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Report R382
Design of the GDSI Open-Platform and GDSI Factsheets

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GDSI
Global Decision Support Initiative

Summary

Aim of this deliverable is to describe the work being carried out for the conceptual design of the Open-Platform and Factsheets for GDSI, in accordance with the project plan of Simona Miraglia (Postdoc2-DTU-BYG) in collaboration with Carlos Moraleda Melero (Research assistant), Sebastian Thöns (DTU-BYG) and Peter Fantke (DTU-MAN).
A brief literature review regarding basic terminology, key concepts about the difference between 'free' and 'open' sources of software and information are summarized as background motivation for the choice of specific functionalities for the *GDSI Open Platform'. A mock-up has been developed to provide a preliminary overview of the architecture of the Platform and how the Platform will work. The document contains also the design of the factsheets, intended as dissemination materal over engineering decision problems of GDSI interest. A summary table listing free tools and free data sources is included in this report as starting point for the identification of useful tools to use as example for the development of the toolbox. The authors are aware that the list of tools and data sources may be not complete.
The toolbox associated with the Platform will be developed and integrated in the GDSI Open Platform by Postdoc3-DTU-Compute.

April 19, 2017

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What is an Open-Platform?

1 Open-Platform

1.1 Introduction

In Baldwin (2011) an extensive review of the definition and use of the term 'platform' can be found. Among the different meanings, Baldwin identifies the most generic definition of platform as given in Robertson (1998), where the term platform is associated with any '*collection of assets that are shared by a set of products*', where the term assets can identify different items, from components to knowledge. Table 1 lists a few common definitions of platform. For a detailed classification of definitions see Baldwin (2011). The core function of a platform is then identified in allowing and sharing of assets to enhance innovation. However, it is in the architecture of the platform that the function of sharing (assets, products, knowledge, etc..) is tailored to its specific area of interest by enabling specifically designed features including list of functions, description of all components needed to perform the functions, description of the interface and operation of the system (Wheelwright, 1992, Baldwin, 2011, Eisenmann et al, 2011). Therefore, modularity and flexibility of the interface are important properties of any platform architecture, because they are essential since the design phase to assure that the platform will be able to allocate any new feature and future evolution of scope.

Table 1: Some definitions of Platform

SOURCE	A	B
Cambridge Dictionary	An opportunity to make your ideas or beliefs known publicly	The type of computer system or smartphone you are using, in relation to the type of software (= computer programs) you can use on it
Tech Terms	A computer's operating system	/
Merriam-Webster Dictionary	The computer architecture and equipment using a particular operating system	An arrangement of computer components that uses a particular operating system
The Free Dictionary	The basic technology of a computer system's hardware and software that defines how a computer is operated and determines what other kinds of software can be used.	/
Oxford dictionary	A standard for the hardware of a computer system, which determines what kinds of software it can run.	/
Business Dictionary	Hardware: Foundation technology of a computer system viewed as a 'layered' device. The bottom (chip level) layer is called a platform such as an 'Intel Platform' or 'SunSparc Platform.' It is a broader view than system architecture which concentrates mainly on standard interfaces.	Software: Operating system (such as Linux, MacOS, Unix, Windows) that is the foundation on which all application software runs
Robertson	'collection of assets that are shared by a set of	/

(1998)	products'	
Tirwana et al. (2010)	Extensible codebase of a software based system that provides core functionality shared by the modules that interoperate with it. A module is an add-on software subsystem that connects to the platform to add functionality to it	/
Baldwin (2011)	1. Product development 'projects that create a new generation of products for a particular firm' 2. Technological systems 'point of control (and rent extraction) in an industry' 3. Transactions 'products, services, firma or institutions that mediate transactions between two or more groups f agents'	

Important properties of platforms are openness and transparency for both developers and users. In Benlian et al.(2015) an overview over the definitions and conceptualization of platform openness can be found. Openness in platform development is generally understood as the degree to which access, use and control of the information is allowed and/or restricted on the platform. Transparency is understood as the degree of exchange of information over the scope of the platform, open technical documentation and terms and condition of use of the material available on the platform. Moreover, the interaction between platform developer and user can generate a beneficial collaboration enlarging the platform network to form a so-called 'platform ecosystem', which consists of the platform initial developer and the third-parties developing complementary parts (sharing materials, tools, participating to discussions, etc…). In this context, transparency becomes a key performance indicator for the third-parties willing to develop complementary parts of the platform, since they mainly respond to the incentive of having their contribution clearly acknowledged and officially recognized (Benlian et al., 2015).
Two possible openness structures are conceptualized in technical literature: horizontal and vertical openness. Horizontal openness is achieved when all restrictions are applied in equal degree to both developers and third parties, meaning that if use, development and commercialisation are not restricted, control and licensing is totally given up. Vertical openness is achieved when the control and restrictions are totally managed by the developers who have to evaluate the trade-off between the degree of control on the development of the platform and openness to the third parties (Benlian et al., 2015).
The GDSI platform will be designed initially as a vertically opened platform where the developers have the full control of the information and developed tools till the network of users (the platform eco-system) grows to a size which makes the trade-off evaluation over openness applicable.

1.2 Platform of Service

An interesting variation of platform, which is also the kind of platform which will be implemented for GDSI, is a '*platform of service*' or '*web-service*'. In Keller & Rexford (2010), an analysis of the evolution of network services can be found, highlighting how sharing of infrastructures from computing to resources for learning has boosted innovation.

Alonso et al (2004) define a web-service as a website interface with the aim of exposing the functionalities of a system and make those functionalities accessible through the web '*in a controlled manner*'. Therefore, web-service are so-called 'wrappers', i.e. they provide a user-friendly interface which unifies different functionalities (software, B2B, forum etc.) in one interface.
The idea at the basis of the GDSI Open-Platform is to provide a platform for fostering innovation, exchange of knowledge and calculation tools in decision making. Therefore, we can allocate the GDSI Open-platform in the category of technological platform of service and platform with the general architecture structure depicted in Figure 1. As highlighted in Figure 1, an important characteristic of the platform architecture is the feedback loop between user in demand and user in supply of the platform (see also Boudreau, 2010). The feedback loop assures the improvement of platform components, i.e. the creation of new feature and update of the existing ones, including the elimination of bugs when tools are provided as open source (i.e. with open access to the source code).

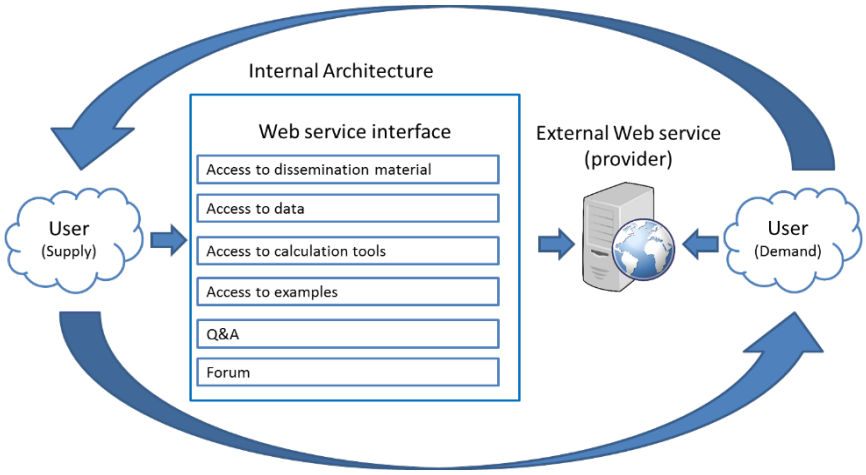

Figure 1. General architecture of GDSI Open Platform

1.2.1 Open Source

It is in the mid-90s that the concept of 'open source' raises as a philosophical movement which rejects the idea of software ownership (i.e. fully covered by intellectual and commercial property) supported also by the development of 'Internet' as a 'place' for collaboration in software development (West, 2003). This philosophical movement was enforced by Stallmann (1999), who launched the GNU Project in 1983 to enforce the idea that all software should be both free and open. Indeed, there is an important difference between 'free' software and 'open' source. Free software do not allow '*ex post appropriation of the technology*', i.e. any improvement made remains under the property of original author, while open source allows any user to combine and customize any software as they want (West, 2003). However, it is intuitive that the use of 'open source' software is not for everybody, but only for the users having the technical skills required to modify and customize the source code (West, 2003).
Boudreau (2010) identifies the main difference between open and closed technologies in the context of innovation platforms. Openness *' relates to the easing of restrictions on the use, development and commercialization of a technology*' (Boudreau, 2010) and therefore the term 'open' relates to a non-ownership of the technology giving full accessibility to all.

'Closed' technologies are fully owned by a single party which restricts its development by means of copyright rights. Therefore, Boudreau (2010) highlights how '*opening the platform to outside contributions creates a new challenge: accumulating and consolidating diverse contributions to a single object'* creating a problem of trade-off between closed and open platform.

1.2.2 Open-Data Platforms

Open-data availability is important for the open access to published scientific work and reproducibility of published results. In addition, transparency over data use is an essential condition to create public value, when decision affecting environment or society are made (Douglas&Meijer, 2016). However, Open-data access is to some extend a controversial topic, especially when the data are related to industrial R&D groups' activities or relate to governmental consulting bodies. Several authors investigated the ethical implication of open and full access to information as means of real democracy and transparent management despite it may cause misunderstanding and misuse of data (Mejer, 2012, Ruijer et al., 2017). In Ruijer (2017), the author argues that often information are available in relation to what '*is asked for*' and seldom to what '*it is needed and can be understood'*, making difficult to avoid misinterpretation. Data need to be provided in a form which is standardized and understandable, i.e. data should be provided with an interface or tool which facilitates interaction with the data and with the data-administrator for feedback. European Directive (2013/37/EU, 2013) on the reuse of public sector information assure the right to access to data and information when the use of data relates to public sector decisions (Ruijer et al., 2017). Technical requirement for the data form on open data platforms are reported in the EU-directive 2013/37. The EU-directive also establishes the type of data which must be excluded by open access platforms and rules for charging marginal cost for data collection. Table 2 summarizes sources and conditions under which no open data access is allowed by EU-Directive 37-2013.

Table 2: EU-directive 2013/37 data access summary

Source	Not suitable for Open Access	Data Format
Public libraries, university libraries, museums, archives, research results, schools and universities, public sector bodies	Data covered by exclusive rights to private partners. National security, defence or public security Statistical confidentiality Commercial confidentiality Protection of personal data Data used by public bodies to generate revenue Data covered by arrangements granting exclusive rights	1. '*machine-readable format'*, i.e. data format is recognizable by any software ; 2. '*open format'*, i.e. platform-independent file format; 3. '*formal open standard'*, a format whose specification are written and provided with the data file.

The GDSI-Patform Open-data database is conceived to make publicly available the data used for the GDSI study-cases in line with the concept of reproducibility of scientific results. The data needs to be provided in a standard form which is currently under discussion as well as the possibility to external researchers to upload data related to their research and of interest for GDSI.

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2 GDSI Open-Platform

2.1 Definition of requirements

The GDSI-Open Platform is meant to exchange information and data available with other research groups, disseminate the research progresses of GDSI, for the storage of information and models, the organization of an analysis of models as well as the presentation of results of decision analyses. In a later stage a toolbox to solve engineering decision problems using the GDSI Framework and algorithms will be published on the platform.
The educational material is provided in form of factsheets. GDSI factsheets are designed to give the user an overview of the basis of decision analysis (see also DTU- Decision Theory course 42714), risk and sustainability assessment, guidelines for solving decision problem where risk and sustainability need to be integrated (GDSI framework) and a set of concrete cases where the structure and solution of a decision problem is described.
Table 3 lists the identified functionality needed for the development of the desired platform.

Table 3. Definition of GDSI platform requirements

FUNCTIONALITIES	NEEDED
1. User Interface (UI)	The UI produce a user interface which makes it easy (self-explanatory), efficient, and enjoyable (user-friendly) to operate the open platform in the way which produces the desired result. A responsive theme compatible with the Content Management System (CMS) Drupal will be selected.
2. File Download system	A FTP (File Transfer Protocol) is needed. It represents the network functionality that enables users to upload web page files. Provided by the Content Management System (CMS).
3. Database Management	Computer software application that interacts with the user, other applications, and the database itself to capture and analyze data. Provided by the Content Management System (CMS).
4. Forum	Online discussion site where people can hold conversations in the form of posted messages. A Message Board will be created (Forum)
5. File tagging and sorting	Tags are the keywords that are applied to the resources, like, web pages, videos, images, paper citations and blogs. Tags are used for categorization and to facilitate search. The tagging functionality will be incorporated in our website.

6.	Online calculation	Software. Application Programming Interface (API). Interactive dashboard allowing a view of project and asset risk. Medium-long term implementation.
7.	User management and roles	Log in, different levels (Register for data. They can see PDF) Register form. - Anonymous user - only allow to view public website - Registered contributor - allow to upload and download files, can create content (e.g. commenting on data, tagging files) which will have to be reviewed by a site editor before making public - Site editor - Manage and administer content and files and review content added/changed by registered contributors - Administrator - Full access to complete website management system
8.	Automatic report	PDF that is auto-generated containing files selected for download and their descriptions and tags, maybe some summary statistics. Medium-long term implementation.

2.2 Implementation of the first version of the Open-Platform

A mock-up was created in order to facilitate the collaboration with the Web-developer on the implementation of a first version of the platform on a purchased internet domain. The main structure of the website was defined, including the front page, menus, submenus and subpages (see Figure 2 to Figure 6).

Figure 1 depicts the 'front' page of the platform, where main information about GDSI goals, scope and activities are provided to the user. Basic and principal information of the Open Platform, with a small video/picture introducing the Open Platform goals are also published on the front page. In addition a contact name can be in the right side. A news section with the latest "Data upload", "case studies", "forum post" and news can be also in the front page, in order to facilitate the access to the most recent content.

A screenshot of the different submenus (Decision Support, Toolbox, Application, Data, Example, Download, Forum and Q&A-Questions & Answers) can be seen in Figure 3 to Figure 6. Information material on topics within the three main fields of interest of GDSI study cases will be available as well as the toolbox.

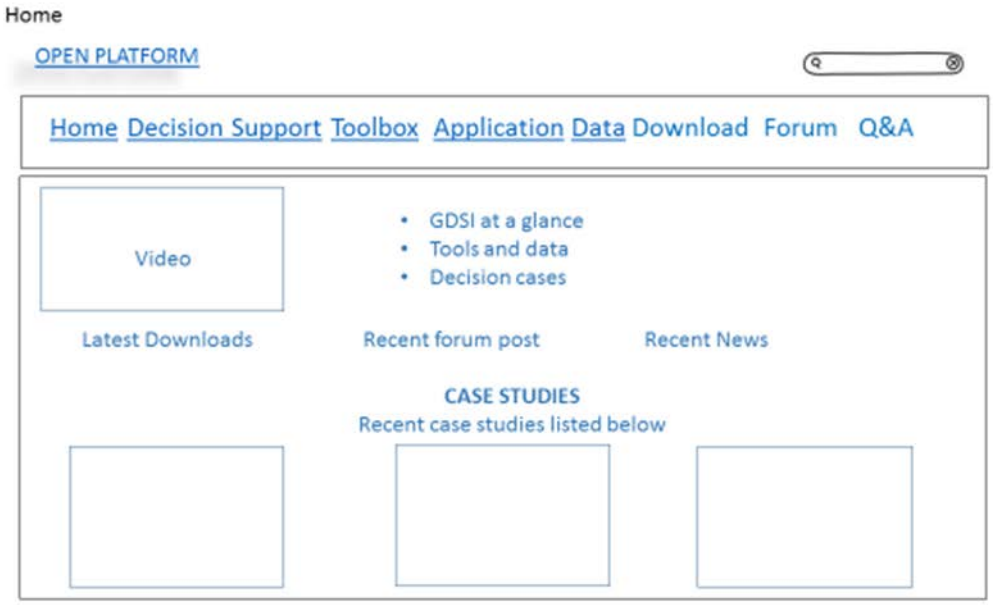

Figure 2. Front page of the Open Platform

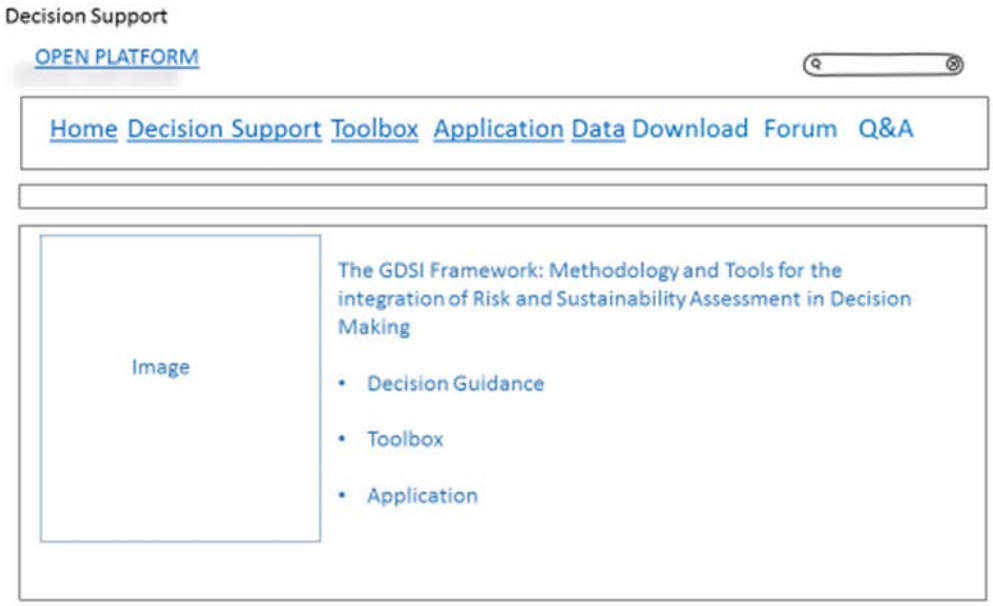

Figure 3. Submenu ‘Decision Support’

Toolbox

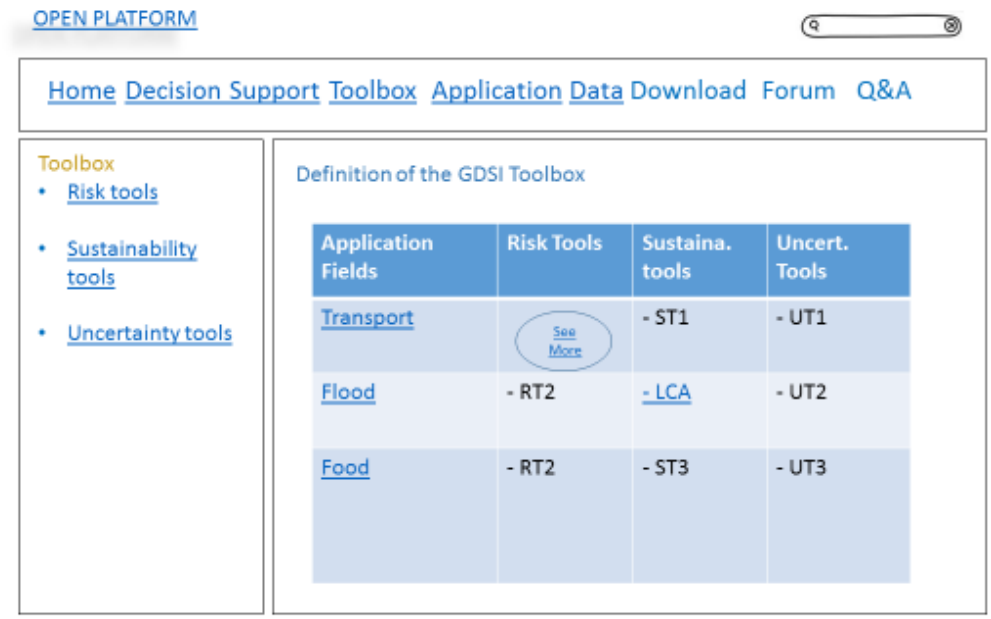

Figure 4. Submenu 'Toolbox'

Application general

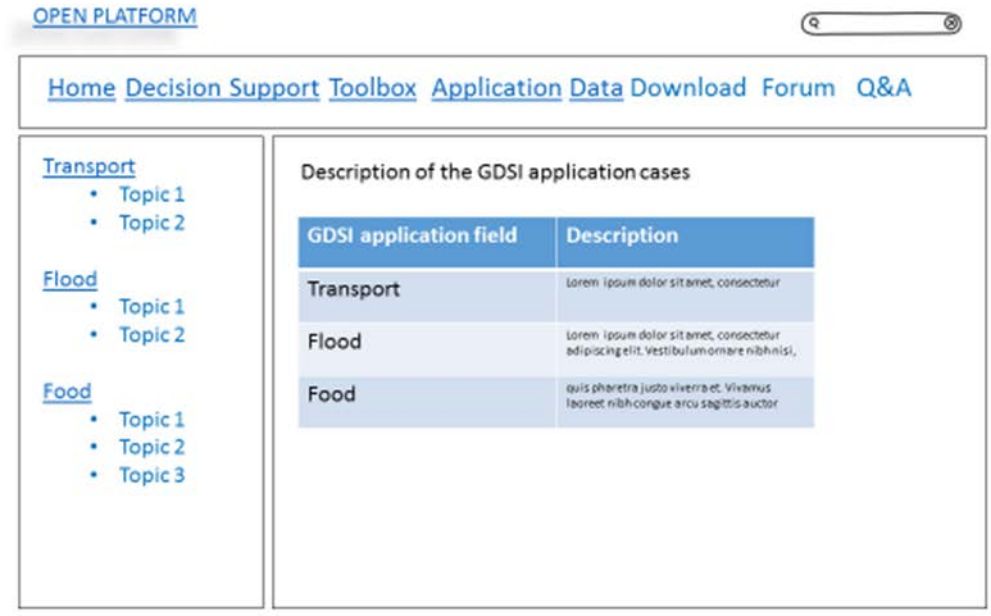

Figure 5. Submenu 'Applications'

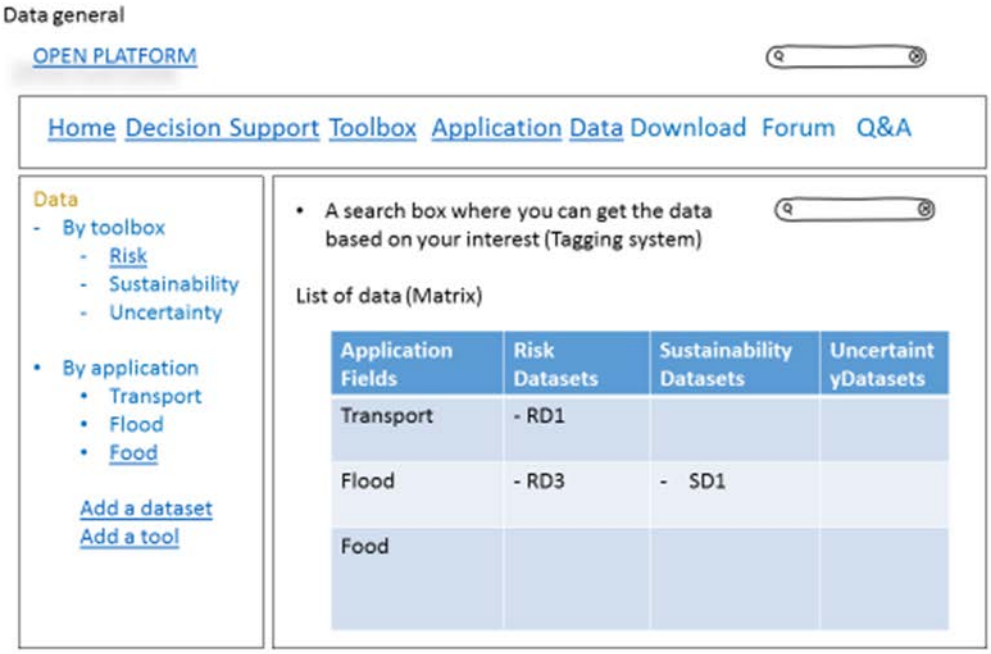

Figure 6. Submenu 'Toolbox'

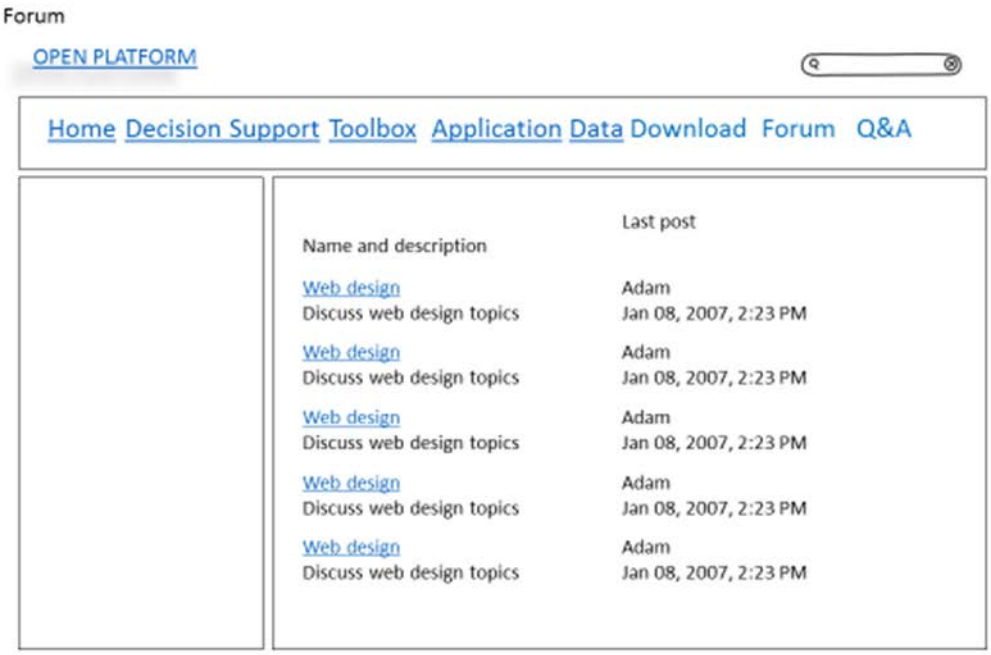

Figure 7. Submenu 'Free data sources' with login option on the bottom right side

2.3 Existing free sources of Tools and Data-set

Several projects have been targeting the collection of data and the design of tools for the modelling of risks and environmental impacts in several fields of application. Powerful tools for uncertainty quantification are also available as 'open source' or 'free software'. In Table 4 a list of useful freely available tools are listed. In Table 5 a list of useful free data sets are listed. The authors are aware of the fact that the list is not complete of all the available sources, but it can be completed during the phase of implementation of the platform.

Table 4. Useful Free Tools sources

CATEGORY	TOOLS
9. Statistical Computing , Graphics and Inference	• The R project: https://www.r-project.org/ • Sparse Multinomial Logistic Regression- SMLR: https://users.cs.duke.edu/~amink/software/smlr/ • DTU DACE-Matlab Kriging Toolbox: http://www2.imm.dtu.dk/projects/dace/ • The BUGS Project: http://www.mrc-bsu.cam.ac.uk/software/bugs/
1. Uncertainty quantification	• OpenCOSSAN: http://www.cossan.co.uk/software/open-cossan-engine.php • The Framework for Uncertainty Quantification: UQLab, ETH Zurich: http://www.uqlab.com/ • OpenTurns - PHIMECA Engineering SA: http://www.openturns.org/ • UNICORN: http://www.lighttwist.net/wp/unicorn-download
2. Fault Tree	• Fault Tree Analyser: http://www.fault-tree-analysis-software.com/fault-tree-analyser
3. Bayesian Networks	• Bayes Fusion LLC: http://www.bayesfusion.com/ • HUGIN Expert Academic license: http://www.hugin.com/ • UniNet: http://www.lighttwist.net/wp/uninet • Kevin Murphy OpenBayes : http://www.cs.ubc.ca/~murphyk/OpenB

	ayes/index.html • Bayesian Network Inference with Java Objects -Banjo: https://users.cs.duke.edu/~amink/software/banjo/
4. Petri-Nets	• WoPeD (Workflow Petri Net Designer): http://woped.dhbw-karlsruhe.de/woped/
5. Life Cycle Assessment	• OpenLCA: http://www.openlca.org/ • Integrated Product Policy Toolbox: http://ec.europa.eu/environment/ipp/toolbox.htm • JRC- European Platform on Life Cycle Assessment: http://eplca.jrc.ec.europa.eu/?page_id=140 • DTU-USEtox: http://www.usetox.org/
6. GIS software	• QGIS Project: http://www.qgis.org/en/site/
7. Traffic Models	• Road traffic simulation SUMO-Simulation of Urban MObility: http://www.dlr.de/ts/en/desktopdefault.aspx/tabid-9883/16931_read-41000/ • Transport Simulations MATSim: http://www.matsim.org/
8. Flood Modelling	• ANUGA Hydrodynamic/Hydraulic Modelling: https://anuga.anu.edu.au/ • Water modelling system MOHID: http://www.mohid.com/ • Numerical Modelling of Flow BASEMENT: http://www.basement.ethz.ch/ • Data Assimilation OpenDA: http://www.openda.org/
9. Chemical models	• QSAR Models 1-KNIME : https://www.knime.org • QSARINS: http://www.qsar.it/ • Open 3D QSAR: http://open3dqsar.sourceforge.net/ • CoMFA: http://www.cmbi.ru.nl/edu/bioinf4/comfa

	-Prac/comfa.shtml#introduc • OCHEM: https://ochem.eu/home/show.do • Chemical and biological data mining ChemBench: https://chembench.mml.unc.edu/ • EPA.Gov EPI-Suite: https://www.epa.gov/tsca-screening-tools/epi-suitetm-estimation-program-interface
10. Computational Methods in Structural Mechanics and Fluid Dynamics	• Mmg Platform for Robust meshing: http://www.mmgtools.org/ • GID-pre and post processor for numerical simulations: http://www.gidhome.com/ • Free FEM software LISA: http://lisafea.com/ • OpenSEES- Performance of structural and geotechnical systems subjected to earthquakes: http://opensees.berkeley.edu/ • FERUM- Finite Element Reliability Using Matlab: http://www.ifma.fr/FERUM • DTU-HAWC2 Wind Energy Horizontal Axis Wind turbine simulation Code 2nd generation : http://www.hawc2.dk/ • DTU-WASP Wind Energy siting of wind turbines and wind farms: http://www.wasp.dk/ • CFD models OpenFOAM: www.openfoam.com
11. General Natural Hazard Risk Assessment	• Probabilistic Risk Assessment (CAPRA) Program : https://ecapra.org/ • AGORA: http://www.risk-agora.org/index.php
12. Seismic Risk Assessment	• USGS-OpenSA (Seismic Hazard Analysis): http://www.opensha.org/ • GEM-OpenQuake: https://www.globalquakemodel.org/openquake/about/ • SELENA-RISe : http://www.norsar.no/seismology/engineering/SELENA-RISe/

13. Chemical Risk Assessment	• ALOHA and CAMEO from EPA-GOV : https://www.epa.gov/cameo
14. Financial Risk	• OpenRisk Tool : https://www.openrisk.eu/openrisk/ • OpenSourceRisk: http://www.opensourcerisk.org/ • Pillar1: http://www.pillarone.org/home

Table 5. Useful Free Data sources

CATEGORY	Data Source
1. Data for Seismic Hazard and Risk analysis	• PEER Ground Motion Database: http://peer.berkeley.edu/products/strong_ground_motion_db.html • Global earthquake Model GEM Foundation: https://www.globalquakemodel.org/resources/use-and-share/data/ • KNMI Dutch Meteorological Institute data-centrum: http://www.knmi.nl/kennis-en-datacentrum
2. Data for Flood Hazard and Risk analysis	• KNMI Dutch Meteorological Institute data-centrum: http://www.knmi.nl/kennis-en-datacentrum • DHI-MIKE software for data management: https://www.mikepoweredbydhi.com/
3. Data for Chemical Hazard and Risk analysis	• Chemical Database ChemIDplus : https://chem.nlm.nih.gov/chemidplus/' • OECD eChemPortal: http://www.oecd.org/chemicalsafety/risk-assessment/echemportalglobalportaltoinformationonchemicalsubstances.htm
4. Data for different purposes	• OECD Data Platform: https://data.oecd.org/ • Global Risk Data Platform, UNEP(Geneva):

http://preview.grid.unep.ch/index.php?preview=home&lang=eng

- The World Bank : http://www.worldbank.org/

2.4 Design of factsheets for Open-Platform

GDSI-factsheets are intended to fulfil the dissemination purpose of the platform regarding the background theory of decision making under uncertainty, quantitative risk and sustainability analysis with respect to the three GDSI fields of application. A factsheet is a document summarizing information about a specific topic and which addresses key points. For the purpose of dissemination of GDSI activities on the GDSI Open Platform, GDSI factsheets need to be as complete as possible and of a good quality, keeping the limit of 5-10 pages.
Any material which is meant to be published will be still included but we will keep the factsheet for internal use till the paper is submitted, then it can be published on the GDSI Open Platform.

The following Factsheets are designed with table of content as follows. The Factsheet template is designed on the basis of the factsheet template used in COST-Action TU1402. The template is shown in Appendix A.

Table 6. Factsheet list and overview of content

Factsheet No.	Title	Description	Table of content

1	Decision Theory and Classes of Engineering decision problems	The main theory of decision making shall be clearly described	- Glossary decision analysis terms and abbreviations
			- Overview on Decision Analysis
			  o Models levels in decision theory
			  o Decision model description
			- Subjective Expected Utility theory
			  o Preferences, Lotteries, Axioms
			  o Prospect theory
			  o Trade-off
			- Decision trees
			- Influence diagrams
			- Treatment of Uncertainties referring to Factsheet3
			- Sensitivity Analysis in decision theory
			- Value of information
			- Multi-Criteria analysis
			- Pareto Optimality (definitions and weighting schemes)

2	Quantitative Sustainability Assessment	The main theory of sustainability assessment shall be clearly described	- Glossary/terminology and abbreviations
			- The Sustainability concept (definitions, dimensions of sustainability etc….)
			- Approaches to sustainability assessment
			- Simple and aggregated indicators of sustainability performance
			- LCA introduction and different methodologies
			  o LCA basics;
			  o Inventory analysis
			  o Impact Assessment
			  o Input-output models
			  o Impact categories

			o Weighing and normalization o Interpretation - Treatment of Uncertainties referring to F3 - Sensitivity Analysis - Overview of Tools for LCA
3	Uncertainty Quantification	Definitions, n theory and methods for uncertainty quantification shall be clearly described	- Definition and classification of sources and type of Uncertainty (Glossary/terminology and abbreviations) - Differences between verification, validation and uncertainty quantification - Representation of uncertainty: Probability theory (classic interpretation, logical interpretation, frequentistic interpretation, subjective interpretation) - Uncertainty Propagation methods: o Method 1…. o Method 2…. - Visualization of results of the uncertainty analysis - Differences between sensitivity analysis and uncertainty quantification Overview of Tools for uncertainty quantification
4	Risk Analysis	The main theory of risk analysis, assessment and management shall be clearly described	- Definition (Glossary/terminology and abbreviations) - Framework and system representation - Methods for risk analysis, assessment, management - Overview of regulations
5	Case Study : Urban transport systems	The full description of the case study with results shall be provided	- Glossary/terminology and abbreviations - General Description and context: Goal and Scope definition for the study case (object of the decision analysis) - System description and Problem structure: o system typology o system boundaries o objective to be achieved o identification of criteria for the system performance assessment o variables describing the problem and performance indicators o prediction models for generation of scenarios and consequence analysis o Most suitable model for scenario evaluation that will be used to complete the case study o representation of uncertainties referring to F3 o Mathematical tools to be used for such case study o identification of decision alternatives o Does the modelling require availability of data? If so which kind? o Stakeholder identification for the specific case study o Are you referring and/or have to

			comply with regulations for the specific case? If so which ones? o For the specific case study is it possible to identify any monitoring activity over the performance of the system? If so what kind of monitoring/data acquisition? When the case study will be completed using the full-framework, then we will write a specific paper with the results.
6	Case Study: Climate change adaptation in relation to urban water management	The full description of the case study with results shall be provided	Idem as Factsheet No. 5
7	Case Study: Food production systems	The full description of the case study with results shall be provided	Idem as Factsheet No. 5
8	GDSI Framework	The main theory underlying the design of the framework and description of the framework shall be clearly described	- Glossary/terminology and abbreviations - Definitions and system representation - Explanation of elements of the framework - Use of the framework
9	GDSI Open Platform: use and content	Information underlying the design of the platform is provided	This report substitutes the factsheet
10	GDSI Toolbox	To Be Defined	To Be Defined

Appendix A: Factsheets Template

Factsheet N.##
Title

Author 1, affiliation – GDSI
Author 2, affiliation – GDSI
Author 3, affiliation

Scope of the fact sheet
[Outline the issue and the scope of the fact sheet. 2 lines]

Abstract
[Please give a short paragraph of the objectives followed by a summary of the technical and theoretical information including the methodologies presented. The key aspects of the fact sheet shall be summarized. Max ½ page.]

Basis / theory / methods
[Provide the basis / theory / methods required in order to understand the content of the fact sheet.]

Application areas
[in which areas can the presented topic be applied?]

Critical appraisal
[Provide a critical appraisal of the theory, methods, and application areas.]

1 [Heading 1]

1.1 [Heading 2]

text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text

$$E = mc^2 \quad (1)$$

text text text text text text text text text text text text text text text text text text text text text text tex text text text text text text text text text text text text text text text text text text text

Table 7: Short title for the table

A	**B**	**C**
1.0	2.0	3.0
jji	jhkhk	hjkhk
bk	kjl	hjkj

text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text text

Figure 8: Clearly explain the content of the figure

Contact information

[Name]
[Position, affiliation and postal address]
[Phone]
[Email]

Abbreviations

DM Decision Maker
UQ Uncertainty Quantification……for example

References

Benjamin J.R., Cornell C.A. (1970). Probability, statistic and decision for civil engineers. McGrraw-Hill.
Yonezawa M., Okuda S., (1997). Structural reliability assessment based on directional vector approximation method. Computers and Engineering. Vol.33, Nos 3-4. Pages 749-752. Elsevier.

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Report R-382
ISBN 9788778774774