, especially software engineering management such as quality management [25].

With the success and size of open source projects [26] and the connected availability of databases of source code, design documents, and process data to the research community, multi-version program analysis has emerged as a relatively new discipline; overviews give [27,28]. These analyses allow investigating the quality of development projects over time, e.g. [29], as opposed to the once-in-time analyses of Quality Models and metrics – an approach that we will exploit, as well.

Still experimentation is underrepresented in Computer Science: a survey of over 400 papers showed that 40% of papers did not include experimentation and they needed it [30]; a similar survey of over 612 of such papers confirms this for 30% of the papers [31]. Quantitative/statistical evaluation of experiments in software engineering was proposed for the first time in 1986 [32]. A good overview of theories, methods and tools gives [33].

## 5. Time Schedule

Work packages *WP 1 – 7* are defined in Section 2.4. The total effort of the activities are 36 Person Months (PM) for the ARiSA group at MSI and 3 – 4 PM per major participating company:

*WP 1*: **Responsible**: ARiSA, 3 PM (ARiSA).

**Milestone**: Quality Model is defined and published in the compendium.

**Start – Deadline**: 1/1/06 – 31/3/06.

*WP 2*: **Responsible**: ARiSA, 1 PM (ARiSA) + ¼ PM per company.

**Milestone**: Specification of software development project requirements and additional deliverables of the software development projects. Setup of Web content management system and Web questionnaire.

**Start – Deadline**: 1/4/06 – 30/4/06.

*WP 3*: **Responsible**: participating companies, 4 PM (ARiSA) + ¼ PM per company.

**Milestone**: One software development project meeting the requirements is selected; developers are instructed to document the process according to deliverables defined in WP 2.

**Start – Deadline**: 1/5/06 – 31/8/06.

*WP 4*: **Responsible**: ARiSA, 4 PM (ARiSA) + 1 PM per company.

**Milestone**: Quality Monitor is installed and running in the selected software development projects, measurements can be documented electronically.

**Start – Deadline**: 1/09 – 31/12/06.

- WP 5:** **Responsible:** participating companies, 9 PM (ARiSA) + 1 – 2 PM per company (accumulated). Continually, measurements are documented, propagated to ARiSA and discussed in meetings (one per quarter and project). Meeting protocols and conclusion are prepared and propagated back by ARiSA.  
**Start – Deadline:** 1/1/07 – 31/8/08 (first measurements 31/3/07, final measurements 31/8/08).
- WP 6:** **Responsible:** ARiSA, accumulated 12 PM (ARiSA).  
Confirmation/rejection of the hypothesis; adaptation of Quality Model and hypothesis, if necessary; feedback to companies.  
**Start – Deadline:** 1/4/07 – 30/9/08 (first feedback 30/4/07, final feedback 30/9/08).
- WP 7:** **Responsible:** ARiSA, 3 PM (ARiSA) + ½ PM per company.  
**Milestone:** Results are reported in the compendium and in a second software quality workshop. If applicable a Quality Monitor consulting service is defined.  
**Start – Deadline:** 1/10/08 – 31/12/08.

Measurements are continuously documented and reported (*WP 5*); feedback is given back (*WP 6*). Hence, these packages overlap. All data is made available instantly to the partners via a project Web page. Therefore, we exploit Artisan’s Web questionnaire, content management and publishing systems. Responsible for installation and dissemination is ARiSA.

Obviously, there are many small, fine-grained but similar individual tasks in *WP 5* and *6*. We use Artisan’s Web based project management system for reporting and keeping track of these tasks and accumulated project times.

Publications at conferences, e.g. International Conference on Software Maintenance, International Conference on Software Engineering, a journal publication, e.g. in IEEE Trans. Software Engineering or IEEE Software, and updates on the compendium site are activities parallel to the Work Packages. Altogether, our research will lead to a PhD thesis. Responsible for publications is ARiSA.

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