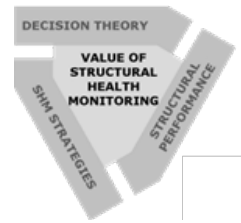


1st Workshop Opening Presentation

Sebastian Thöns

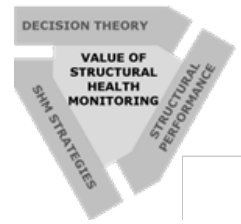


Initiation of COST Action TU1402

SHM constitutes scientifically, technologically and methodologically a well developed field. The potentials of structural health monitoring (SHM) are currently not completely utilised.

Developing SHM to maximize the Value of Information reveals high industrial potentials. Quantifying the Value of SHM is scientifically challenging.

With the initiation of the COST Action TU1402 we are providing a project vision with potentials beyond science and engineering. We are experiencing a large interest.



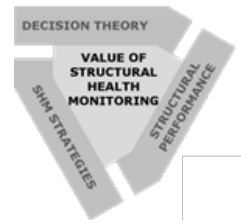
What is COST?

COST (European Cooperation in Science and Technology) is European framework supporting trans-national cooperation and dissemination among researchers, engineers and scholars across Europe.

COST aims to

- Enable breakthrough scientific developments leading to new concepts and products
- Build capacity by connecting high-quality scientific communities in Europe and worldwide
- Provide networking opportunities for Early Stage Researchers
- Increase the research impact on policy makers, regulatory bodies and national decision makers as well as on the private sector

Source: cost.eu

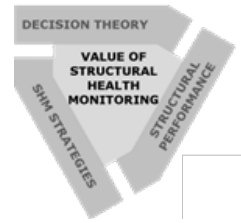


COST Action TU1402: Aims and Objectives

The main objective of the Action is to facilitate sustainable societal developments through improvements of resource efficiency, productivity, robustness, reliability and safety in the design and assets management for structures and infrastructure systems by optimised Structural Health Monitoring (SHM) systems.

Provision and dissemination of a framework with new consistent and efficient approaches to quantify, assess and optimize the benefit of SHM for structures and infrastructures

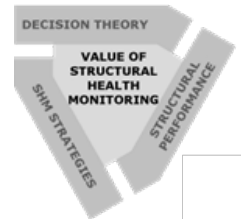
An improved economic efficiency in operation, maintenance and asset management of structures and infrastructures in the increasingly complex and ageing built environment in Europe



COST Action TU1402: Aims and Objectives

Main deliverables:

1. A chapter to the Probabilistic Model Code of the JCSS covering the theoretical and methodological aspects of the quantification of the value of SHM.
2. A library of tools and algorithms developed or tailored for support of the quantification of the values of SHM before its implementation.
3. A guideline on the quantification of the value and optimization of SHM with detailed examples aimed specifically at practising engineers.
4. A well-developed homepage including video streams of keynote presentations from workshops and conferences, written material produced within the Action as well as information about the Action and its participants in general.
5. Dedicated dissemination activities, including training courses for practicing engineers and researchers, regular workshops and special sessions at international conferences.

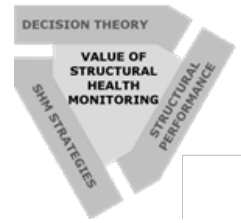


COST Action TU1402: Impact

The COST Action aims to impact science, industry and society.

Science impact:

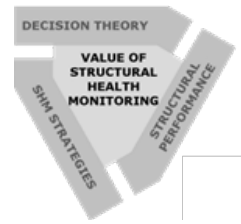
- Development of the scientific field for quantifying the value of Structural Health Monitoring
- The network of this Action with experts in science, industry and stakeholders of structures and infrastructure systems will be utilized for developing project proposals under HORIZON 2020
- The scientific field will be made accessible and practicable by dissemination including guidelines



COST Action TU1402: Impact

European economy and society impact:

- Improved economic efficiency in the continued development, operation and maintenance and asset management of structures and infrastructure systems
- New business opportunities for European small and medium-sized (SME) and large industrial enterprises and the opportunity to create high quality jobs
- Increased competitiveness in the building, construction and structural engineering industry

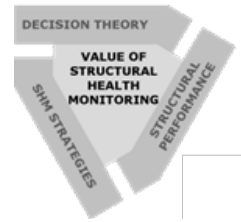


COST Action TU1402: Scientific Program

The scientific focus of the Action is directed to the objective of quantifying the value of structural health monitoring before implementation.

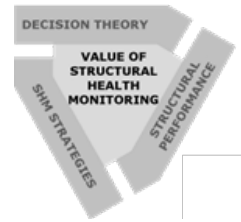
The COST Action comprises 5 Tasks:

- 1.Theoretical framework
- 2.SHM Strategies and Structural Performance
- 3.Methods and Tools
- 4.Case Studies Portfolio
- 5.Development of Guidelines



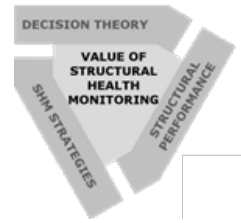
COST Action TU1402: Scientific Program

Tasks		Year															
		1				2				3				4			
		Quarter				Quarter				Quarter				Quarter			
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Task 1: Theoretical Framework																	
a	Clarification of the theory	■	■	■	■												
b	Formulation of theory for applications			■	■	■	■										
c	Communication of the theory						■	■	■								
M1	Dissemination								■								
Task 2: SHM Strategies and Structural Performance																	
a	SHM Categorisation	■	■	■	■												
b	SHM information modelling platform			■	■	■	■	■	■								
M2	Dissemination								■								
Task 3: Methods and Tools																	
a	Databases and modelling toolboxes for engineers and researchers					■	■	■	■								
b	Advancement of algorithms for efficient computation						■	■	■	■							
M3	Dissemination									■							

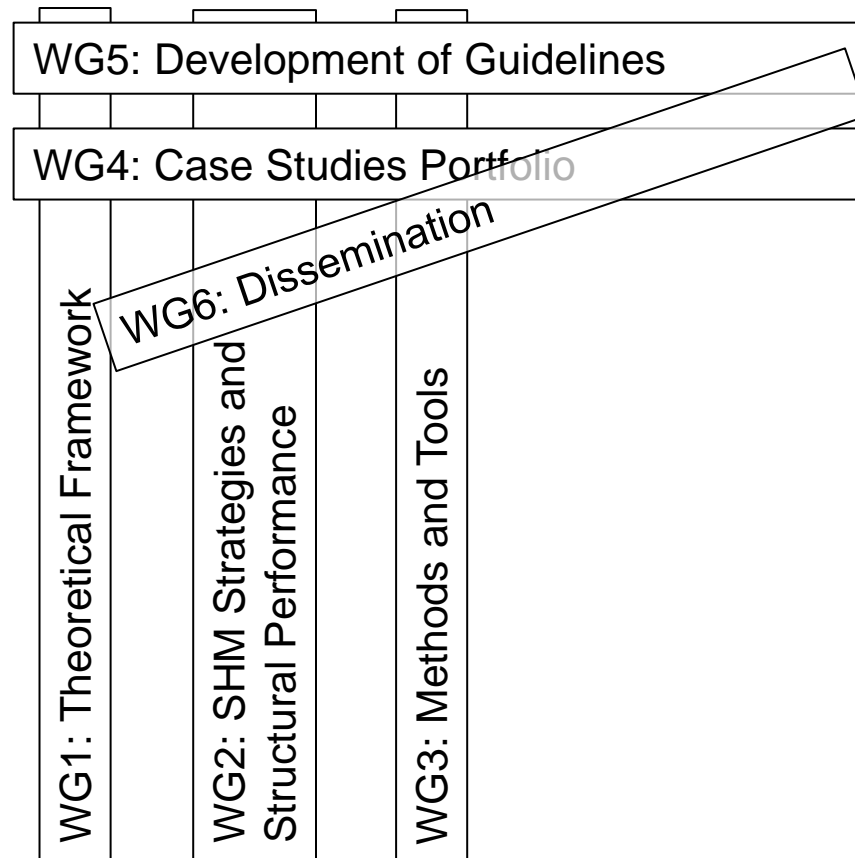


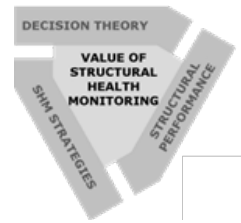
COST Action TU1402: Scientific Program

Tasks		Year															
		1				2				3				4			
		Quarter				Quarter				Quarter				Quarter			
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Task 4: Case Studies Portfolio																	
a	Selection of case studies					■	■	■	■								
b	Case study calculation and documentation									■	■	■	■				
M4	Dissemination													■			
Task 5: Development of Guidelines																	
a	Chapter of JCSS Probabilistic Model Code (PMC)													■	■	■	■
b	Guideline on the quantification of the value and optimization of SHM													■	■	■	■
M5	Dissemination of guidelines																■

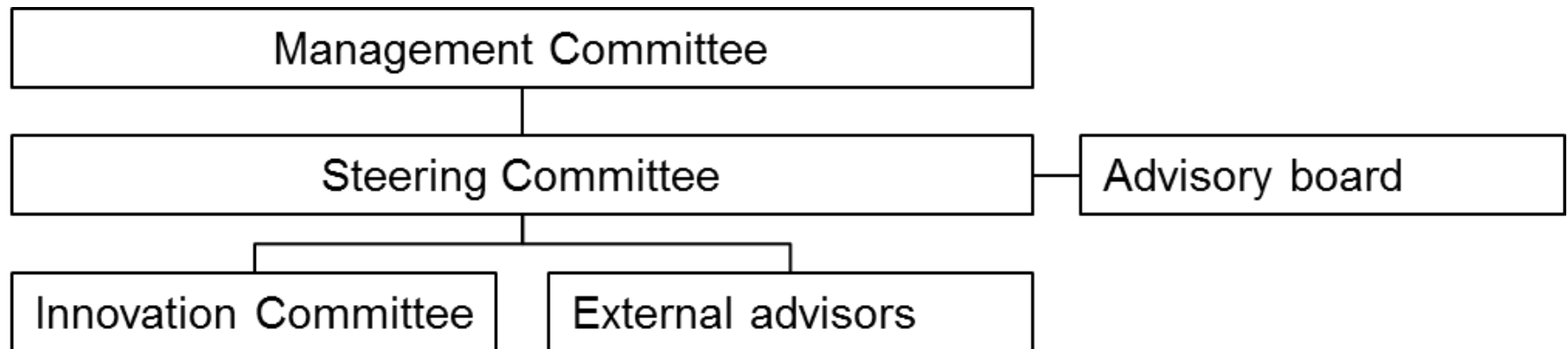


COST Action TU1402: Organisation

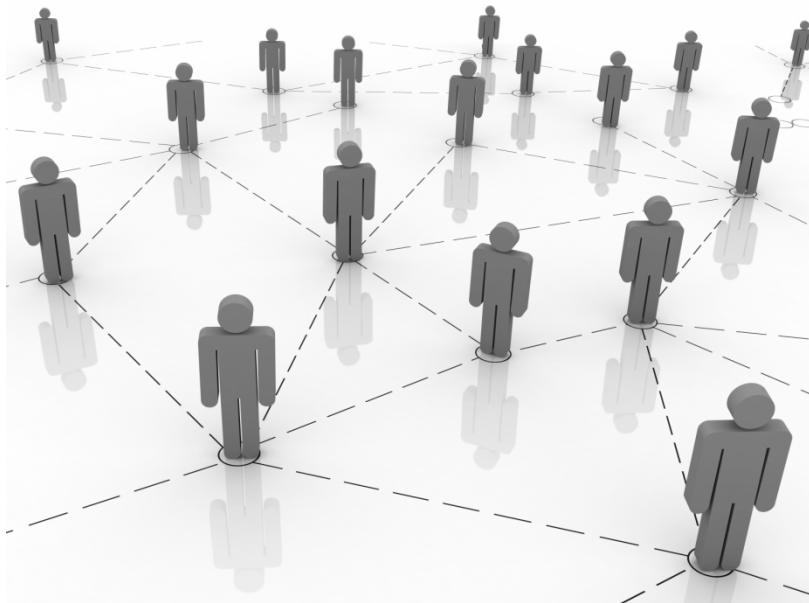




COST Action TU1402: Organisation



COST Action TU1402: Network



The partners comprise various research institutions, engineering consultants and industrial enterprises as well as operators of infrastructures.

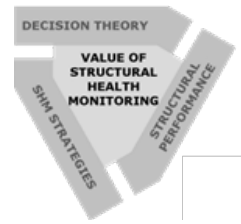
- External Advisors:

- Armen Der Kiureghian, University of California at Berkeley, USA
- James L. Beck, California Institute of Technology, USA
- Dagang Lu, Harbin Institute of Technology, China

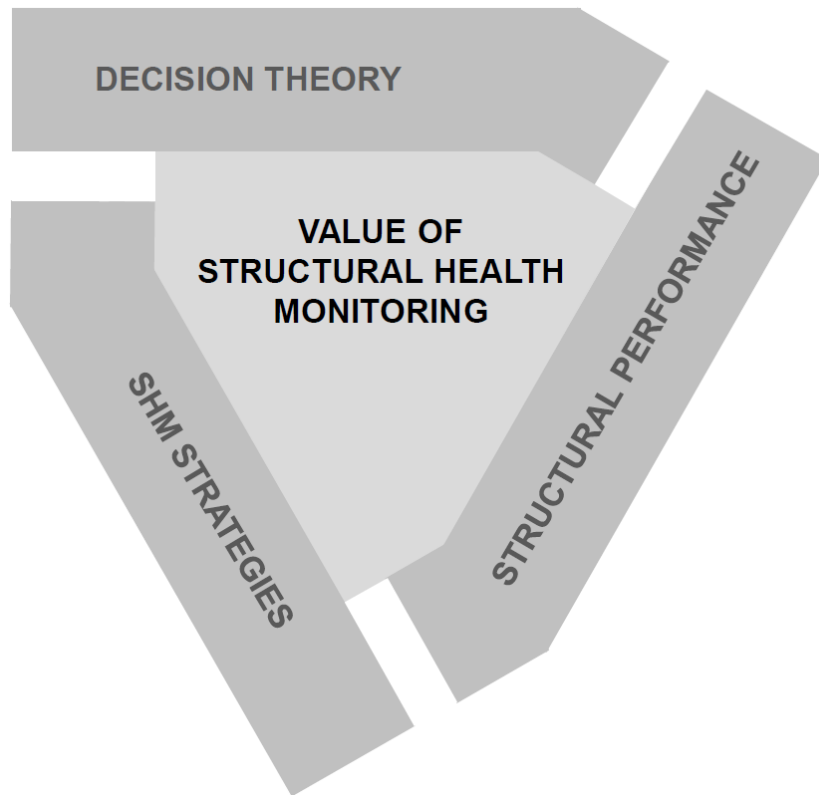
COST Action TU1402: Network



- Full proposal: 50 participants from 20 European countries
- Now: 110 participants from 25 European countries

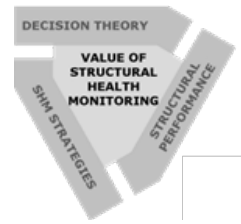


Quantification of the value of structural health monitoring

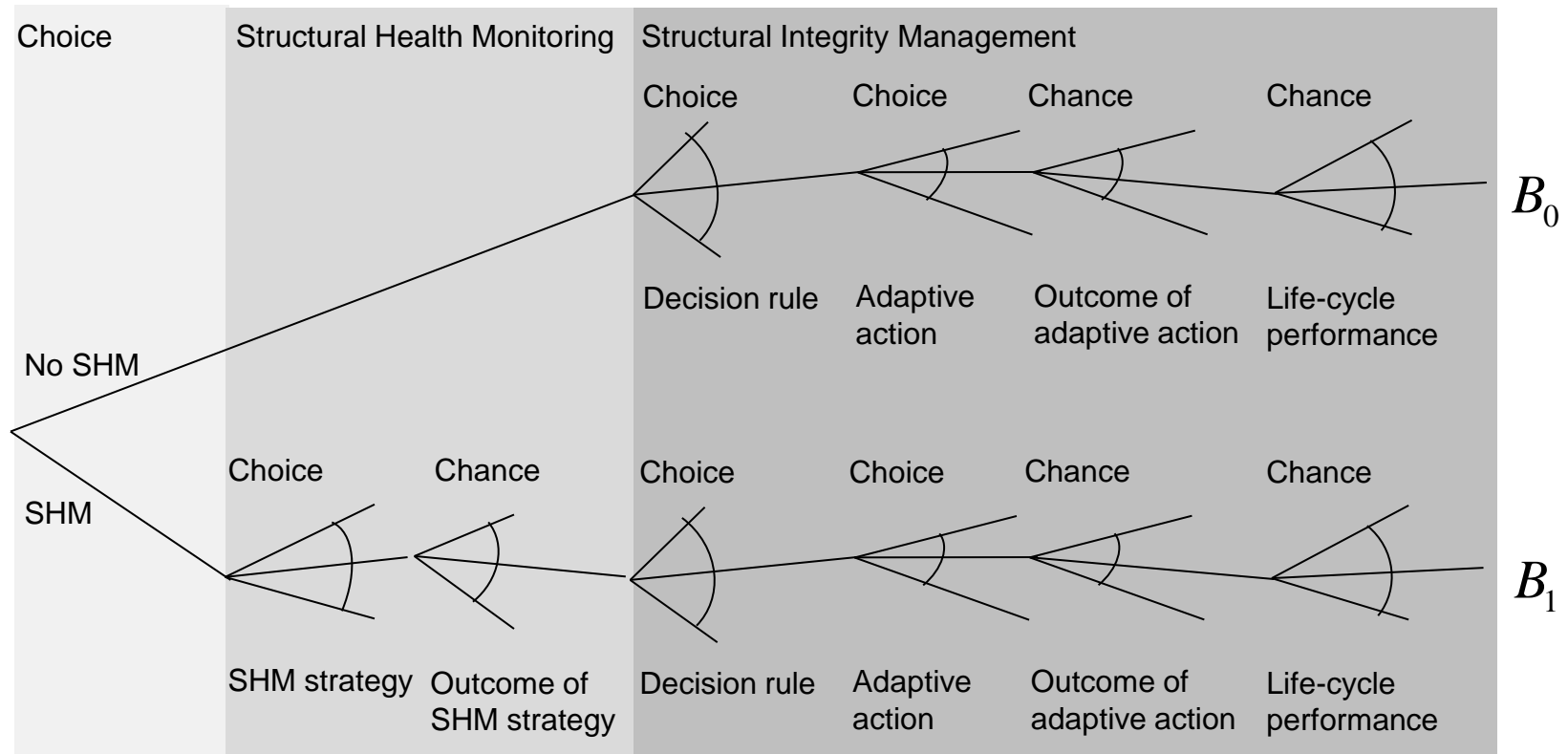


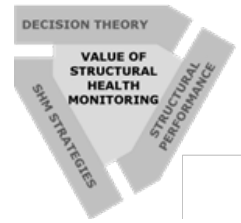
The value of structural health monitoring is calculated as the difference between life cycle benefits B_1 and B_0 :

$$V = B_1 - B_0$$



Quantification of the value of structural health monitoring





Quantification of the value of structural health monitoring

Value of SHM: $V = B_1 - B_0$

B_0 : Life cycle benefit without SHM

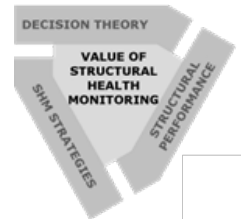
B_1 : Life cycle benefit utilizing SHM

Life cycle benefits: $B_0 = \max_{\mathbf{a}, \mathbf{d}} E_{\mathbf{Z}_E} \left[E_{\mathbf{Z}_A} \left[\mathbf{d}(\mathbf{a}, \mathbf{Z}_E, \mathbf{Z}_A), \mathbf{Z}_E, \mathbf{Z}_A \right] \right]$

$$B_1 = \max_s E_{\bar{\mathbf{Z}}_E} \left[E_{\bar{\mathbf{Z}}_A} \left[\max_{\mathbf{a}, \mathbf{d}} E_{\mathbf{X}|\bar{\mathbf{Z}}_E, \bar{\mathbf{Z}}_A} \left[\mathbf{X}, \bar{\mathbf{Z}}_E, \bar{\mathbf{Z}}_A, \mathbf{s}, \bar{\mathbf{d}}(\bar{\mathbf{a}}, \mathbf{X}, \bar{\mathbf{Z}}_E, \bar{\mathbf{Z}}_A) \right] \right] \right]$$

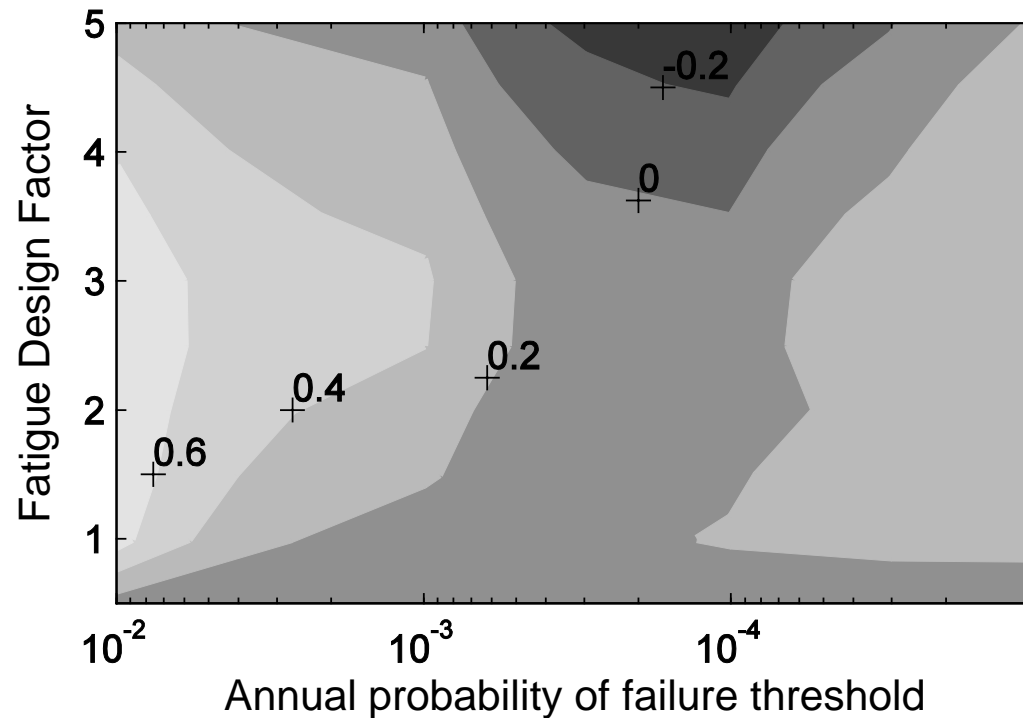
$\mathbf{X}, \mathbf{Z}_A, \mathbf{Z}_E$: Random variables for uncertain monitoring results, aleatory and epistemic uncertainties

$\mathbf{s}, \mathbf{d}, \mathbf{a}$: SHM strategies, decision rules and adaptive actions

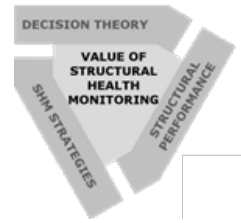


Quantification of the value of structural health monitoring

The value of SHM (normalised) in dependency of the design and the operation reliability.



References: Faber, M. H. and S. Thöns (2013). On the Value of Structural Health Monitoring. ESREL 2013. Amsterdam, The Netherlands.



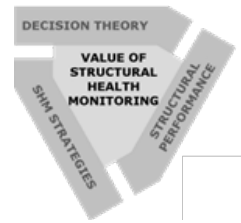
Work Plan 1st Grant Period (2015)

Workshop on Quantifying the Value of SHM

- Location: Technical University of Denmark, Lyngby, Denmark
- Type: Management Committee Meeting, Steering Committee Meeting, Working Group Meeting, Workshops/Conferences, Dissemination Meeting

WG1 (Theoretical Framework) and WG2 (SHM Strategies and Structural Performance) Workshop

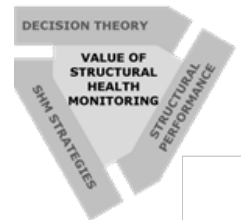
- Location: Istanbul
- Type: Management Committee Meeting, Steering Committee Meeting, Working Group Meeting, Workshops/Conferences



Work Plan 1st Grant Period (2015)

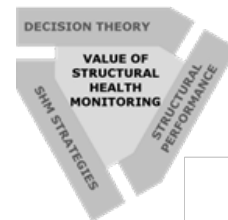
Further activities

- COST Action Webpage development
- Short term scientific missions (STSM)
 - Short-Term Scientific Missions (STSMs) allow scientists to learn from an institution or laboratory in another COST country.



Aims of the 1st Workshop

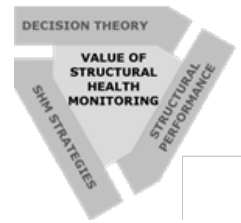
1. Development of a common understanding of the aims and the ideas of the COST Action TU1402 within our network
2. Dissemination of the aims and the ideas of the COST Action TU1402
3. Scientifically, the aims are to progress on
 - a. The clarification of the theory on quantifying the value of SHM (WG1)
 - b. The formulation of the theory for applications (WG1)
 - c. A categorisation of SHM strategies and structural performance models (WG2)



Agenda of the 1st Workshop

DAY 1: Monday, 04. May 2015

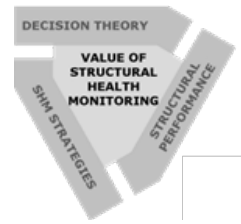
10:00-10:30	Registration and Welcome Reception
10:30-11:00	Workshop Opening Presentation
11:00-13:00	WG 1 Session: Theoretical Framework Chairs: M.H. Faber and D. Val
Lunch Break	
14:00-15:30	WG 3 Session: Methods and Tools Chairs: D. Straub and E. Chatzi
Coffee Break and Poster Presentations	
16:00-16:55	WG 4 Session: Case Studies Portfolio Chairs: Jochen Köhler and Helmut Wenzel
16:55-17:10	Helder Sousa: Let's innovate in the quantification of the Value of Structural Health Monitoring
17:10-18:00	Steering Committee Meeting
19:00	Workshop Dinner



Agenda of the 1st Workshop

DAY 2: Tuesday, 05. May 2015

08:30-11:00	WG 2 Session: SHM Strategies and Structural Performance Chairs: Marios Chryssanthopoulos, Geert Lombeart and Michael Döhler
Coffee Break	
11:30-12:30	WG 5 and WG 6 Session: Standardisation and dissemination Chairs: John Dalsgaard Sørensen (WG 5), Sebastian Thöns (WG 6)
Lunch Break	
13:30-14:00	Discussion and Conclusion
14:00-15:00	Parallel WG Meetings: Discussion, Planning and Preparation of Agendas Chairs: Individual WG Leaders
Coffee Break	
15:30-16:30	Management Committee Meeting



Coming together is a beginning; keeping together is progress; working together is success.

Henry Ford (1863-1947)