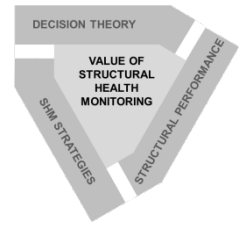


Fact sheet on the domains of the Value of Information in Structural Health Monitoring

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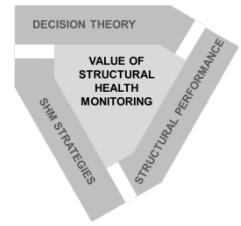
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Scope of the fact sheet

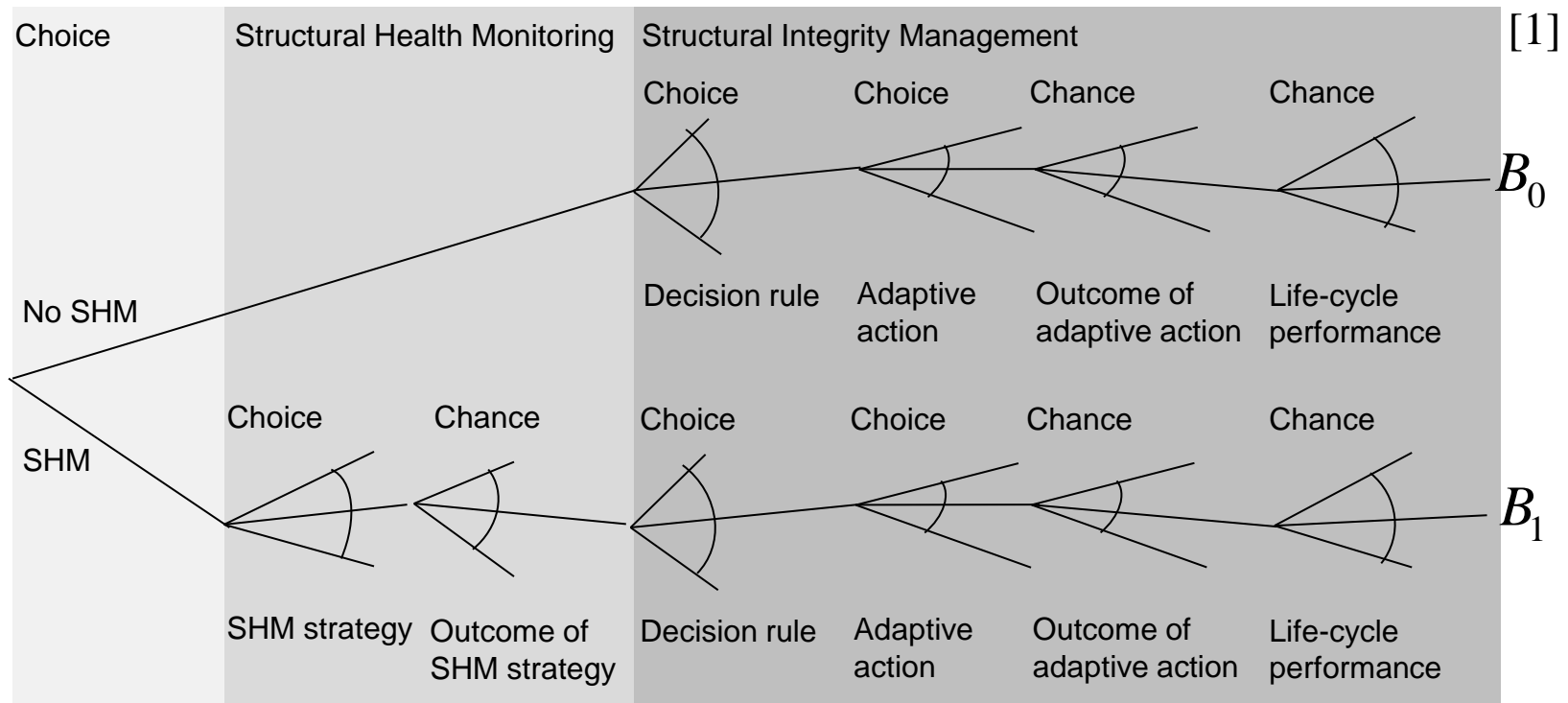
The scope of the fact sheet is to provide an

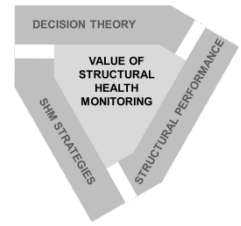
- A brief explanation of the Value of Information
- Overview about domains of Structural Health Monitoring (SHM) with expected positive Value of Information (Vol)
- A critical appraisal and proposals of research needed in order to close gaps in knowledge of the Vol in SHM.



Basis of Value of Information

The Value of Information theory was developed by Raiffa and Schlaifer. In order to obtain the Value of Information a decision process has to be evaluated.





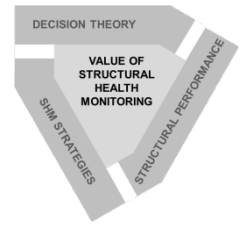
Basis of Value of Information^[2]

Value of Information: $V = B_1 - B_0$

- B_0 : Life cycle benefit without SHM
- B_1 : Life cycle benefit utilising SHM

Assuming a given B_0 benefit B_1 must be maximised in order to achieve the highest Vol V .

$$V = \max_s E_X[B(X, s)] - B_0$$

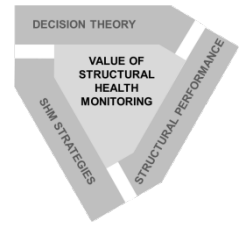


Application areas^[2, 3]

1. Operation optimisation of structures and portfolios of structures:
 - Service life extension
 - Utilisation modification
 - Damage progression monitoring
2. Code making and code calibration
3. Early damage warning
4. Structure prototype development / Design by testing
5. SHM systems prototype development

Further ideas for application area 1 can be:

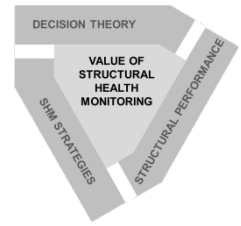
- Resilience of structural system
- Retrofitting SHM to historical buildings



Critical appraisal

Major challenges for Vol in SHM

- Computational effort
- Assessment and modelling of SHM triggered actions
- Probabilistic models relating to the overall system model, especially the monitoring and monitoring process model
- Understanding of the decision process in context of SHM in order to find a good representation of this process and suitable approximations.



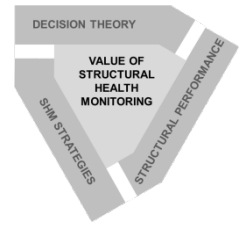
Critical appraisal

Whether or not the Vol is positive for a specific application or application fields has to be consistently and systematically quantified

- Vol has not been consistently and systematically quantified in a wide field of applications
- Each application requires a well defined decision support in order to obtain the Vol

Vol has potential to support the development of new SHM technologies.

- Assess the benefit of a new technology before the actual application
- The concept of Vol has not reached enough SHM researcher and developers
- COST Action TU1402 shall further the application of Vol through education



Thank you for your attention

- [1] Faber, M.H., Val, D. and Thöns, S. 2015. Value of Information in SHM – Considerations on the Theoretical Framework. *Proceedings of the 1st Workshop on Quantifying the Value of Structural Health Monitoring COST Action TU1402* (Sep. 2015), 5–16.
- [2] Faber, M.H. and Thöns, S. 2013. On the value of structural health monitoring. *22nd Annual Conference on European Safety and Reliability* (2013), 2535–2544.
- [3] Wenzel, H. 2015. IRIS Working Document WD-580: Most Common SHM Objectives.