MAGIC

Envisaging a world with greener cities

MAGIC PARTNERS MEETING

October 24, 2019

Taking MAGIC forward

PARK: accelerating the Process for Accessing and using Research outputs & Knowledge

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Electronic Science and SATE Technology

Contents

electronic SCIENCE

Science, Analytics and Toolkits for Emerging Challanges

A few of our capabilities

- User experience modelling
- Software application development
- Workflow analysis and application development
- Mobile application design and development
- Software security
- Software Systems analysis
- IOT application development
- Economics
- Statistical analysis
- Big data analytics
- Big Data, AI and ML
- Models & Simulations
- Economics

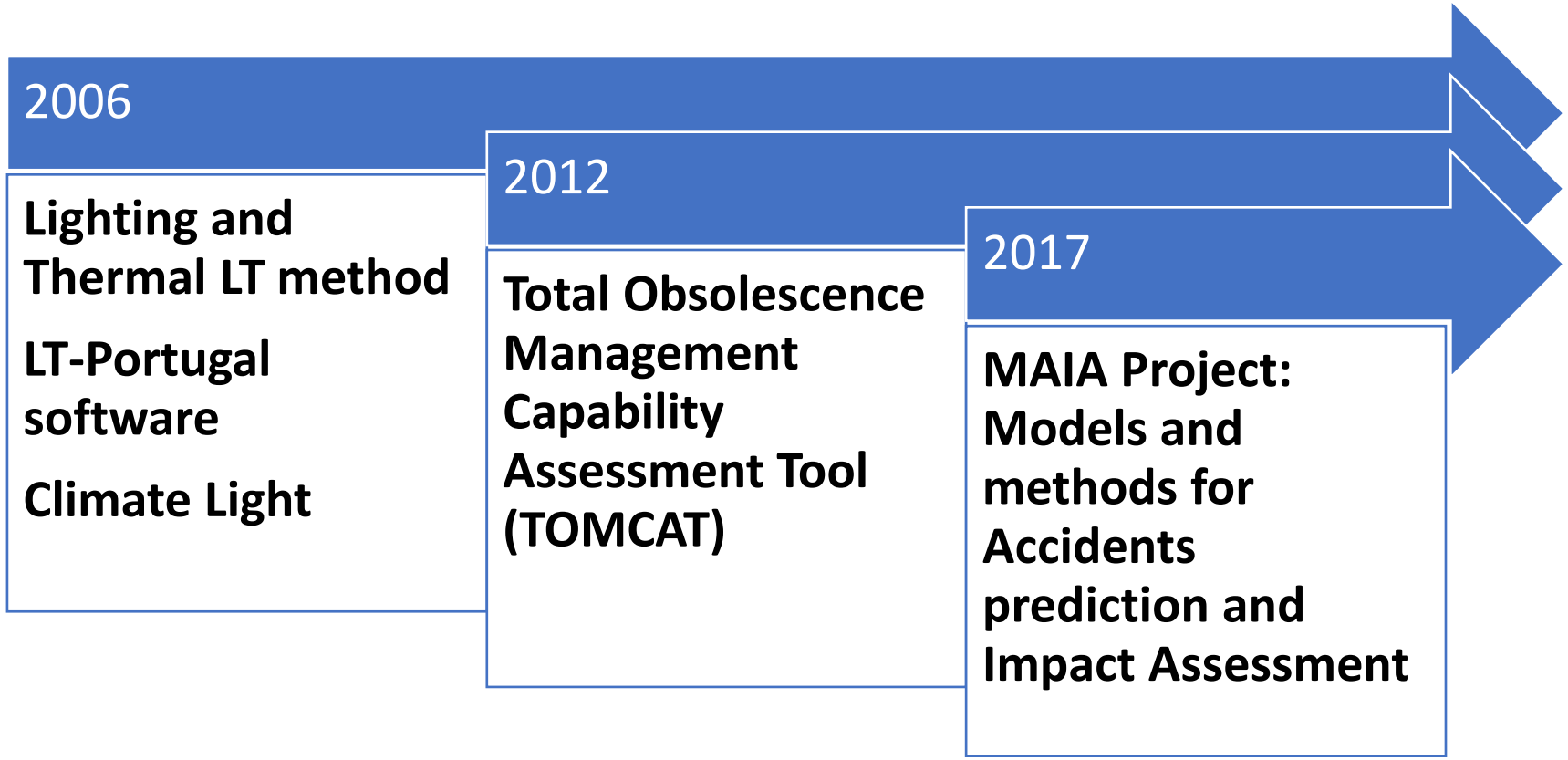
Sectors

- Medical informatics
- Recruitment industry
- Education
- Computer gaming
- Health & wellbeing
- Social organisations
- Regulatory affairs
- Transportation
- Air quality & environment

Products

- Hospital management systems
- University student on boarding systems
- Technology consultancy

Examples of research outputs into usable product



Lighting and Thermal LT method

Main aim

LT-method is a practical tool to predict building energy demand based on the concept of passive zones. It could help inform knowledge about building energy performance at an early stage of design.

Key outputs:

A manual method has been developed by Nick Baker and Koen Steemers, from the Martin Centre for Architectural and Urban studies, University of Cambridge, since 1988.

Important contributions to further revisions were also made by David Hoch, at the Martin Centre for Architectural and Urban Studies, University of Cambridge, and Cambridge architectural Research Ltd.

https://www.sciencedirect.com/science/article/abs/pii/0378778895009507

http://www.esru.strath.ac.uk/Courseware/Design_tools/LT/fur_info.htm

UNIVERSITY OF CAMBRIDGE

CAR

The LT-Portugal software: a design tool for architects.

A software implementation of the LT Method specifically customised for Portugal

http://www.irbnet.de/daten/iconda/CIB17395.pdf

TÉCNICO LISBOA

UNIVERSITY OF CAMBRIDGE

The LT-Portugal software

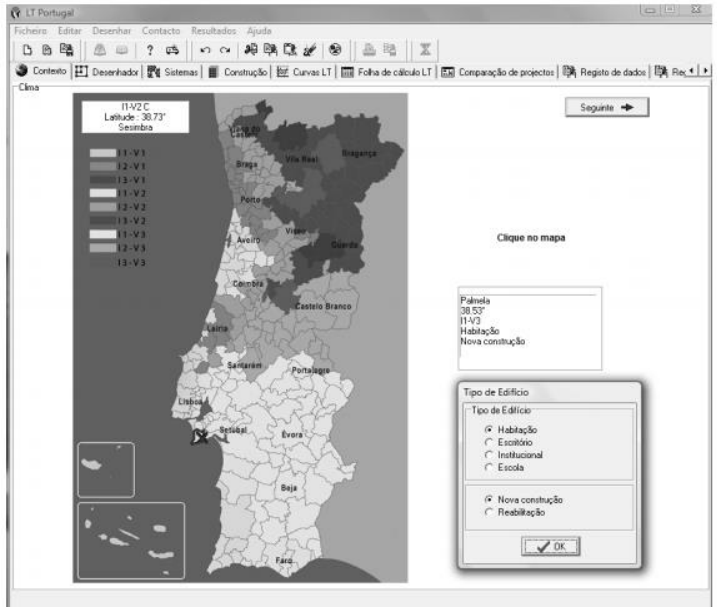


Figure 1: Input screen 1: Context.

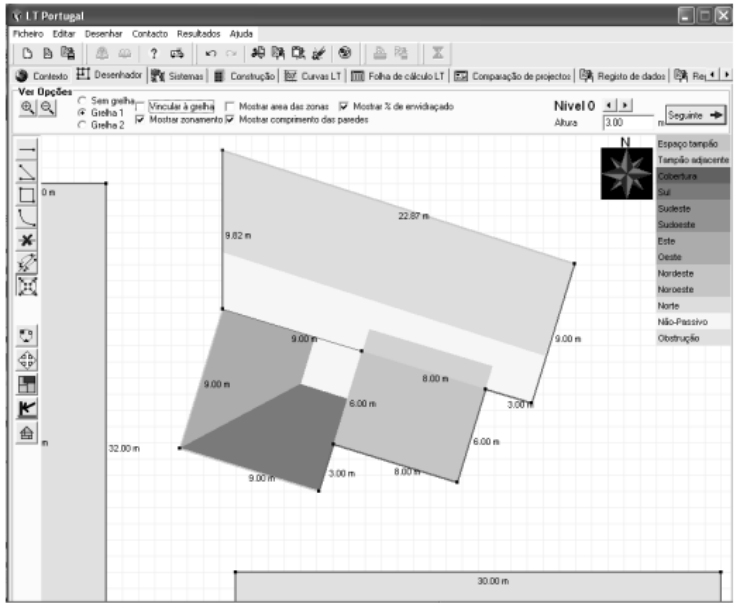


Figure 2: LT Sketcher screen

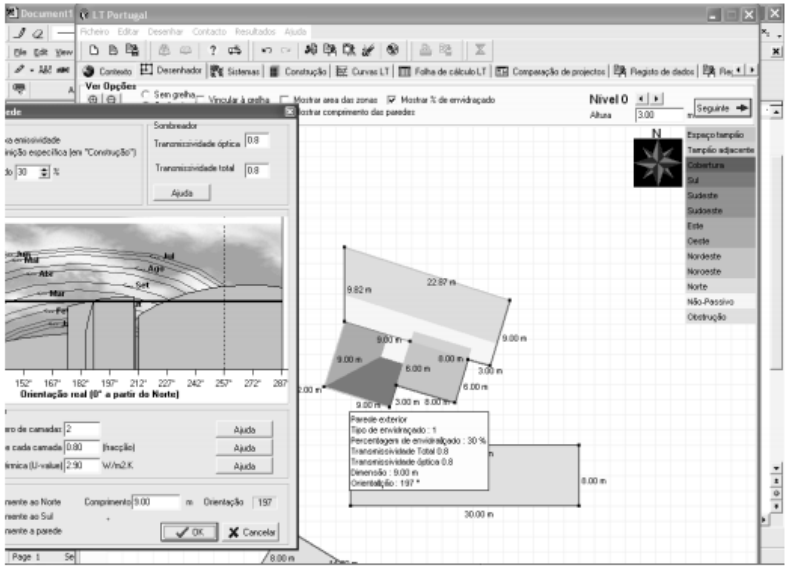


Figure 3: LT Sketcher screen showing plan of building with atrium [in blue] (green house or buffer space).

http://www.irbnet.de/daten/iconda/CIB17395.pdf

ClimateLite

A software for design teams that works towards truly integrated low carbon design from initial design conception.

It is an iteration of the LT Software with the addition of features like Site Analysis, Carbon Mixer and Strategy Wizard

https://www.bre.co.uk/filelibrary/pdf/cap/Climate_Lite_Leaflet_Layout_1.pdf

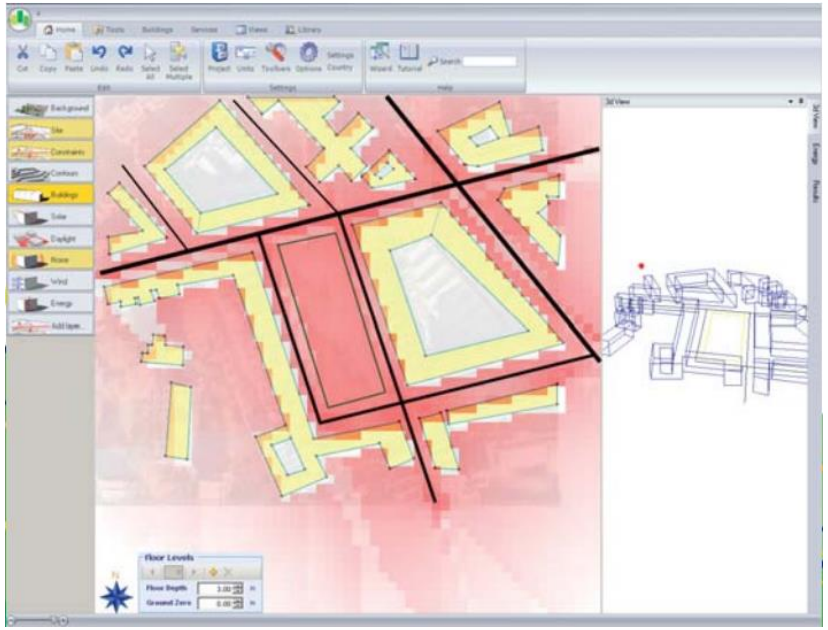


Figure 1: Highlight areas where there are acoustic challenges

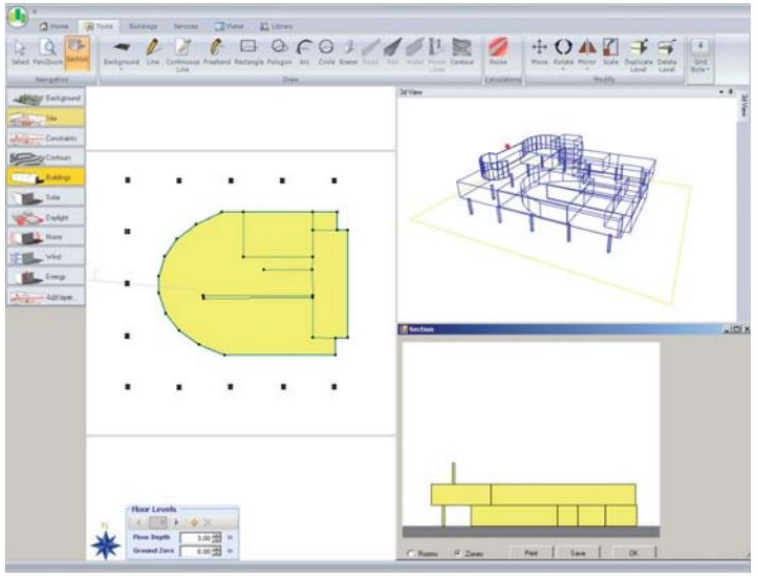


Figure 2: Energy and environmental performance (LT Method)

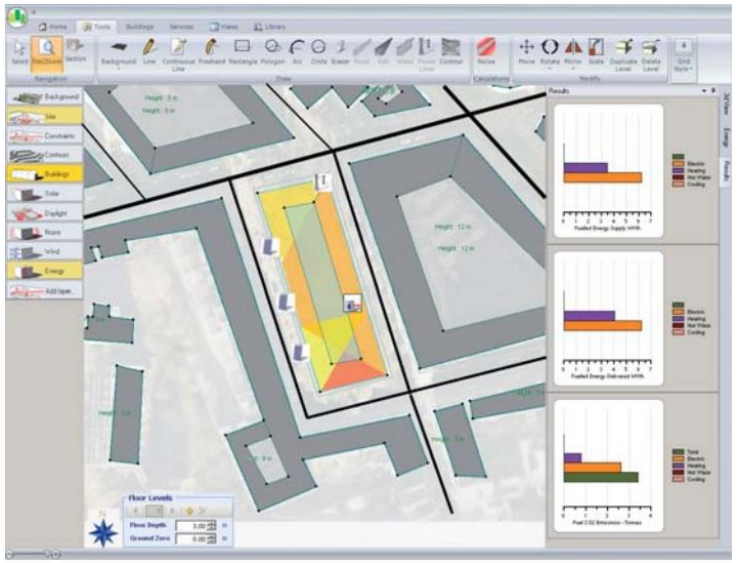


Figure 3: Strategise by considering the most appropriate mix of low-carbon energy technologies.

Total Obsolescence Management Capability Assessment Tool (TOMCAT)

Main aim

TOMCAT is a tool for contractors to perform self-assessment and for the MoD to set *obsolescence management capability improvement targets* to its suppliers.

Key Outputs: A web platform containing scoring scale for metrics and assessment results. The tool was developed by Cranfield University for and in collaboration with the Ministry of Defence.

https://www.researchgate.net/publication/241779062_TOMCAT_An_Obsolescence_Management_Capability_Assessment_Framework

Cranfield University

Ministry of Defence

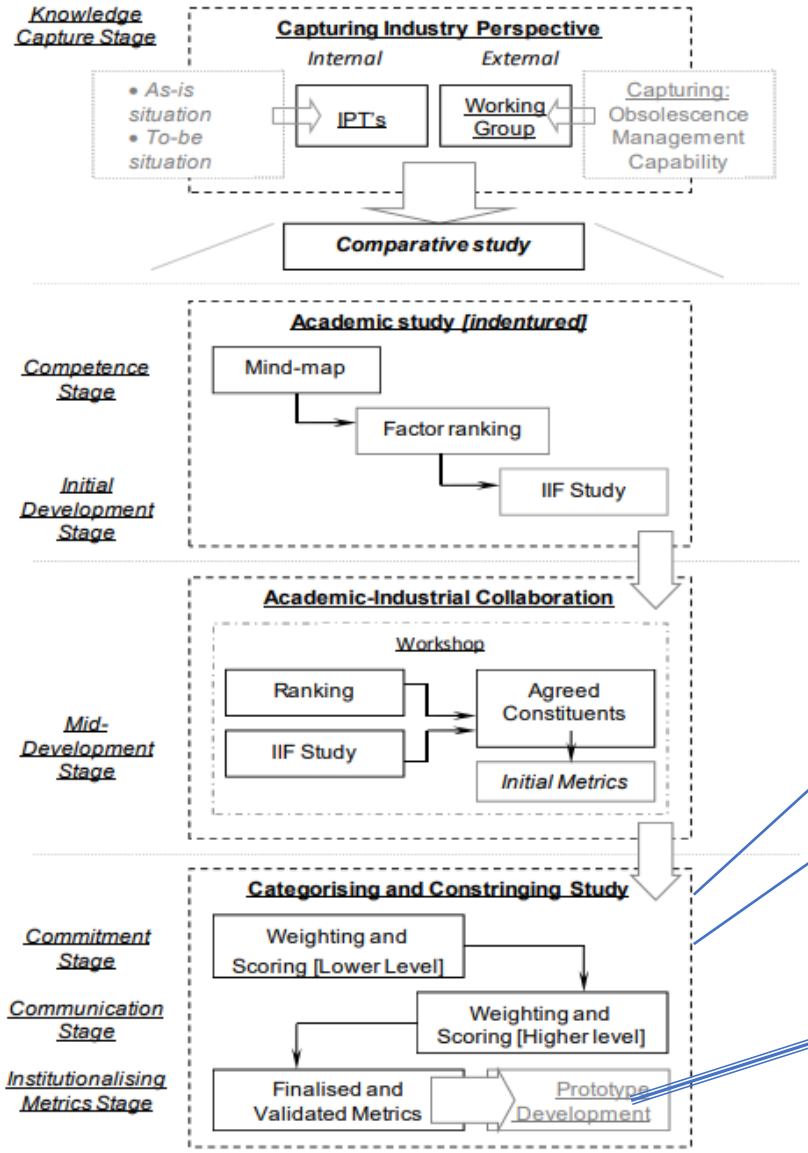


Figure 1. Research Methodology.

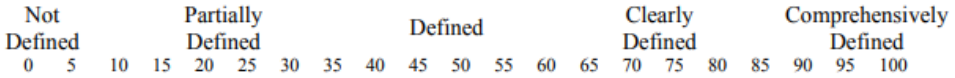


Figure 2. Scoring Scale for Metrics.

Table 2. Number of Metrics per Activity.

Activities	Number of metrics
OM Governance	3
Supplier	3
Design for Obsolescence	4
Risk Assessment	5
Obsolescence Monitoring	3
Communication	4
Obsolescence Resolution Process	3
Total	**25**

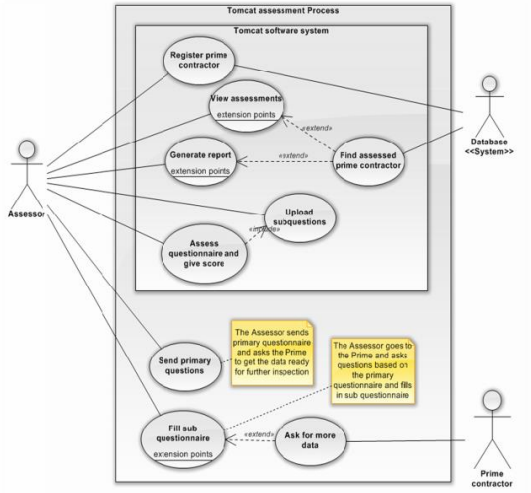


Figure 4. Unified Modelling Language (UML) Diagram of TOMCAT Process.

TOMCAT

Requirements analysis example

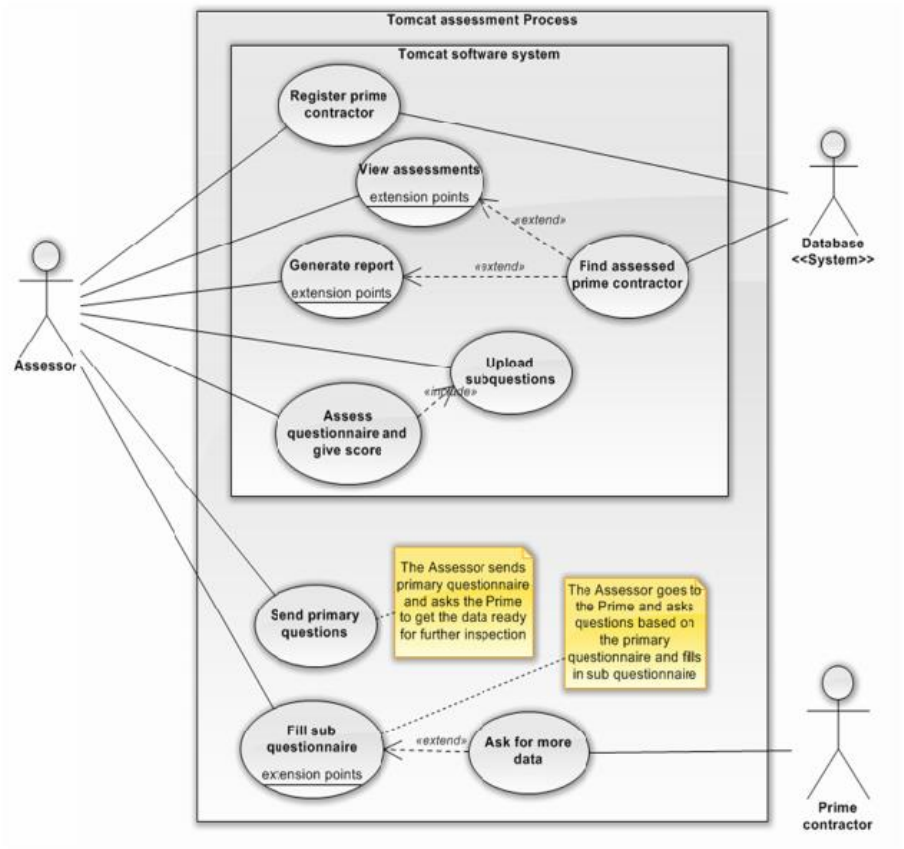


Figure 4. Unified Modelling Language (UML) Diagram of TOMCAT Process.

TOMCAT web assessment platform

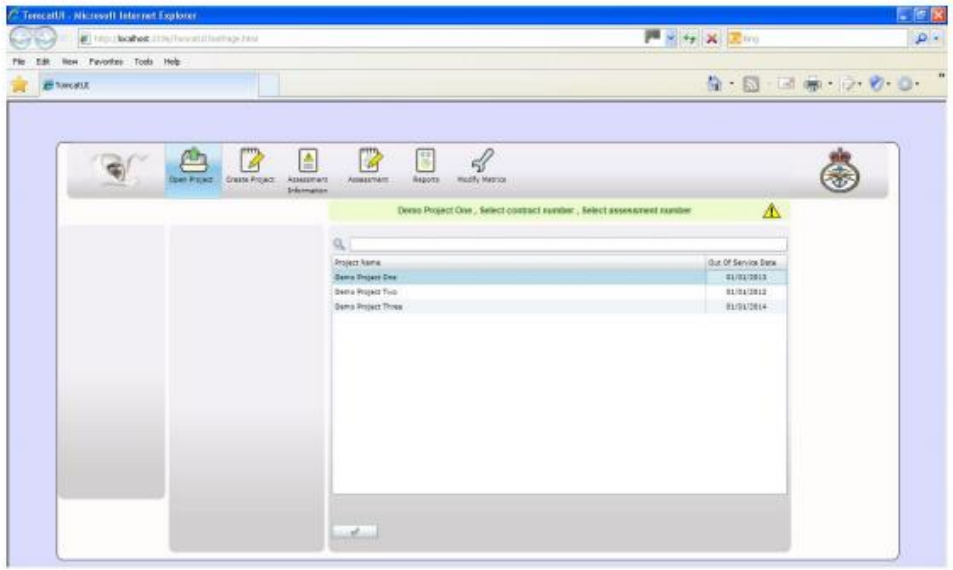


Figure 5. Snapshot of Assessment Creation in TOMCAT.

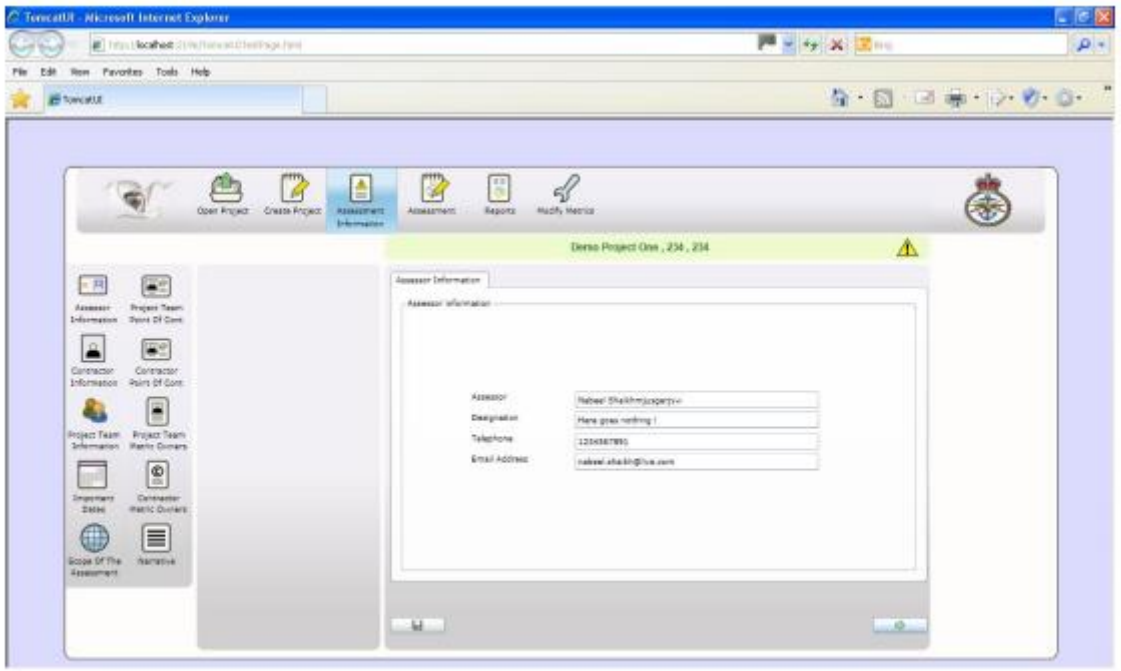


Figure 6. Snapshot of Assessment data input in TOMCAT.

Assessment results

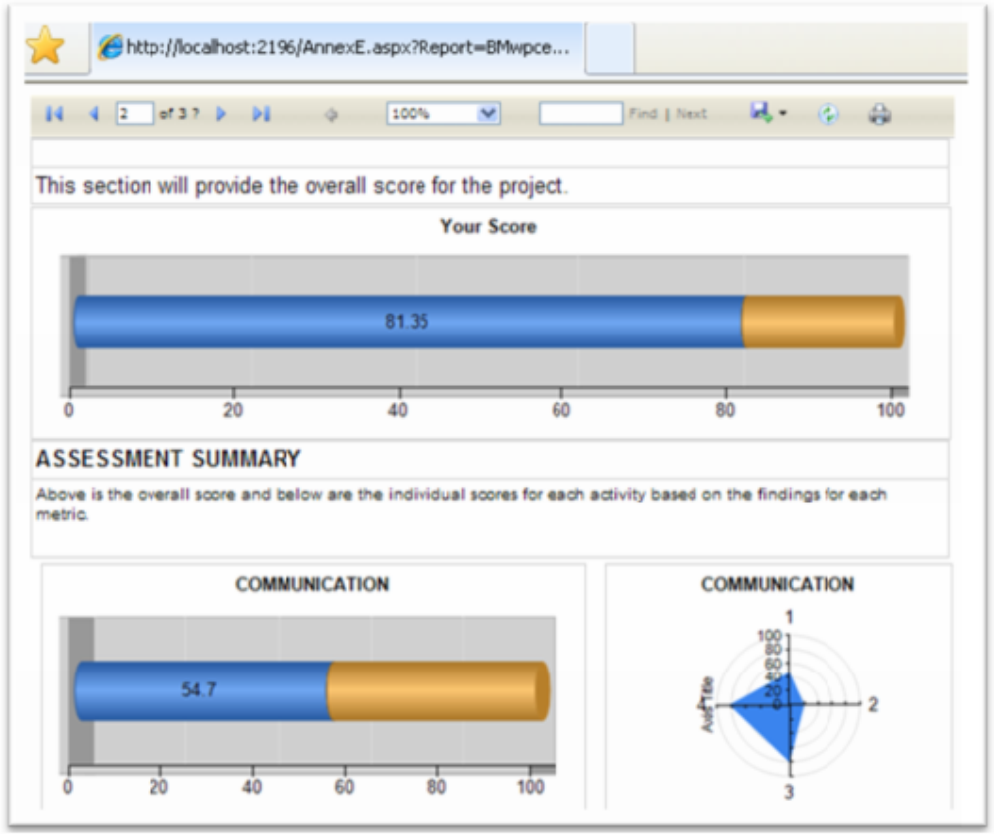
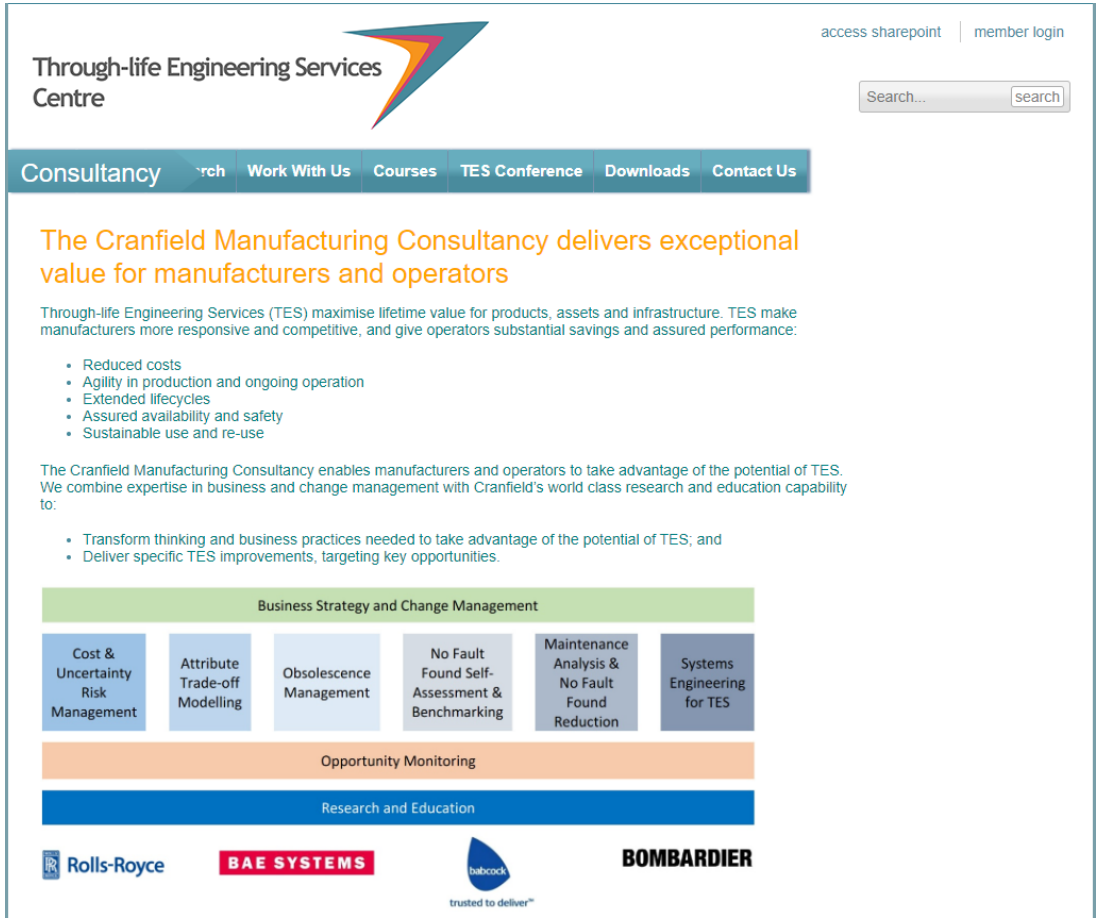


Figure 7. Snapshot of Assessment Report in TOMCAT.

How it ends up being a product



MAIA Project: Models and methods for Accidents prediction and Impact Assessment

DfT funded project, 11 months, May 2017 – March 2018

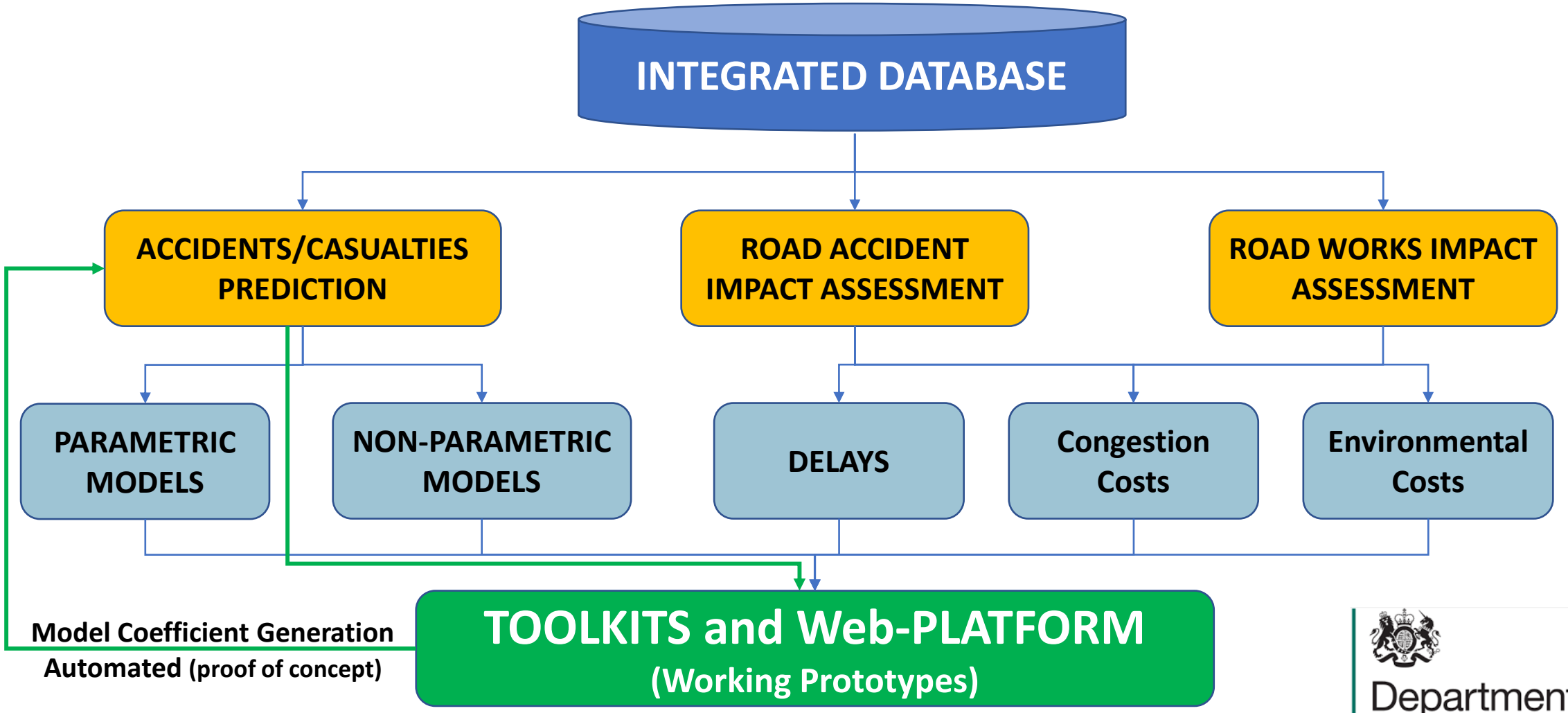
Main Aim

To develop and test new techniques and tools to improve the way road collisions are predicted and related impacts estimated.

Key outputs: a proof-of-concept **web platform** for the analysis, and prediction of road collisions events, enabling **fast and robust models** to run and be **generated at national** as well as **local scale**.

An **Impact Assessment toolkit** using real-world data to understand impacts caused by road collisions and roadworks.

MAIA Project Components

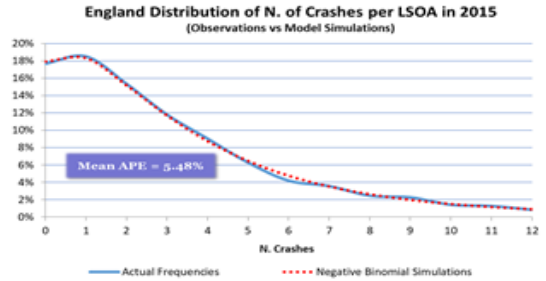


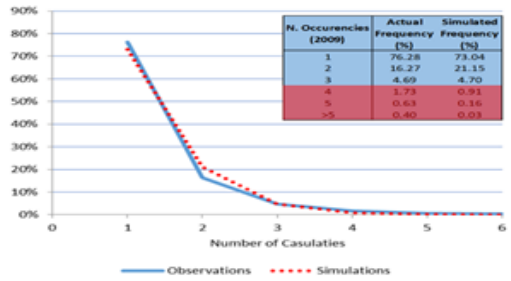
Department for Transport

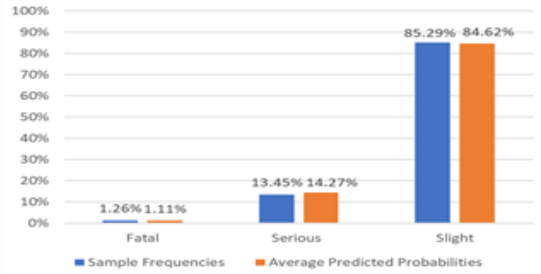
Accident Prediction Models – best models so far

- **32,844 records** of crash annual rates (LSOA) and related potential predictors analysed;
- **1,780,653 records** of STATS19 data (2005-2015) analysed;
- **More than 320 parametric** (microeconometric) **and non-parametric** (artificial neural networks and pools of artificial neural networks) developed and compared;

Resolution	Crash dimensions	Models	Accuracy
LSOA scale	N. of Crashes	• Negative Binomial regression • Ensembling (ANN)	ERROR from 2% to 12%
Link/junction	N. of Casualties	• Poisson Regression • Ensembling (ANN)	ERROR 4% (30% for less frequent events)
Link/junction	Severity	• Ordered Multinomial Probit/Logit Model • Ensembling (ANN)	ERROR 5% slight and 15% serious/fatal

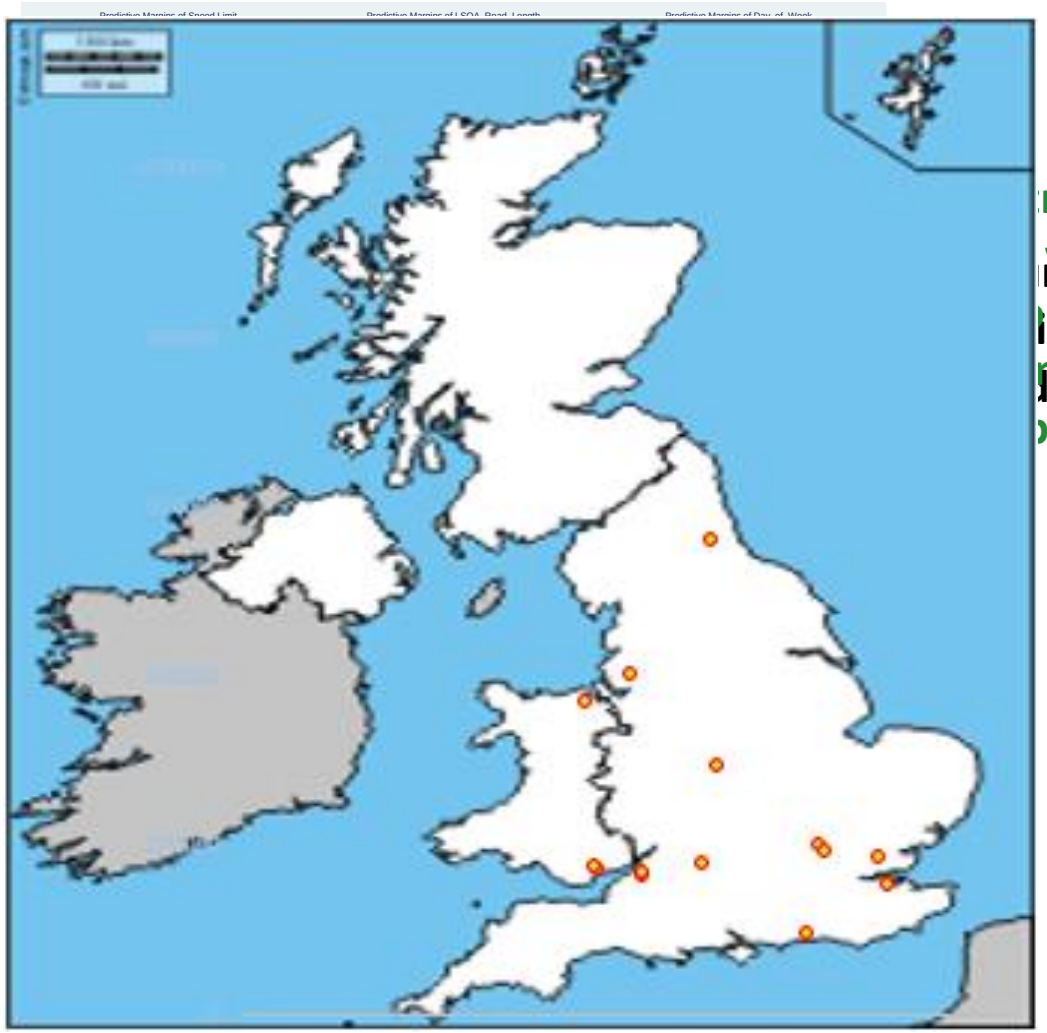


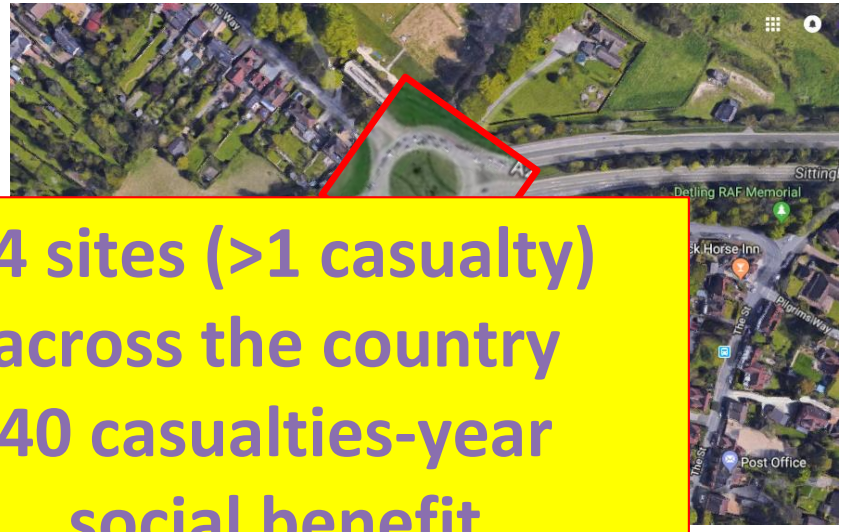




Accident Prediction Models

Planning Example



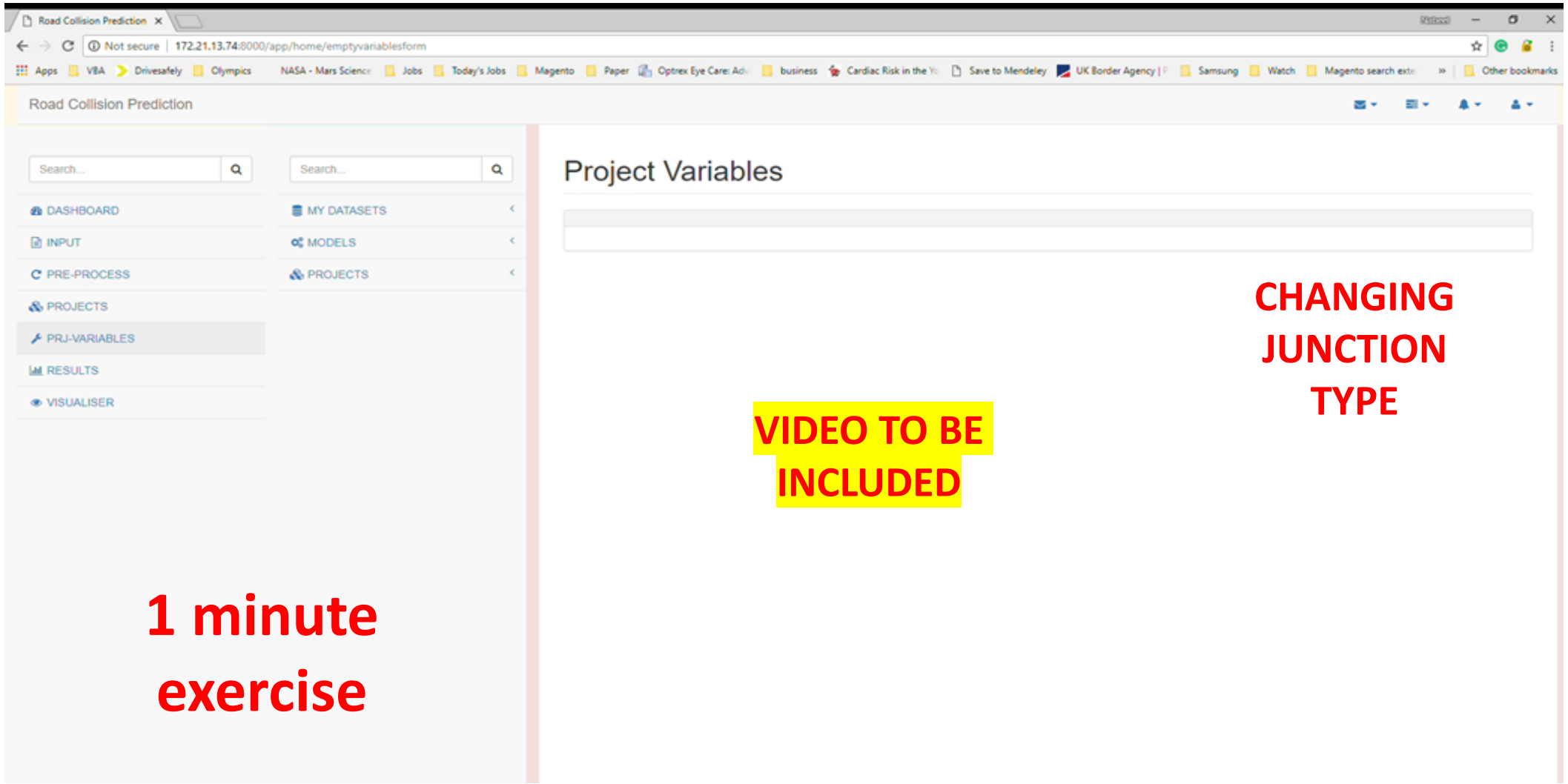


14 sites (>1 casualty)
across the country
40 casualties-year
social benefit

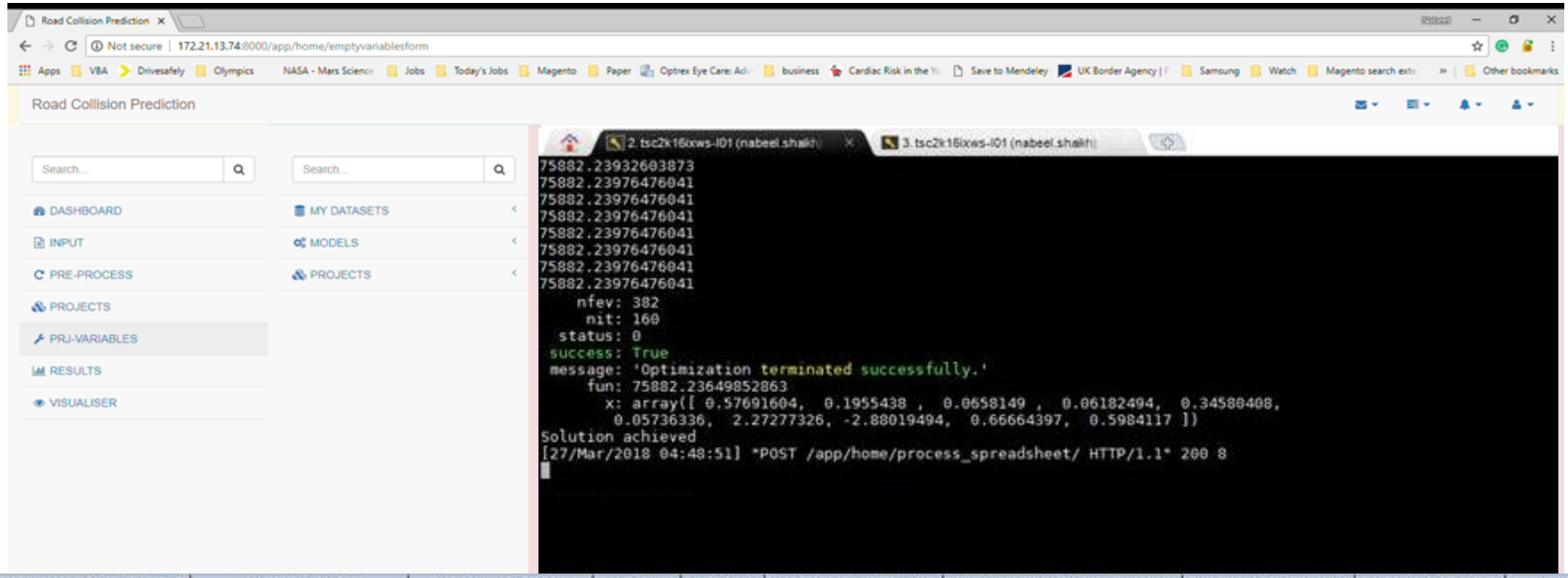
£1.5m

			Δ
Pr			-38%
Prob. [Acc. Sev. = Serious]	0.150	0.115	-24%
Prob. [Acc. Sev. = Slight]	0.839	0.878	+5%
Prob. [N. Casualties >1]	0.3808	0.2408	-37%

Accident Prediction Toolkit (web-based)



- Ability to **update models' coefficients** over time and develop context-specific models (at Local Authority level or for those areas where collision phenomena follow anomalous patterns).



With respect to a single observation	LN (Road Length)	N. Secondary Schools	N. Pubs	Crime (score)	Education Post 16 age (ratio)	Population Density (10^3 People/Sq Km)	Population 16-29 age (ratio)	Female 16-64 age (ratio)	Constant	Alpha Parameter
Estimated Coefficient (EC)	0.577	0.196	0.065	0.061	0.343	0.057	2.282	-2.882	0.667	0.600

LSOA11cd	LSOA11nm	District_Eng	Crashes_2015	Road_kms	LN_Road_kms	N_Sec_Schools	N_Pubs	Crime	Education_Post_16	Population_Density
E01000001	City of London 001A	City of London	17	2.2833826	0.82565794	0	4	0.242	0.13	12.62712
E01000002	City of London 001B	City of London	11	3.6440762	1.29310289	2	13	0.244	0.279	6.182137
E01000003	City of London 001C	City of London	1	0.82978857	-0.186584346	0	1	0.495	0.201	28.73096
E01000005	City of London 001E	City of London	20	4.365521	1.473737541	0	19	0.026	0.272	7.927215
E01000006	Barking and Dagenham 016A	Barking and Dagenham	0	2.5556033	0.938288321	0	0	0.182	0.1	12.74216
E01000007	Barking and Dagenham 015A	Barking and Dagenham	13	3.7651856	1.325797156	0	5	0.128	0.113	10.71

Published at: *United Nation ITS Bulletin* http://www.indiaenvironmentportal.org.in/files/file/Bulletin88_final.pdf *or* [here]
IET ITS Journal (ITS World Congress Special Issue) http://dx.doi.org/10.1049/iet-its.2018.5218 *or* [here]

Collaborators and stakeholders

PARK Proposition

Overall AIM

Develop processes and tools/platform for exploiting Research outputs in a more user friendly and easy way as well as maximise the access and use of Academic Research and Innovation to expert but more importantly to non-expert users.

Objectives in the short/medium-term:

- Explore the **desire, shape and feasibility** of an innovative tool/platform to give easier access to interested actors to the outputs* from Academic research and Innovation (using the MAGIC Project as a use case)
- Conduct a **robust stakeholder mapping** to assess the need and desire for a tool focused around an initial use case identified, the MAGIC project
- Conduct a **technical feasibility exercise** to assess the shape/format (web-platform, centralised or decentralised software, etc.)

Objectives in the long-term:

- Give a **more accessible platform** for non-expert end users such as Planners, Decision Maker, Consultancy, SMEs
- Identify **business model scenarios** that allow the new tool/platform to self-sustain in the future
- Involvement of MAGIC Project partners and key stakeholders (Local Authorities, Policy makers, other Academics) on the Air Quality field will make sure experts as well as non-expert perspectives and needs will be captured

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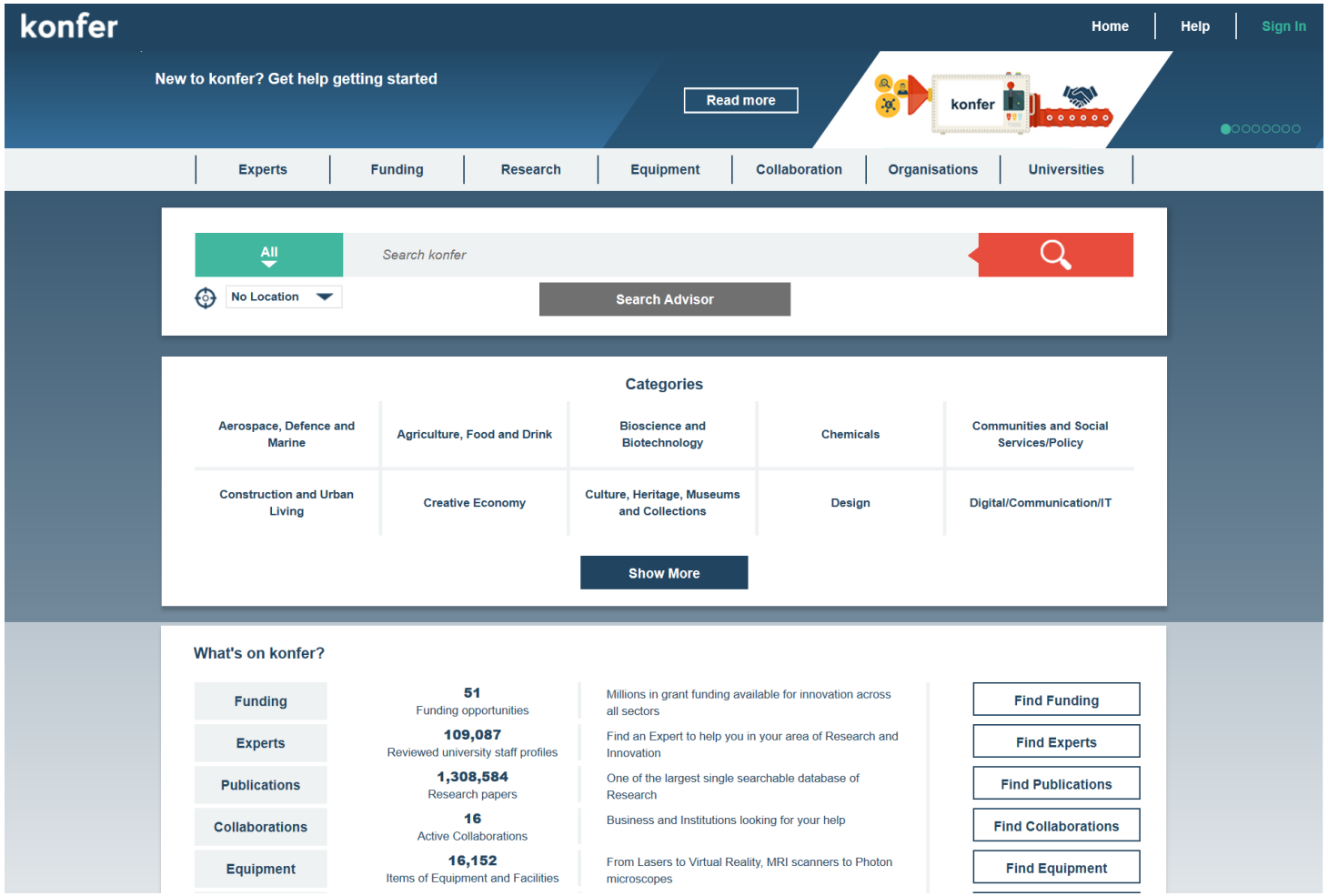
**With the term outputs in this case we intend (models, mathematical formulas, etc.) that traditionally are developed to solve problems or predict events*

Why PARK is needed?

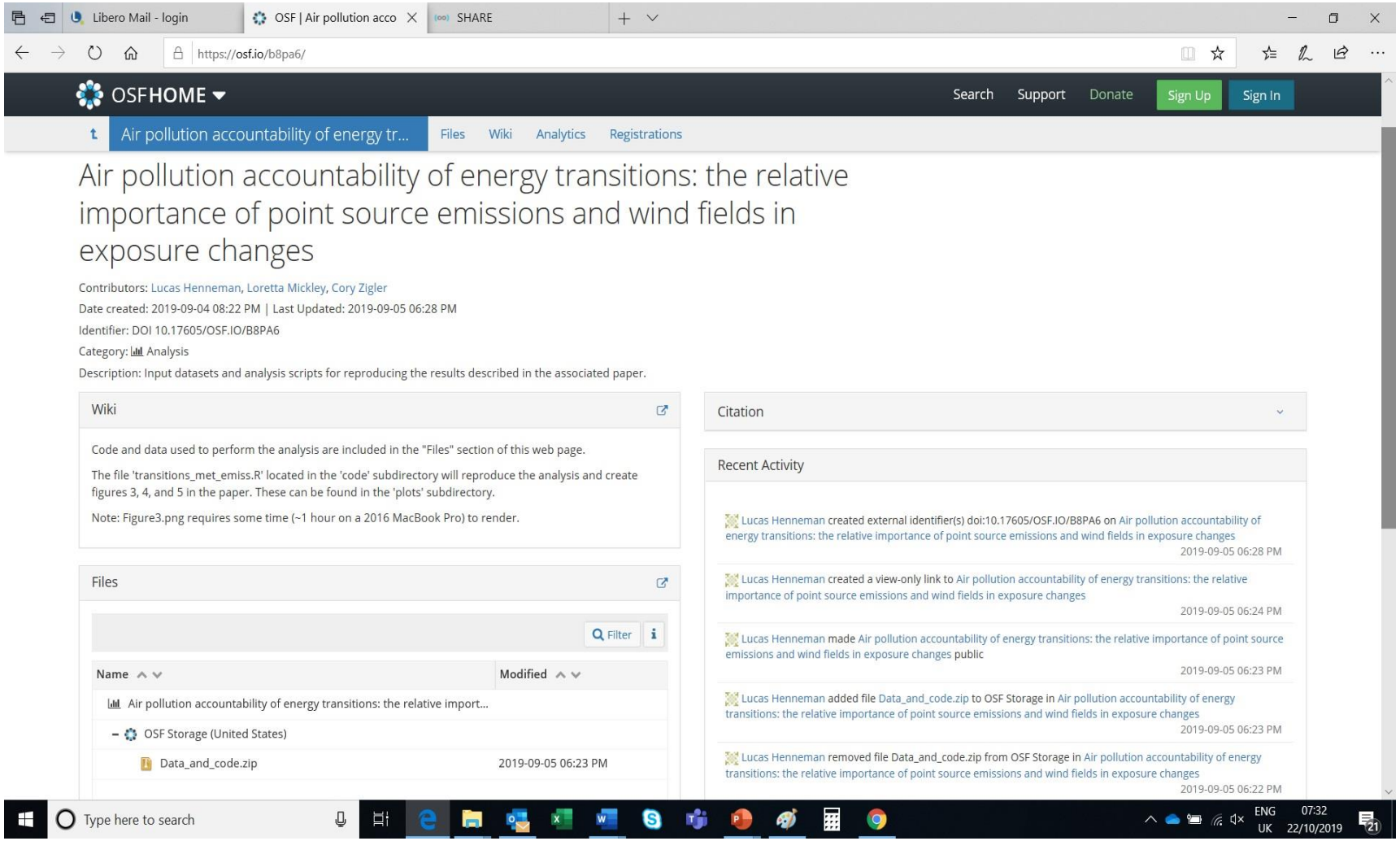
- Existing examples



A national repository of Academic/Research contacts, equipment and projects, which in practice operates as an intelligent brokerage platform for UK universities and businesses. It allows users to search using keywords relating to an area of interest in order to find relevant research and “connect” with original authors to discuss further.

Why PARK is needed?

- Existing examples



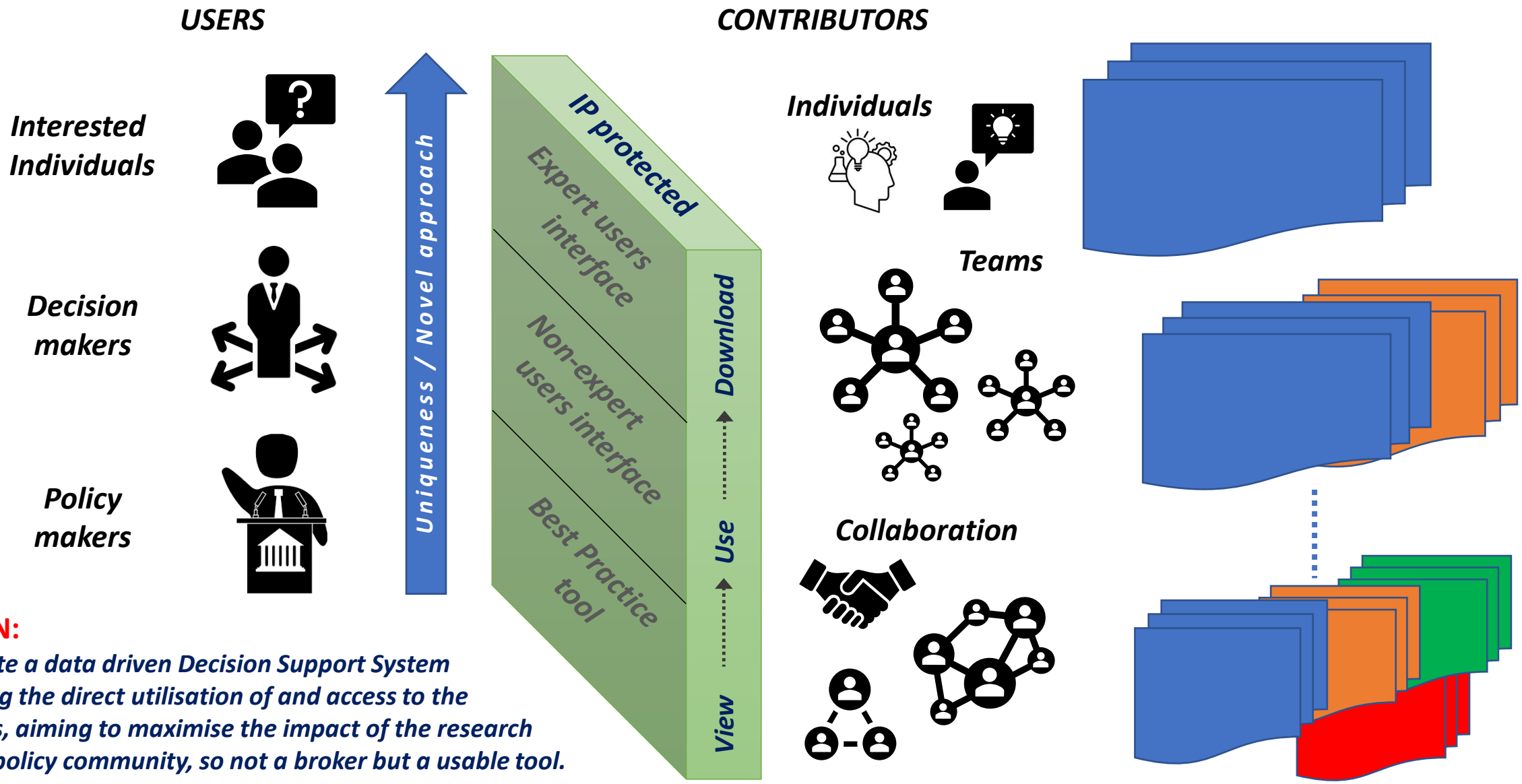
Why PARK is needed?

- Other platforms

Why PARK is needed?

- *Traditional or existing tools/platforms allow to simply search using keywords relating to an area of interest in order to find relevant research and eventually "connect" with original authors to discuss the subject further.*
- *No tool/platform gives a user the capability to use the research of others, unless it has already gone through a long and expensive process to convert the research output (low TRL) into a software or models suite (higher TRL), which most of the time is licensed and expensive to buy/use.*
- *To make a move to break the big barriers of it traditionally being too hard for non-experts to use novel models and innovative approaches.*

PARK – High level concept



VISION:

To create a data driven Decision Support System allowing the direct utilisation of and access to the outputs, aiming to maximise the impact of the research by the policy community, so not a broker but a usable tool.

How PARK and MAGIC can mutually benefit?

MAGIC as identified case study for the PARK project is about Air Quality improvement in cities and, in particular, inside buildings. In the long-term by developing the PARK tool/platform we expect two main positive results:

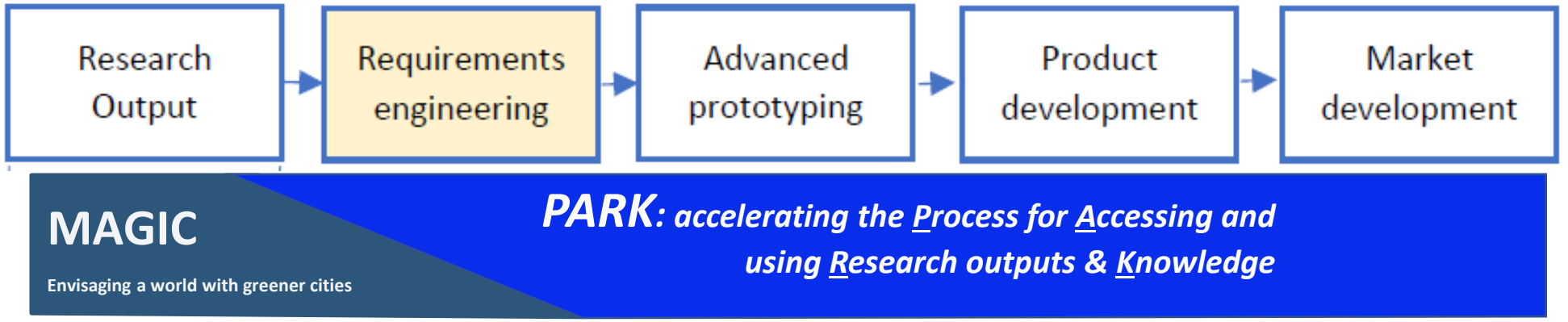
1. ***Provide early access to non-expert users to new and innovative research,***

dual benefit, at an early stage will inform the researcher/IP owner on drawbacks and things that should be modified/improved; at a later stage to already have a group of potential beta-tester for a near to market product.

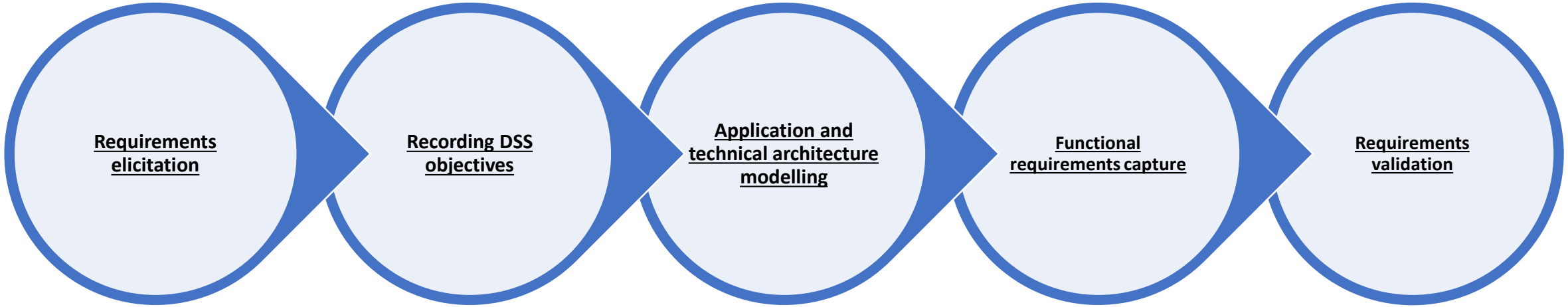
2. ***Accelerate the process of emerging ideas and solutions to move faster into TRL ladder,***

benefit for the UK economy and to increase the chances of playing a world leading role in the future, as time is a key component for the penetration and acquisition of market slices in the different sectors.

Can MAGIC play at the PARK?



Next steps…



- Problem Scoping
- Understand the customer
- Volatility

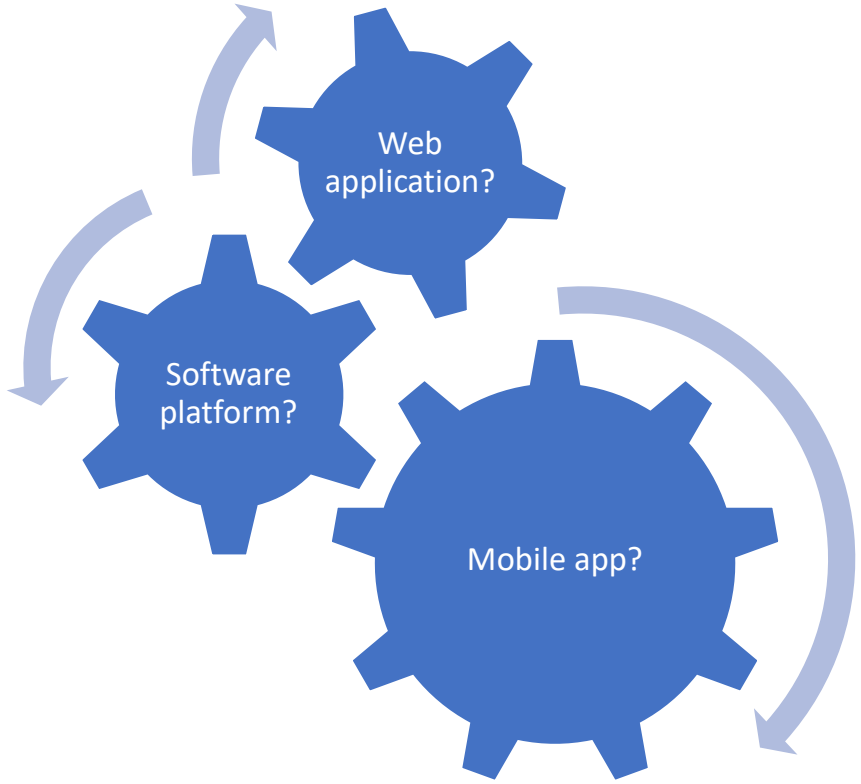
- Use case, flowcharts and dataflow diagrams.
- Create non-functional prototype applications

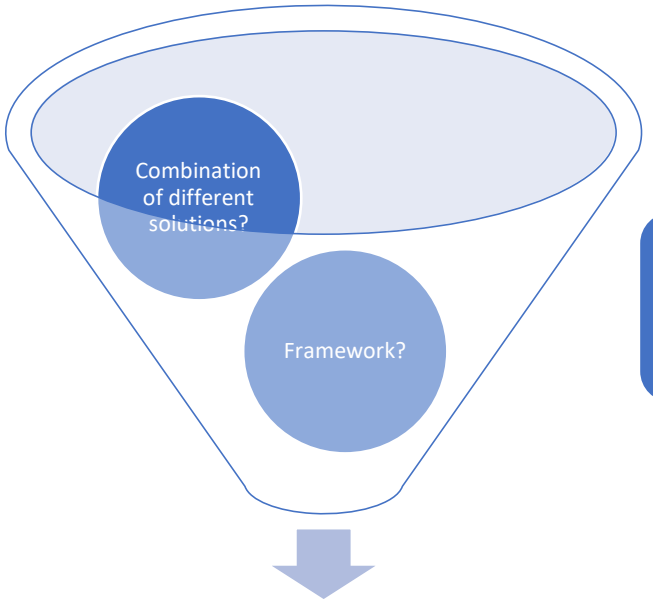
- Logical viewpoint, module viewpoint.
- Concurrency/process/runtime/thread/execution viewpoint.
- Performance viewpoint.

- Functional requirements capture
- Non-functional requirements

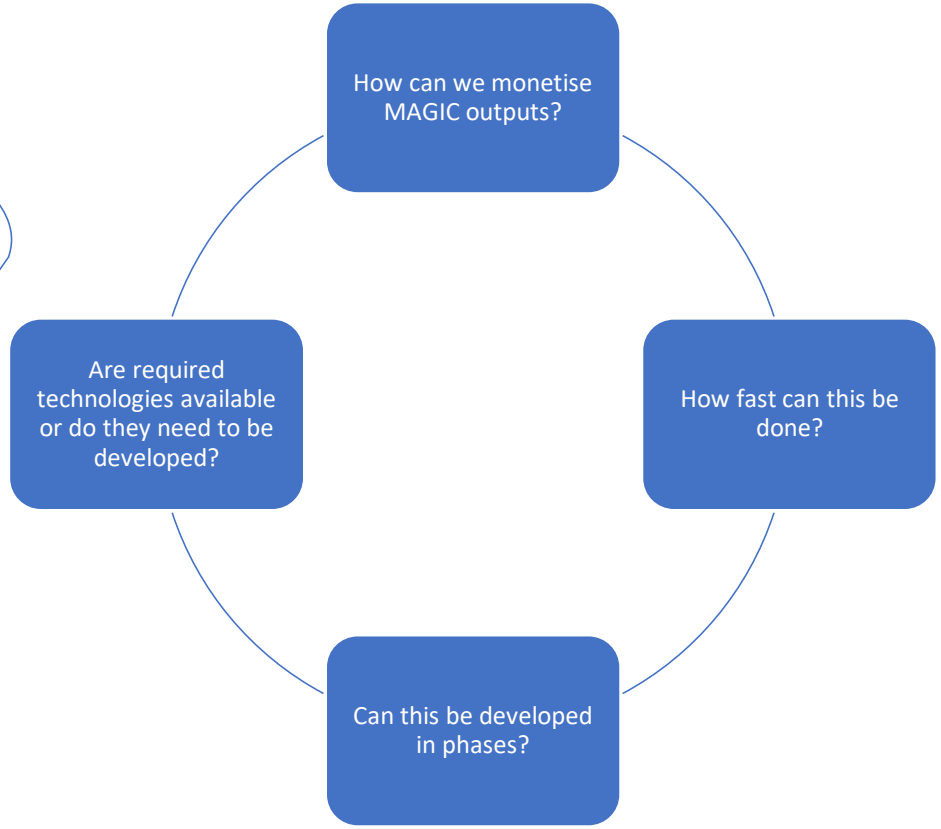
- Correct – accurately states a customer or external need
- Clear – has only one possible meaning
- Feasible – can be implemented within known constraints
- Modifiable – can be easily changed, with history, when necessary
- Necessary – documents something customers really need
- Prioritized – ranked as to importance of inclusion in product
- Traceable – can be linked to system requirements, and to designs, code, and tests

The assessment process should churn out answers like these





What sort of technologies and methodologies are required?



Thanks for your attention

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