COST WORTH

<IMS-02005>

Deliverable D11

Final Report

Document Ref.:	D11 FInal Report.Doc			
Report Version:	Definitive			
Date:	30.03.2006			
Project Co-ordinator:	CARSA		E	
Consortium Partners:	LMS	GR	TRIMEK	E
	LAMAPLAST	GR	CATT	AU
	VIORAL	GR	SCHNEIDER	AU
	ATB	GE	PANHANS	AU
	BRÜGGEN	GE	ETH	CH
	THIELE	GE	ELRO	CH
	CIMRU	IR	TRIBECRAFT	CH
	INAEL	ES	SERTO	CH

COST-WORTH

<IST–2001-52223>

Authors:

CARSA

ATB

CATT

LMS

CIMRU

Distribution:

Partners
(Reviewers)
(CEC)

CHANGE LOG

Version	Date	Change
0.1	24.02.2005	Creation of the document
0.2	16.03.2005	First draft version
0.3	17.03.2005	Draft version updated with Industrial partners contributions
1.0	10.06.2005	Final draft version
2.0	1620.06.2005	Review version with the reviewer comments
2.1	22.06.2005	Second final draft version
2.2	30.03.2006	Final version

CONTENTS

ABBREVIATIONS

A&C	Analysis and Conception phase
ATB	Institute for Applied Systems Technology Bremen GmbH
BPR	Business Process Re-engineering
BEP	Best Enterprise Practice
CBR	Component Based Re-engineering
CATT	CATT Innovation Management GmbH
CIMRU	Computer Integrated Manufacturing Research Unit
COST-WORTH	**CO**aching **S**upport **T**ool to better identify **WOR**king process improvements **TH**rough introduction of Intelligent Manufacturing Systems Solutions
EC	European Commission
e.g.	"exempli gratia" = engl. For example
etc.	etcetera
HW	Hardware
I	Implementation phase
ICT	Information and Communication Technology
i.e.	"id est" = engl. That is
IMS	Intelligent Manufacturing Systems
IMSS	Intelligent Manufacturing Systems Solutions
IST	Information Society Technology
IT	Information Technology
ISO	International Organisation for Standardisation
n.a.	Not applicable
M&T	Methods & Tools
resp.	respective
SAC	Specification and Selection phase
S&S	Specification and Selection phase
SME	Small and Medium sized Enterprises
SW	Software
WP	Workpackage
w.r.t.	With respect to

1 Project overview

Identification

Project number: IST 52223

Project acronym: COST-WORTH

Project title: **CO**aching **S**upport **T**ool to better identify **WOR**king process improvements **TH**rough introduction of Intelligent Manufacturing Systems Solutions

Key Action: II; Action line:

Web address: www.cost-worth.net

CONSORTIUM COMPOSITION:

No.	Partner Indicator – Name	Country	Type	Business activity	RTD role in the project
1	RTD 1 CARSA	E	RTD and consultancy	RTD and consultancy service on innovation, technology and internationalisation management	Requirements Analysis, Planning & Control of Introduction Dissemination and Exploitation Project Co-ordinator
2	RTD 2 LMS	GR	RTD	Research in the field of Information Technology, Electronics and Interfacing of ICT systems	Local coordinator in Greece. Support for Greek Industrial SMEs
3	End-User 1 LAMAPLAST	GR	Ind. Partner	Design and production of plastic articles. (injection moulding)	End-user, business/test case1: Intelligent Workplace for Maintenance
4	End-User 2 VIORAL	GR	Ind. Partner	Castings from automotive & electronic parts for domestic appliances and lighting industries.	End-user, business/test case2: Knowledge Management for product/process improvements
5	RTD 3 ATB	D	RTD and consultancy	Research and Consultancy Service for Business Process Improvement and ICT System Introduction	Methodology provider (BEP methodology). Local coordinator in Germany Mentor for German business cases

No.	Partner Indicator – Name	Country	Type	Business activity	RTD role in the project
6	End-User 3 BRÜGGEN	D	Ind. Partner	Manufacturing of change over platforms	End-user, business/test case 3: Extended enterprise – supplier integration
7	End-User 4 THIELE	D	Ind. Partner	Manufacturing of armoured cars and adaptation of cars on customer demand.	End-user, business/test case 4: Remote Computer Aided Manufacturing
8	RTD 4 CIMRU	IRL	RTD	Research and Consultancy Service for Improvement of Organisation Management and ICT System Introduction	Navigator development
9	End-User 5 TRIMEK	E	Ind. Partner	Measuring systems and machinery manufacturer.	End-user, business/test case 5: After sales and product support
10	End-User 6 INAEL	E	Ind. Partner	Manufacture, mounting, importation and commercialisation of electrical materials	End-user, business/test case 6: Sales Strategy Management via Information Integration
11	RTD 5 CATT	A	RTD consultancy	Developments in the field of methodologies for advanced ICT integration and performance measurement techniques	Measurement Tool development. Support for Austrian Business cases.
12	End-User 7 SCHNEIDER	A	Ind. Partner	Manufacturing entity of garage doors.	End-user, business/test case 7: Decision support tool for strategic controlling
13	End-User 8 PANHANS	A	Ind. Partner	Manufacturing entity. Beam saws manufacturer.	End-user, business/test case 8: Customer Relationship Management

1.1 Introduction:

This project was defined aiming at developing a methodology for helping traditional manufacturing SMEs to improve their manufacturing and business processes.

This should be done through the use of an innovative, internationally recognised, integrated, application-oriented and practicable methodology to be developed under the frame of this project. Such methodology should include a set of tools, combining coaching oriented support scheme and component based business re-engineering approach.

The methodology to be developed within the frame of the project should cover all stages in the redefinition of a manufacturing process. Namely: (1) **analysis and concept phase** starting from the identification of the weak points in the company which have to be improved by the new technology and new business structures, (2) **specification & selection phase** and (3) **implementation phase** covering introduction and utilisation of the improvement actions.

In the scope of this project, a methodology framework has been developed providing a unique, consistent and comparable representation of different coaching oriented methodologies. This organised and structured framework of available coaching oriented business process re-engineering/improvement methodologies as well as a navigator system represents key parts of the COST-WORTH Toolbox, enabling SMEs to easily select the most appropriate one(s) for their use in respect to their actual business situation and strategic objectives. For the individual methodologies the COST-WORTH Toolbox also provides references for the support of the application of a specific methodology up to the complete access to the support material required for the application of a selected methodology at a SMEs site.

The COST-WORTH Toolbox makes available different coaching oriented business process re-engineering/improvement methodologies, supporting SMEs to continuously improve their business processes by the efficient introduction of new organisational structures and work practices supported by advanced ICT technological solutions.

To support SMEs in the selection of the most appropriate methodology w.r.t. their actual business situation and objectives, the COST-WORTH Toolbox provides a set of supporting tools. For this purpose the Methodology Framework structured all methodologies inserted in the COST-WORTH Toolbox according to the Methodology Independent Reference Scheme, enabling to present the methodologies in a unique, consistent and comparable way. Furthermore a Navigator tool is provided supporting SMEs with the selection process of a coaching oriented methodology most appropriate for their use.

Moreover the COST-WORT Toolbox addresses also methodology providers / support organisations to represent and provide their methodologies and services, enabling them to insert and/ or update their coaching oriented methodologies in accordance to Methodology Framework requirements. The overall structure, representing the set of tools of the COST-WORTH Toolbox, is presented in Figure 1 .

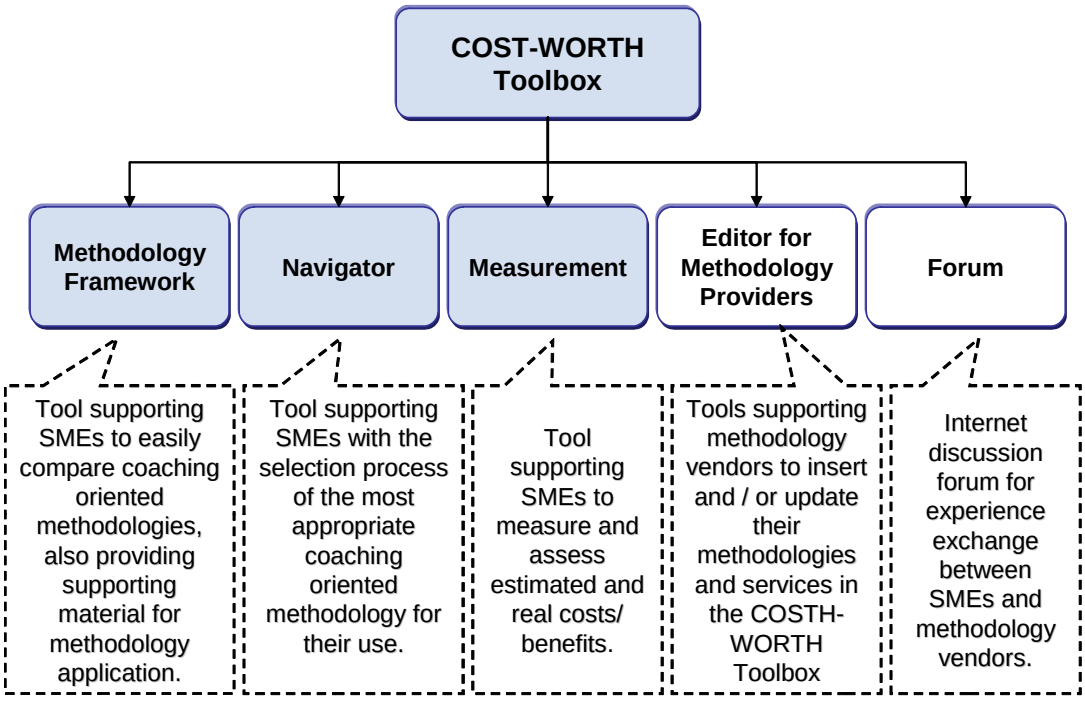


Figure 1 Structure and Elements of the COST-WORTH Toolbox

1.2 Project deliverables

Deliverables list

Id	Deliverable	Resp. Partner	Origi-nal due date	Re-vised due date	Actual delivery	Status	Details of approval reference Estimated date for submission
D 1	COST-WORTH Toolbox Requirements & Concept Definition	CARSA	M6	M6	M7	Approved	According to Reviewers Report on Re-vised PPR3, Revised D5.2 and D6
D2	Project Presentation – *World Wide Web* page	CARSA	M3	M3	M3	Approved	09/05/03. // 14/03/05
D3.1	Definition & Specification of M&T for Analysis & Conception Phase	LMS	M9	M9	M10	Approved	According to 2nd RMR
D3.2	Definition & Specification of M&T for Specification & Selection Phase	ATB	M15	M15	M15	Approved	According to 2nd RMR
D3.3	Definition & Specification of M&T for Implementation Phase	CARSA	M22	M22	M22	Approved	According to Reviewers Report on Re-vised PPR3, Revised D5.2 and D6
D4.1	Design and Development of M&T for Analysis & Conception Phase	LMS	M9	M9	M12/M15	Approved	According to 2nd RMR
D4.2	Design and Development of M&T for Specification & Selection Phase	ATB	M15	M15	M15	Approved	According to 2nd RMR
D4.3	Design and Development of M&T for Implementation Phase	CATT	M22	M22	M22	Approved	According to Reviewers Report on Re-vised PPR3, Revised D5.2 and D6
D5.1	Test Results of Analysis & Conception Phase	LMS	M9	M12	M15	Approved	According to 2nd RMR
D5.2	Test Results of Specification & Selection Phase	ATB	M15	M18	M18	Approved	11/02/05
D5.3	Test Results of Implementation Phase	CATT	M26	M26	M28/M30	Approved	03/03/05
D6	Complete Description of Methods & Tools	LMS	M26	M26	M27	Approved	According to Reviewers Report on Re-vised PPR3, Revised D5.2 and D6
D7	Measurement of Application Results	CATT	M30	M30		Approved	According to 2nd RMR
D7.1	Definitions & Specification of the Measurement Concept	CATT	n.a.	n.a.	M13	Approved	According to 2nd RMR
D7.2	Design & Development of the Measurement Concept	CATT	n.a.	n.a.	M13	Approved	According to 2nd RMR
D8	Optimised Methods & Tools	ATB	M30	M30		Approved	17/03/05
D9	Measurement of Business Results	CARSA	M30	M30		Approved	14/03/05
D10	Dissemination and Use Plan - First Draft - Final Version	CIMRU	 M9 30	 M9 ,30	M7	 Approved Approved	 According to 2nd RMR 17/03/05
D11	Final Report	CARSA	M30	M30		Submitted	First version 17/03/05

D12	Technological Implementation Plan (e-TIP).	CARSA	M32	M32		Submitted	17/03/05
PPR	Periodic Progress Reports						
	PPR1	CARSA	M6	M6	M7	Approved	According to 2nd RMR
	PPR2		M12	M12	M14	Approved	24/01/05
	PPR3		M18	M18	M20	Approved	17/02/05
	PPR4		M24	M24	M26	Approved	17/03/05
	PPR5		M30	M30		Submitted	

2 Project objectives

In reference to the project objectives, the COST-WORTH Toolbox will enable an integration and enhancement of existing, as well as to be developed and up-coming new methods and tools, supporting SMEs to improve their processes in combination with the introduction of advanced ICT. The COST-WORTH Toolbox represents a framework, covering all phases of an improvement life-cycle and all key fields of improvement to be addressed by SMEs. From an application point of view, a selection of methods and tools out of this framework must be enabled, representing a valid combination of possible methods and tools, aiming at the generation of sound decision references for the management level, the key driver of any innovation process in SMEs.

This framework is open to any methodology world wide, also taking into account different cultural aspects w.r.t. the methodology application in the context of IMS, such as introduction of ERP systems, PPC systems, procurement systems, marketplaces etc.. According to this background the following key characteristics of the COST-WORTH Toolbox can be stated:

- provision of an open framework architecture, enabling an integration of existing methods and tools,
- coverage of all phases of the improvement process,
- extendibility of the methodology framework by new methods and tools,
- applicability for different improvement domains (company internal ICT, E-Business etc.),
- selection support of a methodology for the appropriate business case by the toolbox navigator.
- provision of a concept which fulfils all requirements for sound, management based, decisions.

In the following the toolbox architecture, the navigator, the methodology editor, the measurement tool and the Discussion Forum will be described.

The main milestones defined were the following:

Milestone Date	Objectives to be accomplished
Milestone 1 January ‘03:	Finalised detailed identification of the user requirements and elaboration of the methodology concept, including identification of available methods and tools.
Milestone 2 October ‘03:	Toolbox concept refined, Methods and tools designed, specified, developed and integrated. Finalised specification of methods & tools, early prototypes developed.
Milestone 3 May ‘04:	Toolbox concept refined. Methods (guidelines, procedures) and tools (full prototypes) developed, results of prototype testing (intermediate results)
Milestone 4 September ’04:	Results of testing & verification of the methodology by the end-users.
Milestone 5 January ’05:	Finalised measurements of the business benefits of the methods & tools and optimisation of the methodology.

3 Project results and achievements

The outcomes of the COST-WORTH Project are the COST-WORTH Toolbox and the customised partners' coaching oriented methodologies. Both products will be described in detail in the following sections.

Starting point for the integration of first coaching oriented methodologies in the COST-WORTH Toolbox were the 3 methodologies of the participating RTD partners from the EU (ATB, CARSA, and CIMRU). This approach was selected, because partners have a deep understanding of their methodologies, as well as already practical experience with their application. They also have the authority as well as expertise to enhance/modify their methodologies in respect to identified coaching oriented requirements.

The RTD activities on the methodologies were twofold. On the one hand the methodologies served as references to support the identification of the COST-WORTH framework structure:

- Based on the analysis of the different methodologies to identify the common inherent structure of phases or activities of the lifecycle structure and the classification of results created.
- Based on the methods and tools applied by the different methodologies and other features in respect to their execution, identification of the methodology specific information to be presented in the reference structure.

On the other hand, based on the elaborated COST-WORTH framework structure, the required extensions and/or modifications of the specific methodologies were identified addressing the following topics:

- Which steps of an improvement process are covered by the specific methodology?
- Which extensions are required to fulfil all criteria of coaching oriented methodologies?
- Which potential combinations of modules of a specific methodology with other modules of phases or activities of other methodologies are beneficial from user point of view and which modification were required to realise this combination?
- Are there modified of the methodologies required to address the strategic improvement focus already envisaged or based on the analysis of the different business cases?
- Which information are required for the representation of methodologies in the COST-WORTH framework and based on this experience create a guideline for the implementation of a new methodology in the COST-WORTH Toolbox?
- Which support documentation has to be prepared and how it must be presented in the Toolbox, to enable the application of the methodology (handbook, training material, result documentation templates etc.)?

In respect to the above stated, the RTD activities addressing the framework development and the extension and modification of the initial addressed methodologies represent an iterative process, as specified in the WP-description of the DOW: Starting from an initial

elaborated concept of the methodology framework (presented in D1), its detailed structure and type of methodology representation could first be defined, based on the implementation of the different RTD partner methodologies, validated and optimised in the scope their application in the different business cases. This is also valid for the final realisation of the Navigator and measurement concept.

3.1 Objectives Vs Results

Comparing the objectives proposed in the Technical Annex, with the achievements reached by the project, the analysis that can be appointed are detailed in the table bellow.

Objectives addressed	*Results achieved*
1- To create an innovative, internationally recognised, integrated, application-oriented and practicable COST-WORTH methodology including set of methods and tools	The Toolbox developed contains the COST-WORTH methodology, including 5 complete methodologies with their own support material and tools to be executed. The Toolbox has been presented in 3 International conferences, and invited to be presented in a fourth one, out of the scope of the countries participating in the project.
2- The methodologies should be based on a coaching approach and focus upon the effective implementation of organisational improvements and IMSS, with a component based business re-engineering approach to support manufacturing SMEs	The coaching and the component-based approaches have been discussed during the first months of the project, and finally detailed described in the report "*COST-WORTH Toolbox Structure and Glossary_v1.0.doc"*. Based on this criterion, methodologies to be included in the Toolbox were selected and properly customised so that final user could run them by their own, at least partially.
3- Assurance of the achievement of the short- and long-term business objectives of the SMEs Identification of simple, robust and efficient solutions adequate to the needs of SMEs	Solution to be proposed by the methodologies should be completely aligned with the strategy of the firm. In this sense, only methodologies accomplishing this requirement were candidates to be included in the Toolbox.
4- Establishment of an innovation culture in the whole company.	The involvement of all the company staff in the project tasks has showed the crucial importance of the maintenance of continuous improvement activities. This change in innovation culture in the companies can be summarised with the sentence "Problems are not judged as problems any more, but

	as challenges," told by an industrial partner.
5- Easy to learn by the employees in the company in order to enhance the individuals and companies to learn and to adapt to permanent changes	The support material (handbooks and tools) included in the Toolbox have allowed the increase of the skills in the company staff (using DFD, Flowcharts, Gantt diagrams, etc.)
6- Traceability of the solutions and approaches for all participants in the improvement process in order to serve as efficient decision tools at different levels of the company	Tested methodologies support fast and clear management decisions. All information required for sound management decisions were available at any time of the improvement process
7- Reproducibility of the procedure	The industrial partners feedbacks and comments have showed that the initial difficulties to properly understand the methodology have became lower with the project advance and the deeper involvement in the project. The SMEs are now capable to run by themselves the COST-WORTH methodology.
8- Effective combination of organisational, technological and knowledge aspects addressed in the scope of the ICT incorporation, as a part of the overall improvement process.	A critical aspect for the success of the improvement measures is the commitment and the active role of the staff on operational level. This also guarantees high acceptance of the elaborated solution between company employees.

Hints on future research

The results of this project can establish the starting point for future initiatives in the scope of the introduction of new systems and tools in manufacturing SMEs following a successfully tested scheme.

COST-WORTH Toolbox (methodology framework) will guide to industrial SMES in the IMSS implementation to improve the business processes. The implementation of future and emerging technologies, like those based in Ambient Intelligent concepts applied to manufacturing environments, or in pervasive computing tools, etc. will be supported by the COST-WORTH Toolbox.

3.2 COST-WORTH Toolbox

3.2.1 Starting point

In the scope of the IMS-project COST-WORTH a methodology framework has been developed providing a unique, consistent and comparable representation of different coaching oriented methodologies. This organised and structured framework of available coaching oriented business process re-engineering/improvement methodologies as well as a navigator system represents key parts of the COST-WORTH Toolbox, enabling SMEs to easily select the most appropriate one(s) for their use in respect to their actual business situation and strategic objectives. For the individual methodologies the COST-WORTH Toolbox also provides references for the support of the application of a specific methodology up to the complete access to the support material required for the application of a selected methodology at the SMEs site.

The COST-WORTH Toolbox should also had be open to incorporate further coaching oriented methodologies of other providers' worldwide. Its Internet accessibility represents a fundamental novel approach of representing and tailoring improvement methodologies aiming at a maximum benefit for SMEs worldwide.

3.2.2 Essential features of the COST-WORTH Toolbox

As stated above, the key objective of the development of the COST-WORTH methodology framework was to create a matrix type of structure reflecting a methodology independent and methodology dependent reference scheme for the representation of different coaching oriented methodologies.

For the methodology independent reference scheme the improvement process life-cycle structure was selected as the key reference structure. Based on the analysis of the inherent structures of partner's methodologies and the analysis of different life-cycle models standards addressing the ICT procurement [Pulse 1998], the business process improvement in organisations and business process modelling [ISO 15704], as well as the ICT development process [ISO 15504-2]), the methodology independent reference scheme of the methodology framework resulted (see Figure 1).

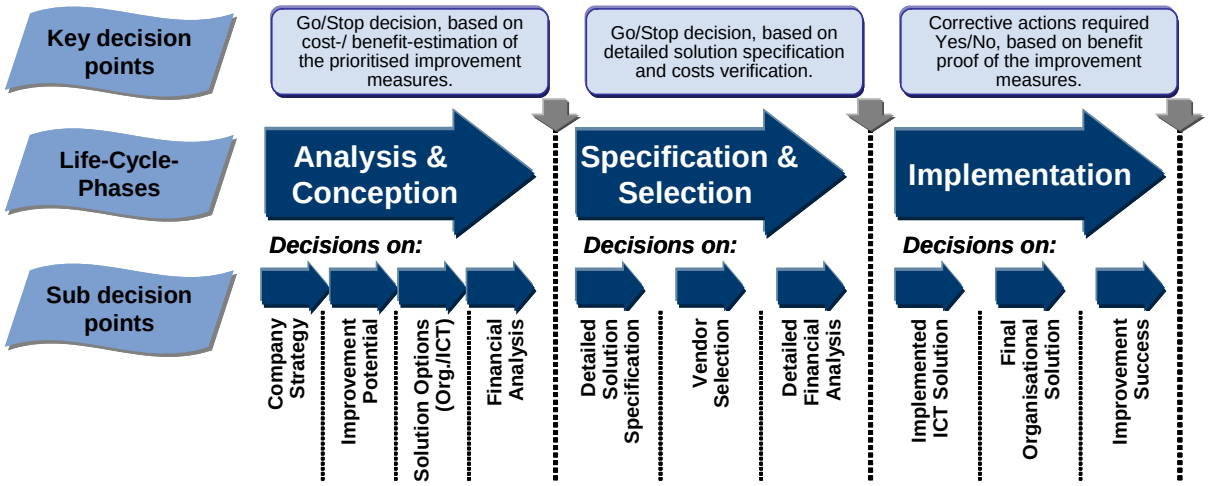


Figure 1: The COST-WORTH Methodology Independent Reference Scheme.

Thereby, the methodology independent reference scheme of the COST-WORTH framework architecture is based on the fact, that any improvement life cycle in a company is driven by management decisions with respect to organisational, technical, financial and other management aspects. Thereby a two level decision point hierarchy was identified as most appropriate:

- ***key decision points***, representing top level management decision points along the improvement life cycle, driving the entire improvement process, where these decision points are in consistence with key phases of the entire improvement life-cycle and
- ***sub decision points***, representing a sequence of subsequent decision processes on the operational level of the company along a life-cycle phase, to elaborate the decision information (organisational, technical, financial etc.) required at the key decision points (top level management decision).

W.r.t. this reference scheme the coaching oriented methodologies are presented in the methodology framework. Therefore for each sub decision point the methodology specific information had been added to this methodology independent framework. To create a structured and for users informative representation of the methodologies the information to be presented is specified too.

For a comparison of methodologies at each sub decision point the methodology specific worksteps to be executed have to be described, as a set of activities instructed by a methodology creating the required decision information. Furthermore, to provide a better understanding of the execution of each workstep, the specified procedures (Set of Procedures - SP) to be carried out have to be described, as well as the applied methods and available supporting tools (Applied Method and Tools - AMT). In addition, to enable a better evaluation of the methodology execution by the user, further execution characteristics/ metrics (e.g. needed effort, time required etc.) for the different work steps of a methodology are presented (Set of Additional Characteristics - SAC).

Based on this definition of the basic elements of the Methodology Dependent Reference Structure, the overall interrelation of these elements is presented in the following Figure 2.

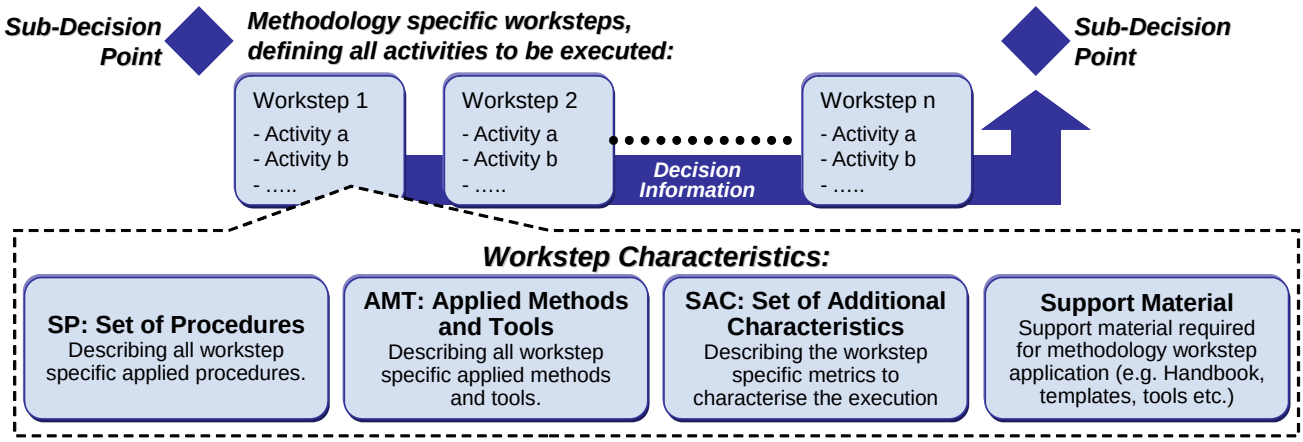


Figure 2: Overall Interrelation of the Basic Framework Architecture elements.

For the application of a selected methodology, the end-user needs specific guidelines and working instructions etc. concerning how to apply the selected methodology. Therefore, the methodology framework also provides a consistent structure for the representation of the support material required for application of the different methodologies. The end-user will find w.r.t. above presented reference scheme for any methodology inserted in the Methodology Framework the following information:

- For each methodology an overview description of the methodology is provided, as well as the description of the strategic improvement focus addressed by the methodology. Furthermore references are stated, offering support for application of a methodology (e.g. interest groups, consultants, web references etc.). Attached for any methodology a handbook, providing specific guidelines and instructions for execution of the work steps, must be provided.

- For each phase (A&C, S&S, I) of each methodology an overview description of the phase is provided. Attached for each phase (A&C, S&S, I) of each methodology, methodology specific information in respect to the methodology independent COST-WORTH framework is represented. Optionally supporting material for methodology application (e.g. training material, documentation templates, software tools etc.) can be provided for each phase of each methodology.

3.2.3 Toolbox Product Description

The COST-WORTH Toolbox makes available different coaching oriented business process re-engineering/improvement methodologies, supporting SMEs to continuously improve their business processes by the efficient introduction of new organisational structures and work practices supported by advanced ICT technological solutions.

To support SMEs in the selection of the most appropriate methodology w.r.t. their actual business situation and objectives, the COST-WORTH Toolbox provides a set of supporting tools. For this purpose the Methodology Framework structured all methodologies inserted in the COST-WORTH Toolbox according to the Methodology Independent Reference Scheme, enabling to present the methodologies in a unique, consistent and comparable way. Furthermore a Navigator tool is provided supporting SMEs with the selection process of a coaching oriented methodology most appropriate for their use.

Moreover the COST-WORT Toolbox addresses also methodology providers / support organisations to represent and provide their methodologies and services, enabling them to insert and/ or update their coaching oriented methodologies in accordance to Methodology Framework requirements. The overall structure, representing the set of tools of the COST-WORTH Toolbox, is presented in Figure 1 . The Toolbox elements are:

- **Methodology Framework:** It represents different available coaching oriented process re-engineering methodologies in a unique, consistent and comparable way. All enhanced/ developed five coaching oriented methodologies and their worksteps currently integrated in the toolbox, are classified in accordance to methodology framework.

- **Navigator Tool:** the Navigator Tool helps SME's to easily select the most appropriate methodology(s) or analysis and conception phase of a methodology for their use in respect to their actual business situation and objectives.

- **Measurement Tool:** the COST-WORTH Toolbox provides a software tool supporting the verification of the cost/benefit ratio valid for all methodologies (the process indicator related measurement approach is methodology as well as business case dependent). The key approach of these tools is based on a comparison between the estimation of the financial benefits (determined from the measured process indicators) and costs for the realisation of an IMSS (labour efforts, investment costs for hardware, software and infrastructure etc.). The resulting calculation of the Pay-Back-Period is also provided. The tool supports a direct comparison of estimated and measured values along the improvement life-cycle.

- **Editor for Methodology Providers: The web-based COST-WORTH Toolbox is fully open** to incorporate further coaching oriented methodologies of other methodology providers' worldwide. Therefore the Methodology Framework Editor is needed, enabling and supporting the methodology developers to insert and / or updated their methodologies in accordance to the framework requirements and inserted those in the web-based COST-WORTH Methodology Framework.

- **The Forum Tool:** Intends to foster the experience exchange between SMEs. The provided worldwide open discussion forum aiming at an exchange of lessons learnt on the application of coaching oriented methodologies, e.g. also covering case studies. This feedback may also be helpful for the methodology owners, to improve their methods and tools based on such feedback.

3.3 General benefits reached from applying the methodologies included within the Toolbox

The characteristics of the COST-WORTH Methodology and the testing done during the project in the eight business cases presented the following benefits:

- **Maximise the business results.** This is possible because the whole Methodology concept was developed to assure that the solutions selected are those that best contribute to the achievement of the defined business objectives and to the elimination of the critical bottlenecks in the company. Also, according with the COST-WORTH Methodology the decision of the particular solution concept is based on a Return On the Investment analysis.

- **Reduction of the total implementation cost.** The challenge is to find the optimal balance between the contribution of external consultants and company staff that will allow: the minimisation of the total cost, while assuring the knowledge acquisition from the company staff necessary to a conscientious decision making. Also a better specification the company requirements facilitate the negotiation with the software vendors and also contribute to a reduction of the total cost of ownership of the selected solutions.

  One of the main objectives of the project was to reduce the total cost of introduction of ICT solutions to a level that should make it accessible to most SMEs. It was possible to achieve this goal in the defined business cases and it is believed that for a wide range of SMEs the COST-WORTH Methodology can make possible the adoption of advanced ICT solutions.

- **Reduction of risk.** The support of a structured and tested Methodology, together with the support of experienced external consultants assures that the necessary base work is done effectively and the work that must be done is planed with detail.
- **Reduction of implementation time.** Since the COST-WORTH Methodology defines the worksteps to be done to finally introduce ICT solutions, what must be done and how in each step and also provide support tools to facilitate the most complex tasks.
- **Solution independent.** The Methodology developed imposes a complete independence of the Methodology and of the external consultants. The solution is selected by the end users taking into account their specific necessities and the business objectives of each company.

3.4 Final Users involvement and experiences

COST-WORTH has been an **SME user driven project**. So, the role of the SME users in this project has been crucial. Their role was not only just to provide requirements on the methodologies & tools and environment for testing of the prototypes, but also to carry out essential RTD tasks to identify the ways in which the effective support to business process improvement in Manufacturing SMEs can be managed in the most efficient way. Therefore, without deep involvement of the SME users in the RTD tasks, it would be not possible to achieve the stated objectives.

Regarding final users experiences, they have been already mentioned in the deliverables related to the WP 400 testing of the methodology, namely D5.1, D5.2 and D5.3, as well as in the Periodic Progress Reports. In these reports, the impressions and feelings obtained by the Industrial partners along the project development have been detailed.

Aspects like the common difficulties with the methodology understandability, deviations regarding extra-efforts needed to complete specific worksteps, positive visions of the methodology suitability and correct approach, support needed by the end users to fulfil all the process covered by the project, etc. have been analysed and commented to the RTD partners.

In the next table, the Methodologies tested by each final user, taking into account the reasons that provoked their decisions are summarised.

	Coaching Oriented Methodologies Developed				
	BEP1-Methodology	**BEP2-Methodology**	**CARSA1-Methodology**	**CARSA2-Methodology**	**CIMRU-Methodology**
Strategic Improvement Focus	*Identification of the overall weak points in the entire company hindering competition during the actual process execution.*	*Identification of weak points w.r.t. process improvements and ICT support of the order handling process.*	*Identification of weak points w.r.t. market and competitor situation.*	*Identification of weak points in process execution*	*Identification of what wants the company achieve.*
Company Test Case	**Schneider / Panhans**	**Brüggen / Thiele / Vioral / Lamaplast**	**Inael**	**Trimek**	**Full Methodology was not tested**

Another 11 business cases have been addressed in Australia (Melbourne and Sydney) and in Switzerland.

Every Business case specific improvement focuses and targeted benefits, ensures the validity of coaching oriented methodologies and reference scheme, as is reflected in the next table:

Company Domain / *NAME*	Addressed Improvements	Targeted Benefits
Plastic articles *LAMAPLAST*	Integration of PPC and management information systems	Minimizing production delays and optimizing productivity
Aluminium and zinc alloys castings, parts, assemblies and moulds VIORAL	Integration of PDA and order management system	Decreasing delivery time, improving customer service and product quality
Swap bodies for lorries *BRÜGGEN*	Production progress monitoring	Minimizing production delays
Customised armoured cars *THIELE*	Integrated handling of product and production information,	Decreasing procurement and production errors and time
Measuring machines *TRIMEK*	Integrated ERP, PPC and knowledge management system,	Reduce development time & production errors, increase productivity
Fuses, arrester etc. *INAEL*	Integration of CAD and testing laboratory full control system	Increase productivity, decrease design/production errors & time
Gate-systems for private or industrial customers *SCHNEIDER*	Optimised product design process,	Increasing design productivity
Woodworking machines *PANHANS*	Integration of PDA and PPC	Minimizing delivery times

3.4.1 Business Financial Benefits

The results obtained after the analysis of the Business results for all the companies are summarised in the Table 1, showing the costs, benefits and Payback period estimated at the beginning of the project and the Real ones.

Table 1: Business Results for all the companies

	Costs (Total €)			Benefits (€ per year)			Pay-Back period (years)		
TEST CASE / METHODO-LOGY	Estimated	Real	Deviation (absolute)	Estimated	Real	Deviation (absolute)	Estimated	Real	Deviation (absolute)
LAMAPLAST / BEP2	239,9	243,000.00	3100.00	108,500.00	91,500.00	-17,000.00	2.2	2.65	**0.45**
VIORAL / BEP2	215,7	216,500.00	800.00	92,000.00	104,350.00	12,350.00	2.34	2.07	-0.27
BRÜGGEN /BEP2	331,75	156,680.00	**-175070.00**	169,000.00	117,686.00	**-51,314.00**	1.96	1.33	**-0.63**
THIELE / BEP2	83,387	70,320.00	-13067.00	80,000.00	89,100.00	9,100.00	1	0.8	-0.2
TRIMEK /CARSA2	95	98,000.00	3000.00	63,500.00	75,000.00	11,500.00	1.45	1.3	-0.15
INAEL / CARSA1	58,667	69,934.00	11267.00	60,250.00	68,750.00	8,500.00	0.97	1.02	0.05
SCHNEIDER / BEP1	121,12	51,792.94	**-69327.06**	137,500.00	38,418.46	**-99,081.54**	0.92	1.35	0.43

3.4.2 Industrial Partners detailed contribution to the project

The involvement of the Industrial partners detailed WP by WP is reflected in the following points:

- **Analysis of requirements on methodologies and Toolbox (WP100)**

  RTD partners, with the obvious contribution from Final Users, analysed the final users requirements for the Methodology development. Such analysis was done through a significant iteration of interpretation of answers to questions reflected in a template defined by RTD partners and completed by Industrial SMEs. The information extracted from these templates was interpreted by all RTD partners and structured in a more practical way and reviewed and accepted by the Industrial companies.

  More detailed information and the questionnaire template are included in Deliverable D1. These Requirements together with the experience and Methodology background of RTD partners were the input for the Methodology Concept Definition. Such Methodology concept definition has been defined in agreement of all RTD partners and accepted by Final Users. With the purpose of making such methodology applicable and usable, a Navigator concept was defined and developed.

- **Definition & Specification and Design & Development of Methods and Tools (WP200 – WP300)**

  Contribution from Industrial partners has been moderated in this phase chapter, and mainly limited to analysing the developments proposed by the RTD partners. The main contribution from the SMEs has been the feedbacks provided to be taken into account when complementing and detailing their content.

- **Application and test and verification of developed and selected methodologies in business cases (WP400)**

This task has been the most important one w.r.t. the participation of the Industrial partners. During the project, the methodologies selected by the tandems local RTDs-Final Users have been customised and applied on each final user. These methodologies are presented in the (Chapter 3.1.3.1).

Following the structure initially proposed the testing has been executed in three phases, namely *Analysis & Conception Phase*, *Specification and Selection Phase* and *Implementation Phase*. The detailed information for each phase related to all the Industrial Partners is included in deliverables D5.1, D5.2 and D5.3. In these reports, the application of the different methodologies on each SME and the testing of these methodologies are widely explained. The comments and inputs received from the experiences collected from the Industrial Partners have been taking into account to refine and optimise the methods and tools.

At the end of the each phase, a working meeting was held with the participation of the Industrial Partners

- Austria working meeting at the end of the A&C phase (held in Panhans facilities on 4th of July 2003)
- Germany working meeting at the end of the S&S Phase (held in Brüggen facilities on 26th of March 2004).

In these meetings, issues like common problems and difficulties detected in the application of the methodologies, lessons learnt during the testing phase, similar bottlenecks detected in the companies, etc. were discussed and analysed.

The assistance and the active participation in the Review Meetings (specially in the 2nd and 3rd RM) have also contributed to exchange the experiences acquired by the Final Users during the COST-WORTH project.

- **Test and verification of COST-WORTH Toolbox (WP500)**

The optimisation is the final step in the development cycle (specification/development/test/optimisation) of the five partners coaching oriented methodologies presented in Figure 1 . Key characteristic of the development cycle was the continuous end-user involvement in all steps over the whole methodology development, ensuring the coverage of all end-user requirements, i.e. practicable and applicable development results from the user point of view. Therefore the optimisation is based on the end-user feedback as a

result of testing and application of the methodologies in the eight business cases, whereby in each business case one methodology was selected and applied. The end-users feedback represents the overall experiences made during the application of the selected methodology, covering all problems, as well as required methodology refinements.

This integrated and end-user driven optimisation approach supports the verification of the development results over the whole methodology development process, enabling an early identification of required refinements from user point of view, also ensuring that the tested handbooks and support material is applicable and understandable.

The results of the optimisation of the methodologies have been detailed in Deliverable D6 and Deliverable D8.

Moreover, as was specified in Deliverable D6, Two different Scenarios were developed to complete the testing of the Toolbox final Version.

- Test Scenario1: covers the COST-WORTH Toolbox test by the SME end-user partners. Therefore the SME end-user tested the specified functionalities, as well as the usability and understandability of the methodology selection and application procedure. This test covers the test of the Toolbox Methodology Framework, Navigator, Measurement and Forum Tool. This test was executed in co-operation with the end-user SMEs in the last phase of the project. The results of this test, i.e. the questionnaires filled in by SME end-users, together with SME end-user feedbacks, are presented in deliverable D8. Those aspects that will be considered as non-sufficient for the End Users have been updated taking into account the questionnaires results analysis.
- Test scenario 2: addresses the mapping and update of partners coaching oriented methodologies on the methodology framework. This test was executed by all RTD partners.

Main Test Topics:

- ✓ Completeness of provided support material enabling application of all methodology worksteps.
- ✓ Quality and understandability of provided information (training material, handbook, documentation templates, SW tools etc.).
- ✓ Traceability of results for company staff.
- ✓ Acceptance of implemented improvement measures.
- ✓ Achieved versus estimated business benefits.

Overall Results:

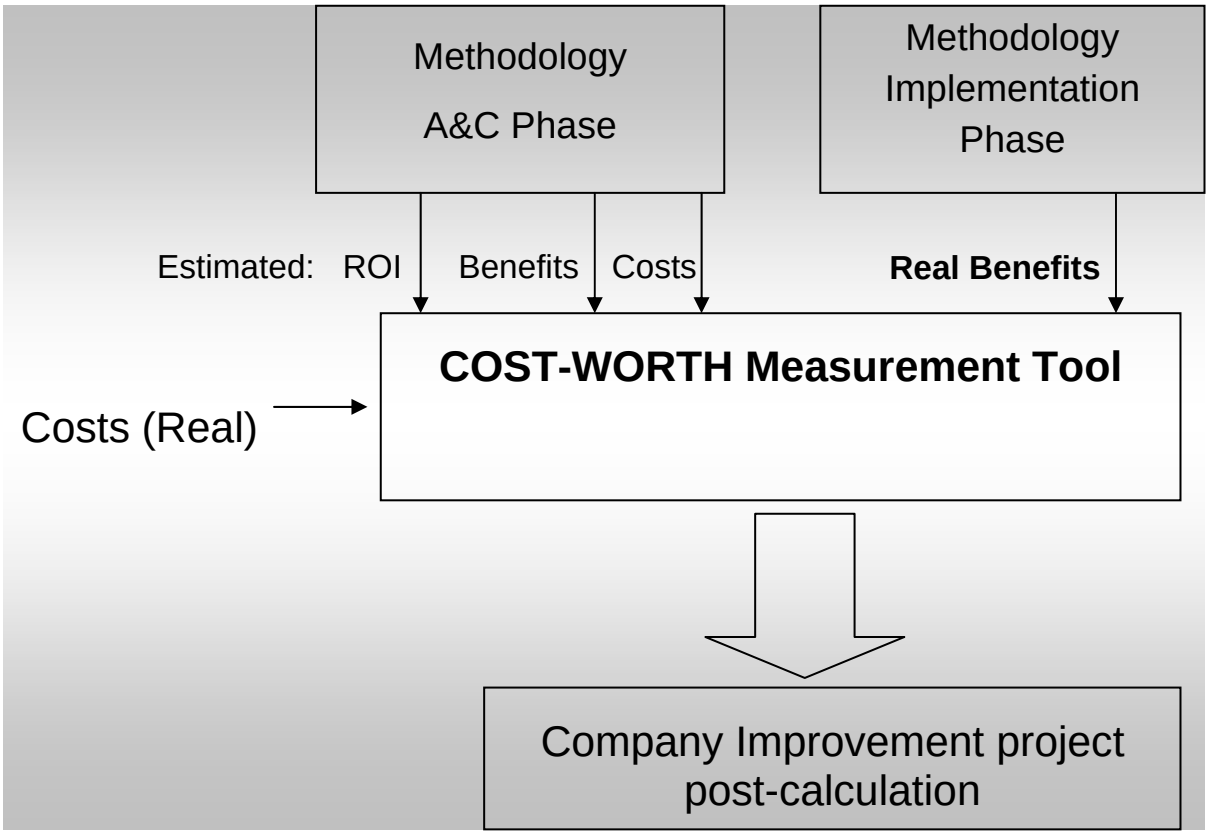
- ✓ Tested methodologies support fast and clear management decisions. All information required for sound management decisions were available at any time of the improvement process.
- ✓ Targeted Business Benefits could be achieved. Measurement of business benefits has shown that in most business cases the achieved benefits are better than targeted.

✓ Detailed methodology specific test results and identified refinements are described in D8.

- **Measurement of business Results WP (500)**

The measurement of business results has been assessed to evaluate the suitability of the solutions implemented on each company, and to calculate the real benefit obtained with the inclusion of the Solution Concept. The figures obtained on each company have been collected in close cooperation between RTD partners and Industrial companies. The collected data have been analysed and interpreted by the RTD partners. The summary data is shown bellow in Table 1 (see chapter 3.2.1).

Taking into account the estimated and the real data for the Costs and Benefits analysis, the Payback period was calculated. The managers of the industrial enterprises confirmed with this measurement analysis the business improvement after the implementation in the company of the ICT solution. The next diagram shows the Measurement tool philosophy.



- **Dissemination and Exploitation of results (WP600)**

The industrial partners have collaborated and supported the dissemination activities, mainly carried out by RTD partners, carried out during the project. In the Deliverable D10 all the dissemination activities are included, also those actions where the Industrial partners collaboration have been more significant.

- **Local project management (WP700)**

The main role of Industrial partners in the management activities has been the preparation and submission of their own Cost Statements for the periods reported. Moreover, the different administrative documents (amendments, CA, letters, etc.) that needed the signature of the Industrial companies have been diligently processed.

3.4.3 Common experiences gained by the participating European SMEs within the scope of their co-operation:

The working meetings held during the project between the all members of the consortium have promoted the experiences interchange and the knowledge share between the industrial partners. These aspects have enriched the innovation culture and the cooperative working culture between the managers of the companies involved in the project. Some of these common experiences gained have been:

- The basic problems in all companies are almost the same in spite of the different manufacturing sectors, their size and the level of implemented ICT: Missing transparency of the process execution and an insufficient information flow, however similar problems require different company specific solutions to be efficient.
- Creating the understanding of the process and information flow by the staff members is of major importance to realise improvements.
- A staff driven improvement process is more difficult than estimated, it is not a straight forward way, rather it requires iterations in the specification of the improvement measures to really cover all aspects and interdependencies.
- New ICT solution have to be integrated with existing ones (history can not be neglected), there is no complete ICT package solving all problems.
- Standard commercial ICT solutions often do not cover required company specific functionalities, while on the other hand, they usual offer much of not needed features, which must be paid by the SMEs usually in high prices on the other hand they also offer unnecessary features which have to be paid.
- Modern development environments and utilisation of “free-SW” enable a fast, tailored and cost efficient development and operation of company specific ICT solutions.
- The interfacing of specific ICT solutions with other legacy systems is easier than estimated but pre-requisites the clear understanding of the process and information flow.

- Improvements endeavours have to be speed up.

The main **lessons learnt** by the industrial partners after the finalisation of the COST-WORTH project can be summarised in the following sentences:

- **Coaching oriented** business improvement methodologies are the **right approach** to **overcome the innovation reluctance of SMEs** in respect to the introduction of advanced IMSS.
- The COST-WORTH Toolbox **opens up a new dimension** of methodology knowledge transfer to SMEs Europe wide, as well as globally.
- However, a methodology only represents a tool, supporting you to run an improvement process efficiently. It will not do the job for you!

3.5 Repercussion of the project results

There exist several formalised methodologies for Best Practice selection and Procurement Processes. They present deficiencies and fail in covering an integrated approach supporting the overall improvement process. This aspect, considering as a crucial element for SMEs, has been specially appointed by this COST-WORTH project. The results of the project have demonstrated that the COST-WORTH methodology has overcome this lacks. The testing and validation processes carried out in 7 companies in 4 countries in EU plus 3 entities in Switzerland and 6 more SMEs in Australia have definitively proved the suitability of the approach proposed by the COST-WORTH methodology.

Moreover, taking into account the results described, the state of the art has been widely beaten by this project. The development of the COST-WORTH methodology and framework has provoked a significant advance in the business processes improvement approach by applying coaching oriented component based schemes.

4 Dissemination and Exploitation results

4.1 Dissemination activities

4.1.1 Relations and synergies with other relevant projects

The consortium has maintained an active relationship with different networks and clusters, in order to foster and enrich the dissemination activities results. Trying to combine different approaches and adding parallel efforts, the different stakeholders involved in the project activities and results have worked together.

The COST-WORTH consortium has identified the relevant research clusters and has joined them.

Both the GEM and Moment project were based on supply chain management and change management. Hence the COST-WORTH project used these networks to access the state of the art research in the area and the tools and techniques that were documented in some of the course material in the GEM project was used in the development of the CIMRU methodology. Further more the requirements of SME's in business process reengineering were also assessed using the experience from the SME's involved in the MOMENT project to understand the requirements for a coaching orientated approach. The key outputs of the COST-WORTH project were also demonstrated to some of the members of these networks for dissemination purposes so as to improve the validation of initial prototype as well as distributing the end results.

Solutions for Innovative Manufacturing Cluster

AIM

http://www.atb-bremen.de/projects/aim/aim_index.html

GEM

http://www.sintef.no/static/tl/projects/gem/

MOMENT

http://moment.nuigalway.ie/default.asp

Networks

Networks have been and will continue be used for the dissemination. For instance, CATT LINZ is as an accredited representative for an Innovation Relay Centre (IRC) office well involved in a very significant network, which will be helpful in the information spreading process. By making use of existing relationships with suitable clusters (companies linked together because of their similar or complementary characteristics in a certain branch) essential contacts have been also established.

Other networks that we have made use of are:

- **Prosoma**: The Prosoma service network (www.prosoma.lu) helps to increase the industrial impact of the IST programme by building a bridge between research and marketplace and by facilitating access to research results. This network provides valuable contacts with systems developers, service providers, equipment manufacturers, venture capitalists, technology brokers and end-users that can provide additional inputs necessary to commercialise our results. This means that we have benefited from a virtual meeting point.

- **T.I.I.: Technology Innovation Information** is a private, financially independent alternative to IRC. It is the European Association of professionals working in technology transfer and innovation support. It has around 300 members from all regions of Europe and beyond, and from all areas of innovation support. This has been helpful in the dissemination process.

- **EBN – European Business and Innovation Centre Network:** EBN is an international association which aims to develop and co-ordinate Business and Innovation Centres (B.I.C.s), as well as to help them increase individual and collective efficiency and performance. As EBN pools experience and know-how, establishes partnerships in research and development, technology and marketing, we have acquired valuable dissemination support from this platform.

4.1.2 Scientific Publications and Workshops

The consortium has presented papers at the **10th ISPE INTERNATIONAL CONFERENCE ON CONCURRENT ENGINEERING: RESEARCH AND APPLICATIONS** or at the **IMS INTERNATIONAL FORUM 2004: GLOBAL CHALLANGES IN MANUFACTURING**. Moreover some articles have been published in scientific and press, e.g. "Integration of business modelling methods for enterprise information system analysis and user requirements gathering" *or* business benefits that are coming out for the SMEs by applying structured ways for their process improvement.

Additionally, other articles and papers have been submitted during the project, although these material have not still been presented Paper submitted at "IEEE/SMC" Conference, Hawaii, 10-12th October 2005.

In order to gain advantage of the workshop benefits the COST-WORTH consortium have been actively involved in a large number of workshops in Spain, Germany, Austria, Ireland and Greece, as well as one presentation of the project results in Sydney (Australia).

The complete and detailed list of workshops held during the project, have been included in deliverable D10.

Follow-up activities:

The main objective of the workshops held during the project has been the dissemination of the project advance and results to the industrial SMEs that could be potential customers after the end of the project. Moreover, some contact has been already done with politicians and regional development agencies trying to increase the impact and to spread the outcomes achieved. Follow-up activities carried out by each RTD partner to finally achieve that potential clients become real customers are reflected in the next table:

Actions	**Countries**				
	Spain	Germany	Austria	Greece	Ireland
Workshops held	3	2	10	8	1
Attendees	40	32	180	22+*75*[1]	20
High Interest in Project results	31	25	145	17	16
Response after a follow up call and/or visit	12	2	12	4	3
Currently active contacts	**6**	**1**	**3**	**2+*1*[2]**	**1**

[1] These values reflect the number of SMEs (22) and university students (75)

It is important to enhance that some workshops were held at initial stages of the project, when the results were not defined yet. The main propose of these workshops was to present the project objectives and the approach initially planned to finally develop the COST-WORTH Toolbox. Due to this, some contacts did not show a high interest in that early stage, but new contacts will be done to recover the communication with these entities in order to present the final results of the project.

The number of companies **really** interested in the project results, do not reach the 10% of companies contacted. The limited number of entities today interested in the Toolbox use and business application, shows the hindrances of European SMEs to pay a consultancy service to optimise their business activities. Although the comments and impressions received by the RTD partners in the seminars and workshops held usually are very positive, the final step to contract the coaching scheme is always really complicated task.

4.1.3 COST-WORTH Website

The COST-WORTH project website has been developed and enriched along the whole duration of the project. The structure of the website was defined to include two different areas. The first is a non-restricted area, where the general information of the project was uploaded and the second area was called "WORKSPACE" and contents all the information that is only available to the consortium partners and the Review Panel.

- Public Area: The information that can be accessible without any restriction is structured in the following chapters:
  - Project: Brief information about the project objectives and the workplan proposed. The information is available in English, German, Spanish and Greek.
  - Partners: All the information of participant partners is detailed in this webpage
  - Contact: Contact data of the project coordinator
  - News: Some activities and presentations realised in the scope of the project are presentd here, including articles presented in different events, project presentation events, dissemination material, etc.
  - Results: This link allows the access to the Toolbox website.

- Workspace: this private area has been defined to permit consortium partners to share information and the inclusion of internal information, as well as to permit the review panel the analysis of the main topics related to the project. The links included in this workspace are:

[2] There are 2 SMEs and 1 Association currently interested in the Project results

- Meetings: Review and Working meetings information, like agendas, prsentations, photos...
- Deliverables: all deliverables submitted to the Commission
- Bibliography: Some docuemtes used in the scope of the project
- Methodologies & Navigator & Measurement: These topics were included in the webpage in their first development stage, to analyse the functionalities and the characteristics of them. The latest veresions of these modules have been updated and uploaded in the Toolbox Website.
- Swiss cases: The reports sent by the Swiss partners have been included in this chapter.
- Tool-box: This link sends the user to the Toolbox homepage.

4.1.4 Other innovative ways to disseminate the project results

Following the recommendations received by the Review Panel after the Final Review Meeting, the consortium will analyse the dissemination and spread of the project results applying new and innovative ideas. The trancision from classic approaches to new dissemination ways, to gain the interest of the SMEs, has been highlighted in the Final Review Meeting. Given that the project result is a very interesting and powerful tool, the exploitation of this Toolbox must be done by all the partners in a significant way. In fact, CARSA has created a new division in the company (formely named **MQS**) that will exploit the results of the project mainly among industrial SMEs.

4.2 Exploitation strategy

The main outcomes of the COST-WORTH project to be exploited are:

a) The COST-WORTH Toolbox

b) Consulting services using the COST-WORTH Toolbox

4.2.1 Market

Three key **Target groups** are envisaged to be addressed. These envisaged target audiences for the COST-WORTH Toolbox and Methodologies developed and the experience gained in the scope of the COST-WORTH project are:

The following are the primary target groups to be addressed for the marketing of developed products and services of the COST-WORTH Toolbox:

- **SME manufacturing companies** as end users interested in the use of COST-WORTH Methodologies for the re-design of process flows and the purchasing and implementation of advanced ICT.

- **Consultancy Organisations** which support manufacturing companies with the introduction of ICT Solutions applying the COST-WORTH Toolbox Methodologies as optimal process improvement approaches and as efficient requirement engineering methodologies, or to enable them to integrate their specific methodologies into the COST-WORTH Toolbox.
- **ICT-system suppliers** within the manufacturing area, introducing their products to manufacturing companies for application of the COST-WORTH Toolbox Methodologies as an efficient requirement engineering tool

4.2.2 Price policy

The pricing policy has been defined taking into account the two outcomes defined above in the IPR rights chapter, namely the Toolbox and the methodologies.

Price policy for COST-WORTH Toolbox

Use of COST-WORTH Toolbox is **free of charge for SME** end-user looking for a methodology.

Price policy for inclusion of Methodologies within COST-WORTH Toolbox

Consultancy organisation, that intent to insert their methodologies in the COST-WORTH Toolbox, has to pay an allowance for checking and activate the provided information and material. This is required to ensure the compliance with the Toolbox regulations and to guarantee the high quality of the presented information. Therefore the partner responsible for Toolbox maintenance and support will demand an allowance of 250€. This allowance includes 5 updates of the provided Methodology information. For any further update another allowance of 100€ have to be paid.

Price policy for Methodologies

Each partner has defined the best strategy for the exploitation of the methodologies in their own target area. Generally speaking, we can distinguish 3 different strategies depending of the final user of the methodologies: Industrial SMEs, Consultancy firms and ICT-Systems Suppliers.

SME End-user

Generally all Methodologies information and material, provided via the COST-WORTH Toolbox, is free of charge only for it's usage in SME companies. Therefore no fee will be demanded for Methodologies, but if desired consultancy support can be offered.

Based on the experience of COST-WORTH partners the efforts required for the consultancy support to introduce the any Methodology in SMEs in the scope of the execution of an improvement project is about 2-5 MM per SME and project. Therefore the consultancy service can be offered between 20.000 and 50.000 Euros to the company for a business improvement project.

Consultancy Organisations

The target customers for the Methodologies are furthermore consultancy companies and technology transfer type organisations, which would apply the methodologies to the SMEs in their regions for the improvement of the SME business processes. Every consultancy organisation interested in the methodology is due to pay for an initial training on the methodology, which includes all training material and a licence fee for each end-user.

Initial price estimation for overtaking the desired Methodology was carried out. In reference to the above stated values of the consultancy costs the licence fee would be ca 1.500 to 2.500 EURO per application (for using a complete set of methods & tools – the licence fee would be ca. 5 % per application of the methodology). For the initial training of about 1 week duration and for handing over the complete set of the methodology training material, templates and tools ca 5000 to10.000 Euro will be charged. Any required support by the consultant after the training would be charged on an individual basis.

ICT-system Suppliers

ICT-system suppliers will mainly be interested in the system specification part of the Methodologies to improve their requirement engineering practices and to some extent in the approaches for the implementation phase to improve their software engineering concepts. With a focus on the system specification part, an initial training for handing over the complete set of Methodology training material, templates and tools for this phase the specified money will be charged, as well as a license fee for each software implementation where the BEP specification approach is applied.

If RTD partner of the COST-WORTH project indent to use a Methodology owned by other partner for consultancy purpose, they only have to pay the license fee. In case that these partners provide a methodology version translated in their mother tongue, than no license fee must be paid.

4.2.3 Competitive environment

The consortium has analysed the potential competitors. There are both direct and indirect competitors. It is understood that direct competitors are those products providing similar services and with the same or alternative features satisfying the same needs, and requirements as the COST-WORTH project. Indirect competitors are those products and services satisfying an alternative need, which substitutes the need satisfied by our product.

a) The COST-WORTH Toolbox

Direct competitors: At present no similar tool has been found considering all different stages of the problem as a whole, but tools partially solving the problem tackled within the COST-WORTH project and consultancies using their own developed methodologies and tools exist.

Indirect competitors: There are also consultancy firms and big companies that try to introduce their ERP software applications as the most adequate solution to solve various company problems.

b) Consulting services using the COST-WORTH Toolbox

Main competitors for this project outcome are service and product providers selling their own products and systems, rather than best solution for problems.

Because of this, it is mandatory to highlight the main differentiating features to be exploited to gain an important competitive advantage. The identified consulting companies that are offering services in this field don't target the traditional SME market; neither do they use such a complete Methodology.

As it has been stated above no commercial product with the same features has been identified, however the consortium has compared the solution proposed by COST-WORTH against the solutions proposed by indirect competitors. This comparison has been made using as comparative criteria those characteristics considered as of major relevance from the final user point of view.

5 Conclusions

The technology innovation speed and increased competition pressure require a very fast implementation of new IMS technologies in daily business operation of SMEs. The necessity for SME specific methodologies, so called “coaching oriented methodologies”, to drive such improvement processes in a cost and time efficient way for companies are becoming a crucial aspect. The experience gained during the practical applications of different coaching oriented methodologies in SMEs is very positive and confirms the need for coaching oriented methodologies.

The developed **COST-WORTH Toolbox**, accessible via internet, provides a consistent structure of existing coaching oriented methodologies, enabling SMEs to select quite simply the most appropriate one(s) for their use in respect to their actual business situation and objectives. The developed framework is open to incorporate further coaching oriented methodologies of other providers, worldwide. Such a structured framework was not available up to now, opening up a new dimension of knowledge to SMEs Europe wide, as well as globally, needed in order to be best prepared to drive company innovations continuously on their own responsibility. The created web-service is aiming at an open knowledge forum concerning coaching oriented methodologies, to push the innovation competence of SMEs, which also offers the features to promote an experience exchange between SMEs world wide, in respect to the application of specific business process reengineering methodologies.

6 Annex 1: Australian final report

EACC-VIC Centre for Global Innovation Management

Level 4, Babel Building,

Department of Management

Faculty of Economics and Commerce

The University of Melbourne,

Parkville, Vic 3010.

Tel: +61 3 8344 7868. Fax: +61 3 8344 3714.

Email: milet@unimelb.edu.au
Web-site: www.unimelb.edu.au

COST-WORTH

Project Reference Number: **CG04-0128**

DEST Contact: Heather - International Science

6.1.1.1 Date	Version	Description	Authorised by	Produced by
11th Dec 2005	0.0	draft document creation	Susu Nousala	Mile Terziovski

15th Dec 2005 Nousala	0.1	final draft	Mile Terziovski	Susu
2005 Dec Nousala	1.0	final document	Mile Terziovski	Susu

Table of Contents

Introduction

6.2 Background

The COST-WORTH project object is to develop a toolbox of methodologies, combining a coaching scheme and component based business re-engineering approach, to support manufacturing SME's in their business improvement.

Key partners in the project are leading researchers in continuous improvement, innovation management and business-related IT development from five University research centres in Europe and Australia. From the EU: University of Patras**,** Institute for Applied Systems Technology Bremen GmbH, National University of Ireland Galway, Switzerland, ETH Swiss Federal Institute of Technology. From Australia: EACC-VIC at The University of Melbourne (Australian Coordinator), EACC-NSW at University of Western Sydney.

The following are identified phases of the methodology which cover:

- Analysis and concept phase (A&C)
- Specification & selection phase (S&S)
- Implementation phase (I&P)

The initial phase of this project has already carried out by the Australian and European partners, was to develop and test relevant methodologies, based on the previously developed Best Practice Enterprise (BEP1 method) the first two phases (A&C, S&S).

This document has the following objectives:

- Project background,
- Project scope,
- Project summary highlights,
- Project milestones, outputs and performance indicators and current project achievements,
- Project budget

Scope

6.3 In Scope

Based on agreed project requirements (DEST, IMS) from Australian and European partners, EACC and DEST, the following points are listed;

1. To test, apply and document COST-WORTH coaching support tool to identify working process improvements through introducing intelligent manufacturing systems solutions.
2. To test method analysis and implement solutions from results gained from using previously developed European partners' methodologies (based on BEP2, which was developed from BEP1 and other relevant tools within the toolbox) with 7 Australian partners: Autotek Pty Ltd, Jensen's Choice Foods Pty Ltd, SCS Plastics Pty Ltd, StreamLux Pty Ltd, AEM Australia Pty Ltd, Broens Industries, Stemar Electrical Products Pty Ltd.
3. Provide appropriate and timely reports to DEST and partners
4. Based on documented outcomes of the 7 partner cases, create Australian region contribution to present to the European partners.
5. Demonstration
6. Dissemination

6.4 Out of Scope

The following areas are **out of** scope for this project

1. To develop entirely new tools/methodologies or models independent from the Cost-Worth tool box.

Project changes

As requested, we have a replacement for the fourth Victorian industry partner, this is StreamLux Pty Ltd. StreamLux began their involvement with CostWorth questionnaire as did the other Australian SME partners.

The other Australian SME partners are as follows: Autotek Pty Ltd, Jensen's Choice Foods Pty Ltd, SCS Plastics Pty Ltd, AEM Australia Pty Ltd, Broens Industries, Stemar Electrical Products Pty Ltd. Jensens's Choice Foods did not continue with participation of BEP2 and diatec, however, did actively contribute to CostWorth questionnaire which was the basis for all the Australian methodologies and tools.

Summary Highlights

6.5 Cost-Worth Project Highlights

- **Dissemination of Outcomes:**
  - **On-line tools**
  - **Seminars/ workshops to Industry Groups**
  - **Industry newsletters**
  - **Journal articles**

- **Continuing Collaboration**
  - **SMEs**
  - **Research Partners**

On-line tools

The Cost-Worth Toolbox

Working with Partner SMEs to finalise the refinement and adaptation of both the BEP-2 tool and the DIATEC tool

1. CW QUESTIONAIRE – www.cgim.unimelb.edu.au/cost-worth/

The purpose of this survey is to gain an overview of the SMEs by collecting a diversified sample of information regarding their actual problems. This is the "Analysis and Conception" (A&C) phase, which includes: systems, organization, technology, planning and control of introduction, and performance measurement, as part of the overall CW methodology. Results of this survey will be used in conjunction with the outcomes from an advanced on-line tool to assist with the next phase, "Specification and Selection" (S&S), in which the processes to be re-engineered and the technological solution to support them will be specified.

2. BEP 2 TOOL – www.cgim.unimelb.edu.au/bep2/

The BEP2 tool is about delivering a unique approach to Small to Medium Enterprises (SMEs). BEP2 is a continuous assessment tool for the SME businesses. This means that the tool can be accessed and used several times over a period of months for comparative results, showing up changes or improvements. The tool focuses on the whole order management process via 5 sections. The BEP2 tool can be applied as a whole or by sections.

Section A – General; Section B - Order Management; Section C – Materials Management; Section D - Delivery Management ; Section E - Production Planning; and Section F – Design

3. DIATEC TOOL – www.cgim.unimelb.edu.au/diatec/

The DIATEC Tool is designed to help assess the current technological situation of an SME and their ability to adopt new technologies. The tool consists of four sections; Technological Resources, Technological Situation, Innovation Capability, and Openness and Cooperation, with a score rating for each section that benchmarks the SME with world's best practice. The two sections on Technological Resources and Techno-

logical Situation focus on the current capabilities of an SME regarding the use of technology. The two sections on Innovation Capability and Openness and Cooperation are future oriented and highlight the areas of an SME that can either restrict or provide a solid foundation for future technological uptake. The four sections provide a holistic view of an SME regarding the use and adoption of technology, with the feedback useful for highlighting areas of improvement and areas of competitive advantage.

Seminars/workshops

6.5.1 Details of COSTWORTH Presentation Meeting with EU Partners, Bremen, September 2005

Hosted visit by key European COSTWORTH partner (Uwe Kirchhoff from ATB in Bremen, Germany). During this visit Dr Kirchhoff gave seminars to academic and practitioner audiences and visited two of our key COSTWORTH SME partners where we held joint meetings with key personnel and inspected production facilities and back office functions reviewing improvement outcomes from the COSTWORTH project.

- The overall goal is improved manufacturing processes for SMEs and hence increased competitiveness
- To be a part of a developing worldwide network (creating effective SME linkages) and contribute to the established EC project
- SMEs to benefit in cost/effort savings through introduction of appropriate new technology
- Further effort/cost savings expected resulting from future use/dissemination of developed methodologies

Unique Australian Contributions

- Extend the application/validation of relevant COSTWORTH methodologies to a wider selection of SMEs.
- The common criteria and methodologies will allow any findings to go through an international comparative analysis – providing improvement feedback to EC partners on documentation and methodologies
- Australian SMEs are considerably smaller and less technologically sophisticated than European SMES
- Thus the COSTWORTH tools have been modified and simplified to suit the Australia SME partners

- Application of the tools has led to a range of business process improvements in our participating SMEs
- The modified tools have been further developed for web-based deployment in SMEs

Note that the Australian contributions were considered significant as we had developed a way of presenting efficient and immediate impact for SMEs with the on-line tools and methodologies, and could be used for smaller divisions within the larger EU SMEs, as explained by the following points;

- Analysis of companies consisted of 47 questions with 4 sections
- Section A – General & Cultural
- Section B – Business Process-Reengineering
- Sections C-G – Order Management
- Section H – Performance Measurement
- Need to modify BEP 2 to suite much smaller Australian SMEs
- Major modification was to reduce the subsections in each category to one
- Re-word questions to enable self administration
- The creation of an instruction sheet

The combined analysis as well as further consultation with the managing director identified the collection of customer information and the subsequent use of this information in the designing of products as an area that would benefit from a BPR project. The following recommendations were put forward:

- Record Customer input via IT.
- Maintain a record of all customer enquiries in a data base.
- Incorporate this information in the design departments.

The use of the tools worked well in identifying areas for ICT improvement

All companies welcomed the tools ability to identify problems and initiate action

- 19/10/05 Presentation to the ITN (Innovation Technology Network) at UWS, Bankstown Campus.

- 1/11/05 Meeting with the NSW Department for State and Regional Development for dissemination of tools

- 16/11/05 Presentation to the Intelligent Manufacturing Systems (IMS) Australian Advisory Board

Email dissemination of the availability of the Australian COSTWORTH Toolbox from the NSW State Government Small Business Development Unit (as follows):

Dear all,

Do you want to improve the management practice and technological adoption of your organisation? Why not download two diagnostic tools provided free of charge by the University of Western Sydney? The University could also

help you to implement the tools. Visit www.cgim.unimelb.edu.au/bep2/ and www.cgim.unimelb.edu.au/diatec/ or email p.ifandoudas@uws.edu.au.

To find out more about the tools and other innovation and technology related opportunities for businesses, please read the latest newsletter at

www.smallbiz.nsw.gov.au/smallbusiness/Technology+in+Business/Technology+and+Innovation+Newsletter.

Viola Lee

Program Manager, Technology and Innovation
Small Business Development Division
Phone: 02 9338 6693 Fax: 02 9338 6705
viola.lee@business.nsw.gov.au

The ITS Australia and ITSVIC presentation

This was a half day seminar of ITS Australia and the ITSVIC Network (hosted by Multi Media Victoria) brought together leaders from Victorian public and private organisations to discuss developments and opportunities across the ITS sector where many projects were discussed/distributed including CostWorth.

The **INRETS delegation** who were guest speakers presented the case for continued and new development of international scientific partnerships to answer European and International calls for tenders, especially within the European Framework Research Programme.

Currently organizing connection to Multimedia Victoria via newsletter or web site.

6.5.2 One day Seminar on Driving Innovation and Efficiency through International Networks

The Cost-Worth project made presentations and ran workshops at a public IMS seminar held at Austool Ingleburn on Monday 27th September 2004 as part of NSW Small Business Month which is supported by the NSW Department of State and Regional Development.

Dr Uwe Kirchoff from Applied Systems Technology Bremen GmbH, Germany visited Australia to provide supportive training and information to each of our Australian partners, for the Cost-Worth project. Dr Kirchoff 's visit was supported by IMS project mobilisation funds from the IMS Australia Secretariat. Dr Kirchoff also presented

the European perspective of the Cost Worth project at the IMS seminar, which was of great value to our SMEs.

6.5.3 The one-day seminar took the form of case study presentations covering theoretical and practical perspectives followed by small group workshops which allowed more detailed discussion and demonstration of some of the project tools developed to date.

Improving business processes - the **Cost-Worth** project aims to design a methodology which will help SMEs to identify areas for re-engineering organisational structures and work practices to increase quality and reduce manufacturing cycle times. It is a DIY system, not one that requires use of consultants. Guest speaker, Dr Uwe Kirchoff General Manager of the Institute for Applied Systems Technology, Bremen in Germany, spoke of the experience with SMEs in Germany.

"Many methodologies for ICT selection and process improvement are available for SMEs but these neither integrate the two nor provide real working instructions for staff along the entire improvement life cycle" Dr Kirchoff said. "While coaching-oriented methodologies offer the missing features, there is no internationally recognised approach to supporting SMEs in innovation. The SMEs are confused".

The Cost-Worth approach enables SMEs to select the methodology or methodologies best suited to their business situation. By using the Cost-Worth toolbox, accessible in 2005 via the Internet, they will also be able to exchange experiences on a discussion board and download support documents. Methodologies can be added to the toolbox, access to which is free.

Australian industry partners entered the Cost-Worth project later than their European counterparts. The local approach was to develop a questionnaire, for use in conjunction with the online analysis tool for identifying weaknesses, to get an understanding of the markets, culture and general operations of the participating Australian SMEs. This provided a starting point for the Australian case studies on use of the harmonised tools and methodologies of the Cost-Worth toolbox.

What has become apparent from the feedback from two Australian companies is that SMEs in Australia are different to SMEs in Europe, being smaller companies operating in a smaller local market and needing to export. Therefore the European tools require modification for use here.

Victorian SME company Autotek has identified the keys to their business as sales, marketing and product development and using the Cost-Worth approach has devised a business process model. Plans for process improvement include online step-by-step procedures illustrated in photographs.

NSW SME AEM manufactures electrical transmission equipment and is convinced that continuous process improvement is essential to competitiveness. AEM's expectations from project involvement are improved methodology for project selection and increased profitability.

Industry Newsletters and Journals

Jointly authored international journal article prepared for dissemination of COSTWORTH outcomes – target journal IJOPM (International Journal of Operations and Production Management).

IMS Newsletter (for international distribution):

6.5.4 Australian Success Stories in the COST-WORTH Project

An Australian consortium comprising the University of Melbourne and the University of Western Sydney, and seven SMEs participated in the IMS COST-WORTH project which recently concluded. Two success stories from this project follow, illustrating that although IMS is a pre-competitive R&D scheme, near-term returns in operational improvements have been achieved by SMEs. In Australia, 70% of IMS project partners are SMEs, and in IMS overall, 40% of partners are SMEs.

The improvement methodologies refined in the COST-WORTH project are now available free of charge to end-user SMEs at the project website www.cost-worth.net. The methodologies are licensed and a royalty is payable by any other organisations (such as consultants and large companies).

6.5.4.1 Auto-Tek and COST-WORTH

Auto-Tek is a respected name in the automotive industry whose attention-grabbing project vehicles appear at international motor shows and has been supplying European automotive products to vehicle manufacturers and the Australian aftermarket for more than 30 years. The company has had a long standing interest in process improvement and joined the IMS project COST-WORTH with dual expectations. The first was to improve project management capability in the design and development of automotive products, thereby supporting Auto-Tek's current push to export project management services to South East Asia. Their other main interest was in establishing relationships with fellow SMEs. “We'd like to link up with companies which are complementary to Auto-Tek though not necessarily in the automotive industry” said company founder Bob Roman. “This would be with a view to joint ventures and possible diversification for Auto-Tek into new areas.”

The objective of the project was to provide a methodology supported by a software-based set of tools and techniques to assist SMEs to re-engineer their processes through the use of IT, e-commerce and e-business. The practical results are reduced costs, quality improvements, and reductions in production cycle time. It was anticipated that using the COST-WORTH methodology, SMEs will make a saving of at least 40% on

the cost of introducing new technology, reduce the risk of failure with new technology and, with the ability to respond quickly to market demands, become more competitive.

Whereas existing process improvement methodologies are mostly geared to large companies, the COST-WORTH project addressed the quite different needs of SMEs. COST-WORTH took into account the fact that, while SMEs must continuously improve business processes to survive in a global marketplace, they usually have limited human and economic resources. Specifically, they lack skilled personnel to drive improvement. The COST-WORTH methodology was therefore developed with an eye to ensuring that it can be easily learned by SME employees and be implemented without calling in external consultants. Implementation would be cost and time efficient, and promote the development of an innovation culture across the company.

Rather than building from scratch however, the COST-WORTH project used the Best Enterprise Practice (BEP) methodology developed by the ATB Institute for Applied Systems Technology in Bremen, Germany, as a starting point. This background IP and the expertise in its application was part of the background IP made available through the IMS project collaboration.

However, it became apparent that Australian SMEs are quite different to their counterparts in Europe, being much smaller and competing in very different market conditions. So the Australian Cost-Worth team, comprising two universities and seven SMEs in a range of industries, tailored the methodology to suit local conditions.

With the tailored methodology Auto-Tek identified the keys to their business as being sales, marketing and product development. Using the COST-WORTH tools and methodology, Auto-Tek developed an Integrated Business Process Model. According to Rod Braszell, General Manager, “COST-WORTH helped us to focus and acted as a catalyst for our quest towards gaining certification as a Q1 Ford supplier”. This quest has been successful and Ford has recognised Auto-Tek under its Q1 Preferred Supplier Quality Award program as “having achieved a level of excellence and as having in place processes and systems for continuous improvement in meeting and exceeding the customer’s needs and expectations”.

6.5.4.2 Stemar and COST-WORTH

Stemar Electrical Products Pty. Ltd. is a small manufacturing plant with a long history of supplying large power supply authorities. The Stemar workforce consists of twenty-eight employees with five office staff and the remainder on the shop floor. Given the size of the business, Stemar has a very flat organisational structure with only two steps separating the general manager and the shop floor. Within this flat structure the main mode of organisational communication is verbal although Stemar is relatively advanced when it comes to IT. Stemar has implemented an ERP system, M1, that has the potential to cover every aspect of the business. However, the M1 system was not being used to its potential simply due to the lack of managerial resources needed to implement and monitor the modules. Implementing the M1 system in areas

such as finite scheduling and capacity planning formed the basis of a BPR (Business process Re-engineering) project.

The three major issues facing Stemar are the rapid expansion of the business, maintaining a high level of customer service and communicating tacit knowledge throughout the organisation. The problems of warehousing and manufacturing space to accommodate the business expansion and tacit knowledge deployment are beyond the scope of ICT solutions. However, the issue of improving delivery performance to customers is a good opportunity to implement an ICT solution.

As a partner in the IMS COST-WORTH project, Stemar was used as a case study in the application of the Best Enterprise Practice (BEP) methodology described in the Auto-Tek case study above.

Using the BEP methodology, weak points were identified in Stemar operations in the areas of Order Management, Delivery Management, Production Management and Design. The common theme among the identified weak points is that of delivering performance and it was determined that addressing many of the weak points in Production Management would have the greatest effect on delivery performance.

Further analysis revealed that synchronising production should be a high priority and would result in the improvement of many of the problems faced in delivery performance. The bottleneck operation was the capacity of the testing facilities that resulted in large amounts of WIP building up before this operation. The recommendations derived from the analysis were to modify the scheduling software to schedule to capacity constraints and to implement a drum-buffer-rope system of production.

Drum-buffer-rope is a production technique inherent in the theory of constraints that schedules production at the pace of the bottleneck operation and reduces the amount of WIP throughout the organisation. Placing a buffer of work in front of the constraint (testing facilities) ensures that bottleneck machines are identified and loaded to the maximum. The bottleneck then becomes the drum that dictates the pace of production. Producing items at a rate greater than the throughput that the bottleneck can process will only cause an increase in WIP before the testing facilities without increasing output. The capacity of the testing facilities becomes the rope that triggers the release of materials into the production process. This ensures that only what is needed is manufactured thus reducing excess WIP. The benefits of scheduling production in this way are a reduction in WIP, an increase in total output, greater visibility on the production floor and increased delivery performance, all of which should contribute to an increase in customer satisfaction.

Senior Management at Stemar viewed the outcomes of the qualitative analysis and the BEP tool as “spot on” and acted on the weak points identified. The tool identified capacity and scheduling as the key areas of improvement. The company began by completely changing the layout of the factory to allow for an even flow. They then changed their raw material process from dumping work once a week to feeding the factory on a daily basis. A second test facility room was built (alleviating the capacity constraint) and dedicated testing facilities were built along the new production line. They have successfully modified the use of their ERP system to schedule and monitor production and have put more importance in the bar coding system that is meant to track production.

The combined result of these changes to process weak points identified during the COST-WORTH analysis is that they have achieved a substantial improvement in delivery performance, a primary goal of the project. Delivery performance in November, 2004 was at 65% on time delivery with late orders having an average of 14 days late. The implementation began in December, 2004 and delivery performance by March, 2005 had reached 84% on time with the average days late reduced to 10. Total output has also increased making the delivery improvements more significant, with latest reports putting delivery on time at 95%.

Please also see:

http://www.au.ims.org/news/20051004IMSAUenewsletter.htm

6.5.5 Collaboration and New Project Outlines

Expressions of interest were being sought as a result from continuing collaboration of companies and researchers from the CostWorth project. The EOI came about through the successful experience of participants from the CostWorth project and were putting forward the following project:

6.5.5.1 AMI4SME - Revolution in the Industrial Environment: Ambient Intelligence Technology for Business Process Improvement in Manufacturing SMEs

The next revolutionary step in process innovation in industry is to radically innovate the whole industrial working environment, by focusing it upon the role of the human being in industry and by applying emerging systemic approaches. The strategic objective of the AmI4SME project is to enable SMEs to actively take part in this revolution. The project aims at proposing a new, revolutionary scheme for systemic innovation of industrial working environments in SMEs by applying Ambient Intelligence (AmI) technology.

The AmI concept is to surround people with electronic environments which are sensitive and responsive to their wishes. AmI technologies are expected to combine concepts of ubiquitous computing, mobile sensory networks and intelligent agents placing humans in the centre of technological developments.

The prime application areas for the project are the distributed shop-floor; maintenance processes and the life cycle management of production system supply chains where application of AmI enables more effective dynamic collaborative work environments for a set of SMEs.

Milestone Work Tables

The performance indicators and current project achievements are descriptions of the project's activities to corresponding milestones.

The following milestones and outputs and are defined as per the DEST Long Funding agreement (v2/2003).

Milestones	**Outputs**	**Performance indicators**	**Current Project Achievements**
M7			
Project Management Planning and control of the overall project activities	Local Project Management National project Management	Meeting quality cost & time in accordance with previous milestones	Effective completion of Project tasks was achieved (see summary) SME was very positive as seen through active participation and continuing collaboration
02.05.05 -02.06.05			
M8			
Post Implementation Evaluation of Partners	Evaluate business performance of each SME. Check efficiency & effectiveness of method & impact on SME business perform	On-line tools were made available to Aust. SME to evaluate tools and gather info on usefulness to compare with EU partner results	Achieved improvement & retained business through improved business process. Developed tools so that SMEs could use easily and continue to do so on their own. Feed back was a very important component as this allowed for important modifications that focused on the SMEs needs and way of working with regards to their processes. This also gave them confidence to carry out the work on their own.
02.06.05-15.12.05			