

COST
Technical Committee “Forestry“

COST Action E36

*Modelling and Simulation in the Pulp & Paper
Industry*

PROGRESS REPORT

Period: from (01-04) to (01-06)

(Start date of the Action: 22.1.04)

(last update: 18.1.06)

This Report is prepared by the Management Committee of the Action and presented to the relevant Technical Committee. The report is a "cumulative" report, i.e. it is updated annually and covers the period beginning from the start date of the Action.

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1 OVERVIEW: ACTION IDENTIFICATION DATA

(see attached table "Action identification data" attached at the end)

2 OBJECTIVES

The main objective of the Action is to promote the development and application of modelling and simulation techniques in pulp and paper manufacturing processes. This is intended to e.g. reduce emissions and increase the productivity and cost-efficiency of the processes.

The main benefit will be a better understanding of the mechanisms of the processes and their control loops. This will help to find solutions for currently pending problems in the paper industry: improving the paper quality, optimising the wet end chemistry, enhancing the runnability and reducing emissions by improving process design, process monitoring and decision support during operation. In the long run this action should also contribute to designing superior or new product properties.

3 TECHNICAL DESCRIPTION AND IMPLEMENTATION

3.1 Items of technical work,

Scientific area 1: Modelling and Simulation of Pulp and Paper Production

Pulp and paper production processes are complex and cover most of the unit operations known in chemical engineering. Due to the large amounts of water used and the low efficiency of the majority of separation steps, the process includes many re-circulated streams. This applies to all media involved - water, fibres and fillers, air and energy. For this reason, establishing a simple static balance can be a very demanding task. Heat balances have been handled with varying success during the last two decades. More difficult problems such as the simulation of various contaminants like stickies have not yet been handled successfully within the industry. Simulation of pulping processes has further advanced and can feed in some experience of handling multi-component balances including complex chemical reactions. Nevertheless, improved static modelling is the key to a better design of pulping and paper production processes and will therefore be addressed in the Action.

The paper production process is highly dynamic, and only few approaches to the dynamics of a paper machine have been published so far. Especially the dynamics of the paper machine wet end may be described as one of the most complex combinations of hydrodynamics and colloidal chemistry. No simulation model has yet been able to fully describe the processes taking place there. Only if the dynamics are understood can the dynamic optimisation of the paper production process be addressed.

Scientific area 2: Online Use of Simulation and Simulation Based Optimisation in the Pulp and Paper Production Processes

Due to the complexity of the pulping process and the dynamics of the paper production process, process control systems have widely been established in the pulp and paper industry. For a typical application, the number of the I/O connections can vary between 30,000 and more than 100,000. In most cases conventional control technology is used. Operators see the actual values displayed on screens, PID-controllers help to operate the plant.

Various approaches can be followed to manage these complex systems in an optimum way. The first issue to be addressed is to handle the huge amount of data available within the system. Fast data acquisition, high-dimensional data analysis and reduction play a major role in providing the right data set. In addition new sensors that have become available within the past

few years have to be evaluated as additional sources of information.

Based on the information available and processed, two approaches are to be followed depending on the issue addressed: The first approach is an open loop control by simulation-based decision making. Non-linear system modelling combined with multivariable system optimisation is one of the basic principles to be used here. Models are calibrated with real data, scenarios are calculated based thereupon. The results are made available to the operators and technologists who will then decide on the next steps to be taken.

The second approach is a closed loop approach. All quick control functions that are now performed by simple PID controllers are to be evaluated for their performance. Based on this evaluation, a decision can be made whether or not the application of advanced control techniques like multivariable process control will lead to potential improvements of the process.

Up to now some online simulation applications have been implemented in the industry. Most of the software tools have been developed in other sectors. The petrochemical industry has a leading role in applying these technologies. Existing applications in the paper industry are the optimisation of paper machine quality control (basis weight, filler, moisture etc.) in machine direction that is now widely done with MIMO-MPC (multiple input multiple output model predictive control) by commercial systems (Metso, ABB, Honeywell). The optimisation of basis weight, coat weight and moisture in the cross direction of the sheet were actually one of the first (if not the first) high-dimensional MIMO-MPC even though the dynamics was not dealt with quite correctly.

These applications serve as a good starting point for advanced simulation based optimisation. The main goal therefore is to identify new applications and to use all know how concerning the dynamic description of paper making processes to adapt other available solutions to the paper production process.

3.2 The mode of operation

The Action is based on a close co-operation and interaction between scientists and engineers from the pulp & paper industry, related research establishments and simulation software suppliers. This is promoted via

- Work group discussion meetings
- Exchange of publications and findings
- Organisation of workshops, seminars, conferences, site visits etc.
- Publication of seminar or conference proceedings
- Publication of the Actions annual interim reports and the final report
- Joint projects on specific topics may be launched by two or more partners

3.3 Working Groups

Within the broad terms of the proposed COST Action there is scope for three working groups on modelling and simulation in the pulp and paper industry. The groups will meet to exchange information on developments in the areas mentioned in chapter C. Special attention will be given to software as the major tool for modelling and simulation. Therefore the third working group (C) will consist of participants of all other working groups and additional suppliers. Here

the questions of a “lingua franca” connecting all simulation activities will be discussed in detail. The discussions will include the development and use of software packages.

The working groups shall cover, but not be limited to, applications of modelling and simulation tools in the following technological areas:

A) Modelling and Simulation of Pulp and Paper Production Processes

This working group will cover all topics concerning the modelling and simulation of the whole pulp and paper production process. This includes the chemical reactions in digesters, the complex pulp washing process, the modification of fibre properties during the process of stock preparation, the modelling of the complex wet end chemistry and the modelling of water loops and energy balances. Special attention will be given to the use of dynamic process simulation, real-time simulation tools and model validation tools.

B) Online Use of Simulation in Pulp and Paper Production Processes

This working group will concentrate on the use of simulation models during plant operation. It focuses on simulation-based decision making, multivariable process control, fast data acquisition, high-dimensional data analysis and reduction, non-linear system modelling and multivariable system optimisation.

C) Use of Simulation Software in the Pulp and Paper Industry

This working group intends to bring software developers and (possible) users together in order to reach agreements on the contents, features, relevance and performance of software products. Existing software packages should be evaluated. User needs and goals for further developments are to be elaborated. Discussions will include the development and use of software packages.

The working groups will meet and organise discussion meetings on a regular basis as funded by the COST action framework, which covers the travelling expenses of two representatives from each country. Other activities, such as short study visits and organised conferences, will also be conducted.

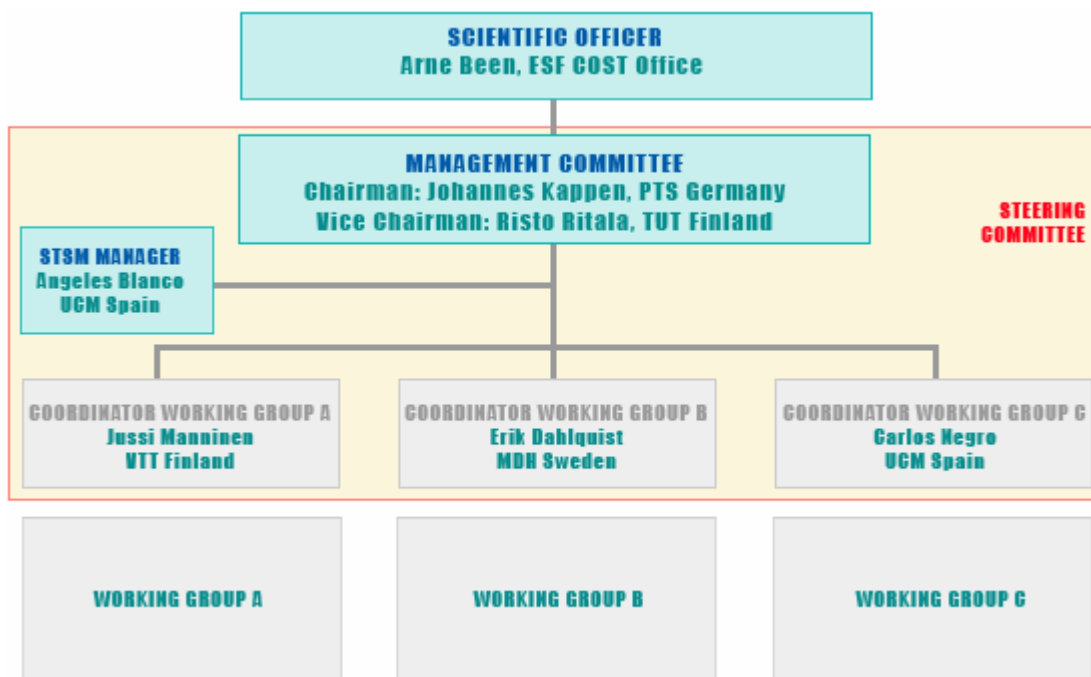
The focus of the third working group is on the exchange of knowledge between the working groups and on fostering the development of simulation tools with a high compatibility across the platforms used. This group will therefore meet on a schedule that is different from that of the other two actions. The third working group will organise dedicated workshops to meet with suppliers and developers of software in order to exchange knowledge and enhance software development.

3.4 Organisation of secretarial services

The coordinative work load is shared amongst the Chairman, the Vice-Chairman, the Working Group leaders and the STSM manager. Support is provided by the Cost office. No additional services have been used until now.

4 PARTICIPATION AND COORDINATION

4.1 Overview



4.2 Management Committee

Johannes KAPPEN (Chairman)

Papiertechnische Stiftung

Hess-Str.134

D-80797 München, Germany

Tel: +49 89 121 4462

Fax: +49 89 121 4636

E-mail: j.kappen@ptspaper.de

Risto RITALA (Vice Chairman)

Tampere University of Technology

Institute of Measurement & Information Technology

P.O. Box 692

FIN-33101 Tampere, Finland

Tel: +358 3 3115 2483

Fax: +358 3 3115 2171

E-mail: risto.ritala@tut.fi

BELGIUM

Denis Dochain, Université Catholique de Louvain / Cesame, Louvain-la-Neuve

DENMARK

John Hoffmann, Hartmann A/S, Lyngby

Hans Ole Mathiesen, Hartmann A/S, Skovlunde

FINLAND

Kari EDELMANN, VTT Processes, Jyväskylä

Jussi MANNINEN (Steering Committee Member, Working Group A Coordinator), VTT

Processes, Espoo

FRANCE

Jean RUIZ, Centre Technique du papier, Grenoble

Guy EYMIN, Centre Technique du papier, Grenoble

GERMANY

Harald GROSSMANN, Technische Universität Dresden, Dresden

NORWAY

Bernt LIE, Telemark University College, Porsgrunn

POLAND

Dariusz ASENDRYCH, University of Technology, Czestochowa

ROMANIA

Elena BOBU, Technical University

Livia BUCSA, University "Lucian Blaga"

SLOVAKIA

Stefan BOHACEK, Pulp and Paper Research Institute, Bratislava

Gabriela SZEIFFOVA, Pulp and Paper Research Institute, Bratislava

SLOVENIA

Adolf MOZE, Slovenian Pulp and Paper Institute, Ljubljana

SPAIN

Angeles BLANCO (Steering Committee Member, STSM Manager), Universidad Complutense de Madrid, Madrid

Carlos NEGRO (Steering Committee Member, Working Group C Coordinator), Universidad Complutense de Madrid, Madrid

SWEDEN

Peter AXEGÅRD, Swedish Pulp and Paper Institute, Stockholm

Erik DAHLQUIST (Steering Committee Member, Working Group B Coordinator), Mälardalen University, Västerås

THE NETHERLANDS

D.M.R. LO CASCIO, TNO-MEP, Apeldoorn

Leon P.A.A. JOORE, Millvision, Raamsdonk

UNITED KINGDOM

Hong WANG, UMIST, Electrical & Electronic Engineering, Manchester

ESF/COST Office

Arne Been, COST Office, Brussels

4.3 Participating Institutions

(List: denomination and country without address)

No additional Institutions are taking part in the action.

4.4 Meetings of the Management Committee

(List: date, place of each meeting)

Date	Place
22.1. - 23.1.2004	Cost Office, Brussels (B)
8.3.2004	Munich (GER, PTS)
22.9.2004	Copenhagen (DK, DTU)
21.10.2004 (only Steering Committee; SC)	Cost Office, Brussels (B)
27.4.2005 (only Steering Committee; SC)	Annecy (F)
7.10.2005	Espoo (Fin, VTT)

4.5 Meetings of the Working Groups

(List: date, place of each meeting)

Working Group	Date	Place
A, B, C	8.3.2004	Munich (GER, PTS)
A, B, C	22.9.2004	Copenhagen (DK, DTU)
A, B, C	27.4.2005	Annecy (F)
A, B, C	5.10.2005	Espoo (Fin, VTT)

4.5 Short-term scientific missions

(List: dates, hosts and nationality of scientists and topics)

Date	Host	Name and nationality of scientist	Topic
19.07- 23.07.2004	PTS, DE	Alvaro Alonso, ES	Comparison of simulation programs.
23.08- 27.08.2004	KCL, FI	Alvaro Alonso, ES	Exchange of information about different software packages for data analysis and modeling.
06.09- 17.09.2004	VTT, FIN	Georg Kamml, DE	Exchange of knowledge on simulation models and optimisation tools.
25.10- 29.10.2004	STFI, SE	Cornelia Lumpe, NL	Applying chemical calculations to WinGEMS models and dynamic modeling.
31.01. – 11.02.2005	PTS, DE	Antti Aikala, FIN	Application of the DOTS toolset.
21.02. – 04.03.2005	UCM,ES	David Ravnjak, SLO	Simulation of polymer behavior
11.04. – 22.04.2005	PTS; DE	Nejc Zakrajcek, SLO	Applicability of specific simulation tools under Slovenian conditions / requirements
02.08. – 31.08.2005	VTT, FI	Esperanza Torres, ES	Exchange of knowledge about the cleanability in closed flow systems and its application to computational fluid dynamic models (CFD)

5 **RESULTS**

(Describe in no more than 2 pages the main results achieved indicating the key scientific and technical outcomes of the Action with a comparison with the international state-of-the art and with a self-assessment of results obtained versus objectives. Describe briefly the progress with respect to timetable and possible problems encountered. Additional documentation like extended scientific reports, proceedings of Workshops, Seminars, Conferences may be provided separately as an annex to the annual Progress Report and should be referred in the report. Describe efforts made and success achieved in involving young scientists).

5.1 **Description of the initial situation as observed in Munich conference**

A first conference was organised in Munich. Being situated in the beginning of the COST Action E 36, it served as an ideal option to define the state, modelling and simulation in pulp and paper has currently reached. Against the background of what has been presented during the two days the following clusters could be identified:

- spreadsheet based object oriented process models,
- tools for monitoring and evaluation of online data,
- model based process optimisation and
- in smaller number, some approaches to model single process steps as the modelisation of the press- or drying section.

One large trend is to upgrade static simulation tools by integration of dynamic abilities into the simulators used. A big issue still to be solved is to define quality parameters for the validity of both, steady state and dynamic simulation models. In many papers more accurate models of the processes were identified as still missing. Thus, one important task will be to develop proper generic models of key processes that ideally will be available for common use within the industry.

5.2 **Working group results**

Working group A

Working group (WG) A looks at the use of modelling and off-line simulation as a R&D tool, for an optimal process design, for use in operator training and trouble shooting. The working group will cover topics that are important for wider use of modelling and simulation for the whole pulping and paper production process. These topics are:

- evaluation, calibration and validation of models
- property characterisation and modelling (e.g. fibres)
- modelling of solid-liquid separation processes (e.g. presses, forming section)
- water system chemistry modelling
- end-product quality modelling

The work is carried out by arranging thematic meetings, where working group members and invited experts present and discuss their approaches to the problem in question. WG A will also help WG C in improving compatibility between different simulation tools for better model portability.

In the spring meeting in Annecy, WG A work concentrated on water removal modelling. During the Espoo meeting in the autumn, fibre property characterisation was the theme. In both occasions presentations were given by research and industrial partners followed by lengthy discussions. The number of industrial participants in the WG is quite high hence providing a fruitful ground for personal contacts and transferring research knowledge to the industry. Wet end chemistry will be the topic for next meeting, and the same theme will be followed up in

spring 2007 in connection with PTS Surface Chemistry conference.

Working group B

WG B will concentrate on the use of simulation models during the operation phase. It focuses on model-based monitoring, simulation-based operations decision support and model-based control.

For this purpose, it is intended to look deeply into multivariable process control, fast data acquisition, high-dimensional data analysis and reduction, non-linear system modelling and multivariable system optimisation.

The thematic focus of the working group is:

- understanding the operator behaviour, decision making
- dynamic optimisation, MPDS, algorithms and applications
- combining physical simulators, grey box models and black box modelling
- model based and/or simulation based diagnostics

Next activities are intended to refine the thematic focus. The benefit and infrastructure analysis on application topics is to be explored. Working group B plans to write a book concerning “Application of Process Simulation in P&P Industry”.

The focus during 2005 has been to organize the writing of a book on Simulation and modelling for Pulp and Paper industry. The content of the book has been discussed at the meetings in Ancy and Espoo, and a detailed content list with responsible persons for each section has been made. During 2006 the chapters of the book will be added and organized with the aim to have the book ready 2007. A number of chapters have already been written. WG A and AG C will supply complimentary chapters to the book. The target group for the book will be process engineers, operators and managers in P&P industry.

Working group C

WG C intends to bring together software developers and (possible) users in order to reach agreements on the contents, features, relevance and performance of software products. Existing software packages should be evaluated. User needs and the goals of further developments are to be established. Discussions will include the development and use of software packages. In addition WG C will take care of integration aspects (simulation software in mill environments).

WG C is specially intended to take care of the knowledge exchange between the WG's and to foster the development of better simulation tools with a high compatibility across the platforms used. This WG will therefore have a different schedule, organising dedicated workshops to meet with suppliers and developers of software in order to exchange knowledge and enhance software development.

WG C has already carried out a survey of all partners in the COST Action E36 to gather information on current software use. In addition, all available software evaluations performed by the partners have been collected and will be processed by WG C. The results of this survey on software use have been published as a mini-booklet. Currently 13 organisations in 8 countries are taking part.

Most important software packages will be presented using different sample models, as well as they will be described in detail by evaluating the results from a survey with questions about software performance that will be sent to software suppliers during 2006. A first sample model has been presented during 2005. Results are being collected and a report will be delivered to all

interested COST E36 members within 2006.

Workshops are planned to cover the topics of software evaluation, mathematical tools for data analysis, neural networks, multivariate analysis, data handling and pre-processing before simulation and on requirement specifications for future simulation tools.

5.3. **Competencies directory**

The Action has analyzed competence categories associated with modeling and simulation of pulping and papermaking processes. This categorization is intended to be used with “competence yellow pages” that allow the research groups to present themselves in a compact and coherent way, and which allows new research groups and organizations utilizing the technology to make searches for partnerships.” Each participant has been asked to provide a “portrait” concerning relevant information. The information has been collected This is to be used to compile the directory that will ultimately be published on the web page.

5.4. **Research project list and FP7 focused activities**

The action has been discussing heavily on how it could properly help participants to prepare for FP7. Information concerning the FOREST PLATFORM has been exchanged. The action is actively supporting the gathering of consortia. In order to do this the MC has decided to do the following:

1. Dedicated workshop on FP7 collaboration (to happen in June 4th 2006)
2. Compile research list as a source of information on partner activities

To prepare the research list the Action has asked all participants to provide a list containing all relevant research activities performed in the filed of modelling and simulation.


6 **DISSEMINATION OF RESULTS**

6.1 **Publications and Reports**

Total number of Publications: 7

6.1.1 **Flyer of the action**

A flyer has been prepared to be used in order to briefly describe the action.



COST E36 - Modelling and Simulation in the Pulp and Paper Industry

E36 is a European COST action on modelling and simulation in the pulp and paper industry to support the scientific exchange of knowledge in this field

Objectives and Benefits

The main objective of the Action is to promote the development and application of modelling and simulation techniques in pulp and paper manufacturing processes. The main benefit will be a better understanding of the mechanisms of the processes and their control loops. This will help to find solutions for currently pending problems in the paper industry: improving the paper quality, optimising the wet end chemistry, enhancing the sustainability and reducing emissions by improving process design, process monitoring and decision support during operation. In the long run this action should also contribute to designing superior or new product properties.

Why this COST action?

- The big questions in simulation are still to be solved or are just about to be solved (paper properties, wet end chemistry)
- The complexity and the high velocity of processes can not any more be mastered by individuals or simple automation tools
- A large number of research projects started or are about to start and probably simulation will be one key issue in PPS
- There is no general awareness in the mills concerning simulation and therefore a need for the dissemination of know-how
- Simulation is a typical future problem solving approach
- Number of applications of simulation tools will have high growth rates in future

Key Figures E36

12 participating countries: Belgium, Finland, France, Germany, Netherlands, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden, United Kingdom

Members MG:
Approx. representing all major scientific papers in the field of Modelling and Simulation in the pulp and paper industry

Members WG's:
> 40 of the most experienced simulation experts in pulp and paper in Europe

Duration: 4 years (22.1.2004 – 21.1.2008)
Budget: approx. 0.6 M€ per year

COST ...

- ... is one of the oldest funding mechanisms of the European Commission
- ... has been established in order to promote the exchange of scientific knowledge within the European Community
- ... is a predecessor of the Networks of Excellence (NoE) set-up within the 6th Framework Programme
- ... is funded by the European Community within the 6th Framework Programme and managed by the European Science Foundation (ESF)

Questions?
www.costE36.org

Contact: Dr.-Ing. Johannes Kappen • phone: +49 (0) 89 12146 462 • Mail: j.kappen@tq.com
Prof. Dr. Risto Tahvanainen • phone: +358 (0) 41 543 1922 • Mail: rtahvan@utu.fi

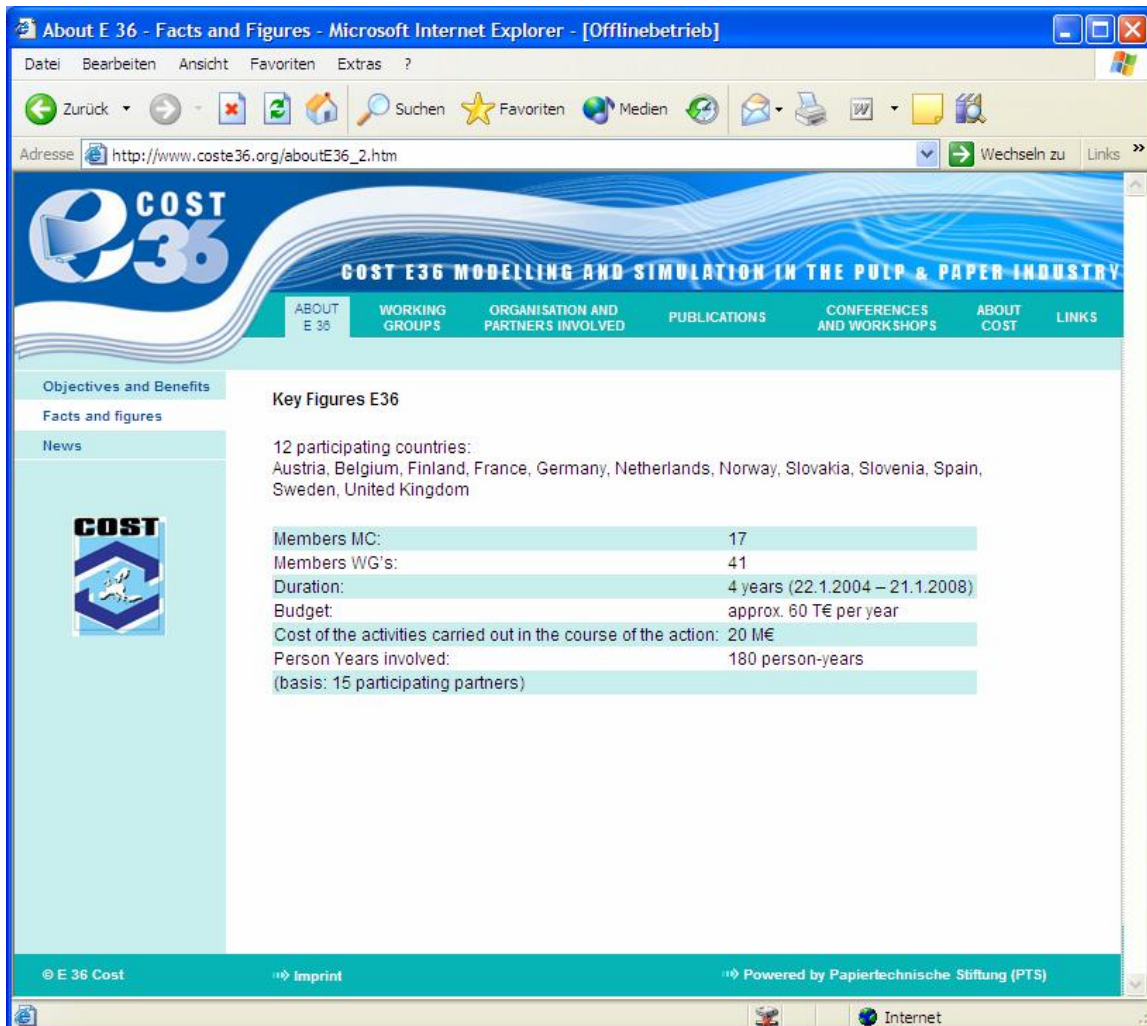
6.2 Conferences and Workshops

Date	Location	Title
9.3. - 10.3.2004	Munich	Simulation and Process Control
28.4.2005	Annecy	Model based decision support (Flexible and eco-efficient paper production through dynamic optimisation of operational tasks and scenarios) in connection with project DOTS
29.4.2005	Annecy	Modelling simulation and decision support system for process technical and economic optimisation - Potential industrial applications and perspectives on new technologies
6.10.2005	Espoo	Model validation

6.3 Web site

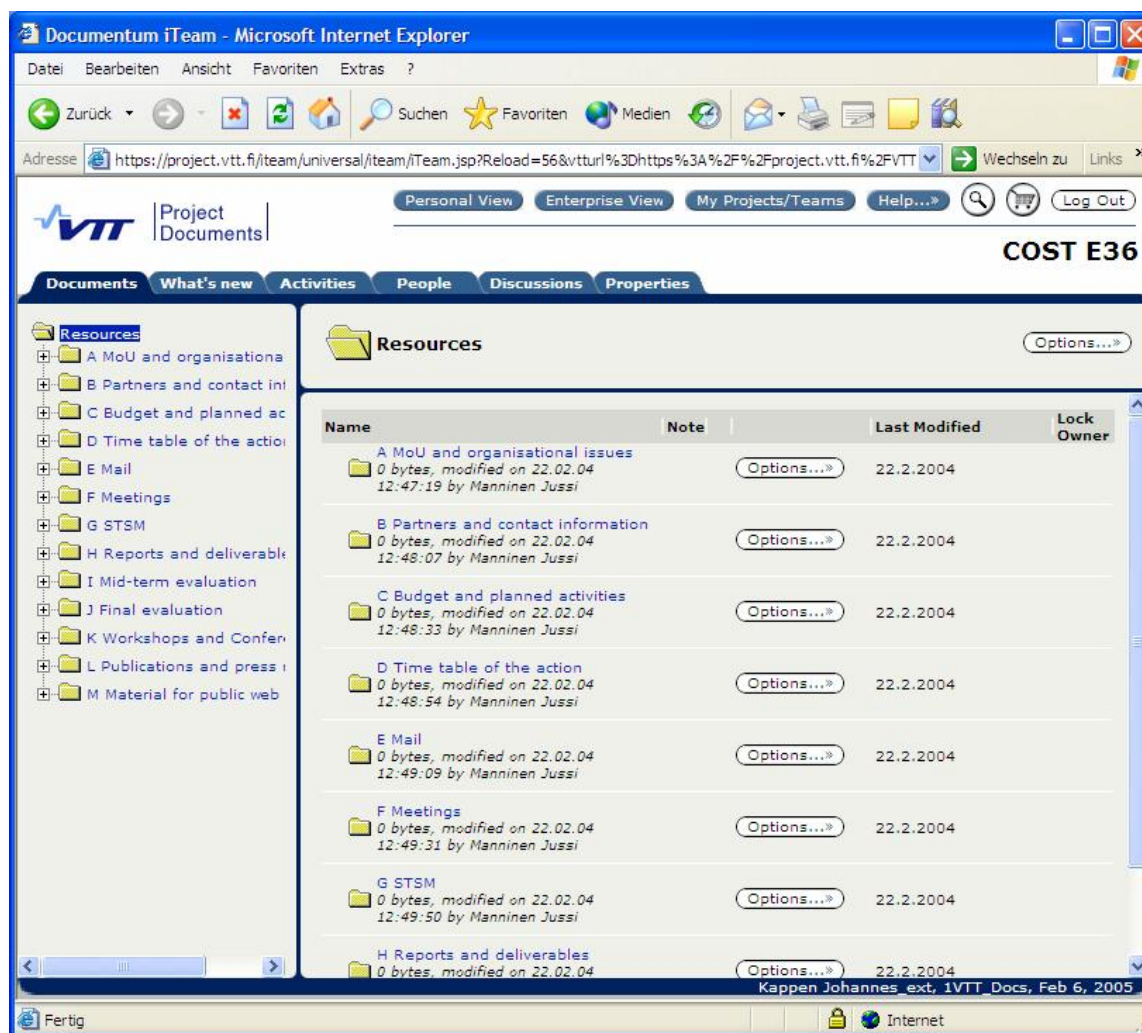
A Homepage has been set up to give a first insight into Cost E36 (Fig. 1). It also is a platform to promote the activities towards the general public. The website is available following the link www.costE36.org. These pages have been set up and are operated by PTS.

Fig. 1 View of homepage Cost E36



In order to support the internal exchange of documents a document system is operated (Fig. 2). This is only available to members of the cost action. These pages have been set up and are operated by VTT.

Fig. 2 View of internal document handling system Cost E36



6.4 Scientific and Technical Co-operation

(List briefly co-operation and contacts established with scientific institutions, with other research programmes, especially in the EU framework programme, and with potential users)

There have been taken actions by Cost E36 to establish a contact with ASIM, the German speaking simulation association and EUROSIM, its European mother institution. To our regret this did not work out until now. Another attempt in 2005 did not succeed. Other forms of collaboration will be tested in 2006. COST E 36 is actively supporting the Mathmod Conference in Vienna in Feb 2006 by providing a whole session of presentations.

6.5 Transfer of results

(List briefly co-operation and contacts established with the Commission, with normalisation and standardisation bodies, with industry and operators)

WG A maintains mainly contacts with the industry through the regular industrial representations in the group (Voith, Andritz, Hartmann, Nalco)

WG B is planning a meeting to get operators views on the use of modelling and simulation results in daily practice.

WG C will send the 'Main Specifications of different software packages' survey to simulation software suppliers in order to evaluate selected software packages and discuss options for further improvement, as well as presentations with a dynamic sample model will be carried out during 2006.

The conference “**Modelling simulation and decision support system for process technical and economic optimisation - Potential industrial applications and perspectives on new technologies**” in Annecy has been the most important instrument to involve industry into the action E36 in **2005**:

This conference proposed to express how the research work can lead to industrial applications and to outline prospects for these new technologies. André Bauer, Production Director at Papeteries de Clairefontaine and Chairman of Conferences, expressed his conviction that these new modelling and simulation tools would contribute to the high-performance of machines. This was followed by a series of high level presentations from high level researchers, equipment suppliers and paper mill managers. Mats Hiertner, a publication paper specialist at Stora Enso research centre (Finland), was asked to answer to the question “When is simulation applicable?” He showed a simulation model printout of the Stora Enso multi-purpose and universal digital machine as a result of a three-year development project. “The simulation programme went well. The aim was to reduce trials on machine”. But the demand for using this model did not occur. Hence the conclusion: “A specific simulator to solve specific problems is necessary”. Other (smaller) simulation projects proved to be beneficial. But Hiertner made a categorical statement: “For a successful simulation, problems to be solved must be clearly defined; no necessity to make too complicated models”. In conclusion, it is necessary to make simple and offer an economic benefit”. Further information can be found on the homepage of the action and a cited publication (“**Conference europeennes Atip - De la recherche a l'industrie**”). At the end of the meeting, both studious and friendly, participants had quality information to share with their companies and colleagues in view of next projects.

6.6 Contacts in the ERA

(List the contacts, if any, with other activities in the European Research Area (ERA), e.g. integrated or targeted projects, NoE, EUROCORES, etc.)

The Action has been in contact with EU/FW5 project DOTS (G1RD-CT-2002-00755) which is developing dynamic optimization for paper machine applications. There is a strong synergy between Cost E36 and DOTS in that DOTS relies on dynamic process models. The results of DOTS have been presented and discussed both in March meeting Munich and in September meeting in Copenhagen. The action continued the close cooperation with EU/FW5 project DOTS (G1RD-CT-2002-00755) on dynamic optimization for paper machine applications till the projects completion in the end of February 2005. In conjunction with COSTE36 workshop in Annecy, France a DOTS post-project seminar was arranged. With this event and other activities within COSTE36, the results of DOTS have been widely disseminated. In current and future research of COSTE36 participants the need of dynamic optimization will be well understood and the opportunities that dynamic optimization offers in taking the modeling and simulation to an operator tool will be considered

SIM-SERV is a FW5 NoE that was completed in the end of October 2004. SIM-SERV promotes simulation as a practical tool for process industries and is thus closely related to COSTE36. SIM-SERV aims to sustain and develop its activities as a not-for-profit organization offering assistance in finding competent partners for building practical simulation applications. COSTE36 will support SIM-SERV in this task by making its partners aware of SIM-SERV and

by seeking joint actions.

ECOTARGET is a FP6 IP that started in November 2004 developing new technologies for pulp and paper industry. The main simulation activities in the project are very closely related to COSTE36. The Action provided contact ground in the spring of 2004 to compile the simulation project team for Ecotarget, and an STSM in September 2004 provided means for one of the key members in the team to prepare for the work. Since all key team members are active in the Action, COSTE36 provides opportunity to host Ecotarget project meetings after the Action meeting.

7 ECONOMIC DIMENSION

7.1 Total manpower

(List estimate of total manpower expressed in person-year dedicated to the activities of the action for each year and the total duration of the action)

Year	Manpower (person years)
2004	50
2005	55
2006	
2007	
2008	
Total (estimated)	180

7.2 Funds received

(List funds received from the COST budget for each year and for the entire duration of the Action utilised for Secretariat, Publications, Workshops and Seminars, MC meetings, Short-Terms scientific missions, other and Total)

Date	Funding	Title
22.1. - 23.1.2004	8867	MC Kickoff Meeting, Cost Office, Brussels
8.3.2004	27508	MC and WG-Meetings, Munich
9.3. – 10.3.2004	3000	Conference, Munich
22.9.2004	22467	MC and WG-Meetings Copenhagen
25.10.2004	4107	SC-Meeting, Cost Office, Brussels
2004 Total	68293	
27.4.2005	34690	WG and SC-Meeting, Annecy
28.4.2005	9000	Workshop, Annecy
5.10. - 7.10.2005	17173	WG and MC-Meeting, Espoo
6.10.2005	1690	STSM, Munich
Total 2005	62555	

8 SELF EVALUATION

(only in the last annual progress report)

Indicate, in no more than 1 page, what were, in the opinion of the MC, the main successes, the drawbacks (if any) and the key difficulties encountered (if any).

APPENDIX 1: Action identification data

Action Overview

COST Action E36

Title: *"Modelling and Simulation in Pulp and Paper Industry"*

Domain: Forests and Forestry Products

MoU:

Entry Into Force: 9/10/2003¹ **CSO Approval:** 6/02/2003

End of Action or Prolongation: 21/01/2008² **1st MC:** 22/01/2004

Total Number of Signatories: 13

Belgium	9/10/2003	Denmark	6/10/2004	Finland	31/10/2003
Germany	9/10/2003	Netherlands	15/10/2003	Norway	25/06/2004
Poland	17/02/2006	Romania	23/03/2004	Slovak Republic	15/10/2003
Slovenia	9/10/2003	Spain	8/10/2003	Sweden	9/10/2003
United Kingdom	2/12/2003				

Non Cost Institutions participating:

None

Working Groups:

None

Science Officer & Management Committee Chair:

Mr Arne BEEN Secretariat (Science Officer)

Mr Johannes KAPPEN Management Committee (Chair)

Papiertechnische Stiftung

Hess-str. 134

80797 München

Germany

Publications:

7

Website: <http://www.coste36.org/>

Publications:

Kappen J. und Ch. Bienert (Hrsg.)
München: PTS 2004; PTS Symposium Simulation and Process Control for the Paper Industry PTS-MS 441

Johannes Kappen, Erik Dahlquist, Jussi Manninen, Carlos Negro, Risto Ritala
A big leap forward – The new European COST Action E 36 "Modelling and Simulation in the Pulp & Paper Industry"
Lyngby, SIMS 2004, DTU, Danish Technical University, September 23rd – 24th 2004.

A. Alonso, A. Blanco and C. Negro
Mini-Booklet concerning the use of simulation software 'Use of simulation software in the Pulp and Paper Industry' Edited by COST E36 Action.
Madrid, 2004

Daniele Bouvron
Conference europeennes Atip - De la recherche a l'industrie
Revue du Papier Carton 80, May-June 2005

A. Alonso, A. Blanco, C. Negro and I. San Pío
UCM and HPM, 2005
Validation as a crucial step for improving robustness of models: Application to paper quality predictions
COST Workshop Model validation
Espoo, October 6th 2005

J. Kappen, J. Manninen and R. Ritala
Espoo: VTT 2005,
COST Workshop Model validation
Espoo, October 6th 2005
ISBN 951-38-6300-X (URL:<http://www.vtt.fi/inf/pdf/>)

Angeles Blanco, Eric Dahlquist, Johannes Kappen, Jussi Manninen, Carlos Negro and Risto Ritala
Modelling and simulation in the pulp and paper industry – current state and future perspectives
(to be published soon)

Website: <http://www.coste36.org>