D7.8 Final Dissemination and Exploitations Report

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## Document Information

### Document Status

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<td>Work Package</td>
<td>WP7: Dissemination and Implementation Strategy</td>
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<td>31 December 2014</td>
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Executive Summary

The first part of this document gives an overview of the dissemination materials created within the MODUM project, as well as the MODUM dissemination and communication activities that have been carried out by the partners.

The second part of this document describes the identified exploitable outcomes and results of the project and outlines the MODUM partners’ (planned) exploitation activities.

This document was compiled using information provided by all MODUM partners.
1 Introduction

Scope and purpose of this document
The purpose of this document is

- to provide an overview of the dissemination materials created and dissemination and communication activities done in MODUM, and
- to give an outline of the planned exploitation activities of the MODUM partners.

Note:
For a more detailed description of the project’s website, please refer to the deliverable D7.4 “Web Portal”. For a more detailed description of the partners’ dissemination activities, please refer to the deliverable D7.6 “Dissemination of the results”, and for a comprehensive description of the MODUM Conference please refer to deliverable D7.9 “Final Conference”.

Document status and target audience
This document is a public deliverable of the MODUM project, which should inform interested readers about the dissemination activities performed in the MODUM project, and the exploitation activities planned by the MODUM partners.

Document structure
This document is structured into the following sections:

Section 1 provides an introduction for this document and outlines the purpose, scope, context, status, and target audience of this deliverable.

Section 2 gives an overview of the dissemination materials created and the dissemination actions carried out during the runtime of the MODUM project.

Section 3 describes the exploitable results of the project and outlines the partners’ planned exploitation activities
2 Dissemination and Communication

The following chapters give an overview of the dissemination and communication activities made in the MODUM project.

2.1 Dissemination related Deliverables

In accordance with the Contract (Description of Work), 8 dissemination and communication related deliverables have been produced in the MODUM project:

Table 1: Dissemination related MODUM Deliverables

<table>
<thead>
<tr>
<th>Deliverable</th>
<th>Date of finalisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>D7.1 Project fact sheet</td>
<td>Month 3 (Dec. 2011)</td>
</tr>
<tr>
<td>D7.2 Dissemination Plan</td>
<td>Month 20 (May 2013, revised version)</td>
</tr>
<tr>
<td>D7.3 Corporate Design</td>
<td>Month 4 (Jan. 2012)</td>
</tr>
<tr>
<td>D7.4 Website</td>
<td>Website: operational from Month 2 (Nov. 2011), regularly updated; Final version of Website Report: Month 40 (Jan. 2015)</td>
</tr>
<tr>
<td></td>
<td>Project flyer Month 11 (Aug. 2012)</td>
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<tr>
<td></td>
<td>Posters Month 11 (Aug. 2012)</td>
</tr>
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<td></td>
<td>Newsletter I Month 21 (Aug. 2013)</td>
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<td></td>
<td>Newsletter II Month 29 (Feb. 2014)</td>
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<td></td>
<td>Newsletter III Month 34 (July 2014)</td>
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<td></td>
<td>Newsletter IV Month 39 (Dec. 2014)</td>
</tr>
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<td></td>
<td>Project brochure Month 39 (Dec. 2014)</td>
</tr>
<tr>
<td></td>
<td>Presentation Slide Library: Initial version Month 24 (Sept. 2013), regularly updated</td>
</tr>
<tr>
<td>D7.6 Dissemination of Results</td>
<td>Month 40 (Jan. 2015)</td>
</tr>
<tr>
<td>D7.8 Final Dissemination and Exploitations Report</td>
<td>Month 40 (Jan. 2015)</td>
</tr>
<tr>
<td>D7.9 Final conference</td>
<td>Month 36 (Sept. 2014)</td>
</tr>
</tbody>
</table>
2.2 Dissemination Material

This section gives a concise overview of the dissemination materials created within the MODUM project. For more details, please refer to deliverable D7.5 Dissemination Material.

Figure 1: MODUM Dissemination Material: website, brochure, flyer, conference material, newsletter, posters,…
2.2.1 Project logo and corporate design

A corporate design manual was created for the MODUM project. It serves as a guideline for the visual appearance of the project’s promotion and communication products, and includes:

- The project’s logo (with all relevant information such as colours, logo variations, rules for application, positioning, proportions, etc.)
- Templates for Word and PowerPoint documents (including font types, colours, styles, etc.)
- Examples of dissemination products (flyer, poster,...)

The figure below shows the MODUM logo, which is used for any kind of project presentations, the website, brochure, poster, etc.

Figure 2: MODUM Logo

2.2.2 MODUM press information package

In order to facilitate contact with the media a press information package (containing a brief introduction to the project, the project logos in different formats, and some graphical material) was prepared and provided on the project’s website for download. The content of this press information package was updated regularly throughout the course of the project.

2.2.3 MODUM Project Fact sheet

In December 2011 MODUM has produced a fact sheet, which is downloadable from the website in .pdf format. The design took the EU-template for FP7 project fact sheet into account.
2.2.4 MODUM Poster

Two MODUM posters (format DIN A2 and DIN A3 respectively) have been created. Both posters give text-based information regarding the MODUM components plus a graphical presentation.

Figure 4: MODUM Poster (left hand: DIN A3 format, right hand: DIN A2 format)
2.2.5 MODUM Flyer

A MODUM Flyer with concise information about MODUM has been created to present the project. In August 2012 each project partner has got 50 flyers (4 pages, format: DIN A4 folded) to be used as support for the partners' promotion activities.
2.2.6 MODUM Slide library

In order to support the partners in their dissemination activities, a slide library providing basic information about the project has been created (initial version: September 2013) and regularly updated throughout the course of the project.
2.2.7 MODUM Newsletters

In total four newsletters were published within the project duration. All newsletters have been sent out electronically via the MODUM mailing list and are available on the MODUM website.

The first newsletter, which briefly introduced MODUM and gave some basic information about the scope, the objectives and the envisaged results of the project, was sent out as electronic version in August 2013.

The second newsletter informed about the successful completion of the integration of hardware and software systems, described the actual state of the preparatory work for the field trials in Nottingham and Sofia, and gave a short preview on the date and venue of the Final MODUM Conference. It was sent out in electronic version in February 2014.

The third newsletter, which was sent out as electronic version in July 2014, contained a detailed outline of the MODUM trials in Nottingham and Sofia, a short article about the MODUM deployment in the city of Coventry, and a preview (content wise) as well as an invitation to the Final MODUM Conference, which took place in Nottingham (UK) on the 24th of September 2014.

The fourth newsletter contained a short article about the MODUM conference, updates about the results of the trial implementations in Sofia and Nottingham, and a summary of the project’s results and achievement. It was sent out as electronic version in December 2014.
2.3 Website

The project’s public website (http://modum-project.eu) is in operation since December 2011. The website is updated regularly (last update December 2014).

The MODUM website – www.modum-project.eu – provides information about the project and the trial implementations, provides the possibility to download the project’s deliverables and publications, and offers the possibility to contact the project’s coordinator.

The following screenshots from http://modum-project.eu give an impression of the MODUM website. For more information about the MODUM website, please refer to deliverable D7.4 Report about the MODUM website.

Figure 8: Screenshots from the MODUM website (http://modum-project.eu)
From December 2011 (when the website [www.modum-project.eu](http://www.modum-project.eu) was launched) until end of December 2014 a total of 5763 visitors (4082 unique visitors) have accessed the website, and 16887 page views (12159 unique page views) have occurred.

The following graphic shows, how the development of the number of website visitors over time is related to the main dissemination activities of the MODUM consortium.

![Figure 9: Mapping of the number of MODUM website visits with major dissemination activities](image)

**2.4 Dissemination Activities**

The MODUM partners have carried out a lot of dissemination activities during the runtime of the project. This chapter gives a concise overview of the partners’ dissemination, communication and promotion activities. For more detailed information regarding the media relations, scientific publications and presentations, dissemination actions at events, and other dissemination and communication activities, please refer to deliverable *D7.6 Dissemination of the Results*. 
2.4.1 Media relations

Throughout the course of the project, MODUM partners have initiated / published four MODUM-related articles in technical journals, magazines, and newspapers:

• “A clean break”, journal “Traffic Technology International”, 01/2012; article written by Evtim Peytchev (NTU)

• “Systems for Traffic Management in Sofia – from Theory to Praxis”, Bulgarian newspaper “Capital”, 11/4/2013; article initiated by SUMC

• “To Crack a Nut”, magazine “Thinking Highways”, 08/2014, article written by Dave Marples (Technolution)

• “MODUM: Proefproject dynamische en groene route-planning”, “NM magazine”, 01/2015, article written by Sven Maerivoet (TML)

In addition to these articles, partners published also MODUM-related press releases:

• MODUM partner SUMC issued a press release about MODUM in Bulgarian and English language in August 2012. The press release is available at www.sofiatraffic.bg

• UNIMAN included MODUM information in a press release published at the Manchester Business School, and has added a link to the MODUM website in an internal press release. http://www.mbs.ac.uk/about-mbs/news/view/?guid=77224023-2860-4d2f-9bae-34666ff0d64

2.4.2 Scientific publications and presentations

Within the runtime of the MODUM project, five scientific articles have been published by the project partners:


• Tim Skelley, Abdallah Namoun, Nikolay Mehandjie, Manchester Business School, University of Manchester, “The Impact of a Mobile Information System on Changing Travel Behaviour and Improving Travel Experience”, article published in full in the 10th


2.4.3 Dissemination at Events

Project partners promoted the project and its results at 11 events, which represented an excellent opportunity for MODUM dissemination and know-how transfer:

- MODUM presentation at Manchester Business School by Nikolay Mehandjiev and Abdallah Namoun from UNIMAN (29.5.2013)

- MODUM presentation at ARTS workshop in Dublin by Kathy Keeling from UNIMAN (4./5.6.2013)

- 2 MODUM presentations at ITS Dublin 2013 by Sven Maerivoet from TML and William Meijer from Technolutiolion (5./6.6.2013)

- MODUM presentation at Erlang User Conference 2013 by Paul Valckenaers from KULeuven (13.6.2013)

- MODUM presentation at MobiWIS 2013 by Nikolay Mehandjiev from UNIMAN (26.-28.8.2013)

- 2 MODUM presentations at HoloMAS 2013 by Johan Philips from KULeuven (28.8.2013)

- MODUM presentation at Innovations in Transport 2013 by Sven Maerivoet from TML (31.10.2013)

- MODUM presentation at Transport Research Arena TRA 2014 by Sven Maerivoet from TML (14.4.2014)

- MODUM presentation at EC FP7 Concertation Workshop by Sven Maerivoet from TML (30.4.2014)

- MODUM presentation at the MODUM Conference “Building the Bridge from Research to Sustainable Urban Transport Management” (24.9.2014)

- MODUM presentation at WETICE 2014 conference by Abdallah Namoun from UNIMAN (23.-25.6.2014)
2.4.4 Other Dissemination and Communication Activities

Besides publishing articles and papers and giving presentations at well-known events, MODUM partners have also utilised more informal dissemination channels such as personal talks, distribution of MODUM promotion materials, inclusion of MODUM information in the partner organisations' communication channels (e.g., company newsletters and websites), and spreading the knowledge of MODUM in the personal networks of the partners:

In the trial sites Sofia and Nottingham partners have promoted the MODUM trials by distribution of dedicated folders, by direct contacts with potentially interested citizens, and by spreading the word via YouTube, Facebook and Twitter.

Furthermore, MODUM partners established contacts with other European projects (SIMPLICITY, ECOSTAND, M2MGrids, HoPE, AMITRAN, SUPERHUB, MOBIS, MOBINET, TEAM, Eco-Drive, e-COMPASS, COLOMBO, REDUCTION, PEACOX, ICT-EMISSIONS, GETSERVICE, DECOMOBIL, and CARBOTRAF and informed them about MODUM.

Partners SUMC and UNIMAN had several meetings with the big Bulgarian mobile phone service provider VIVACOM, and have achieved a cooperation agreement: VIVACOM agreed to publish and promote the Bulgarian version of the MODUM app in the VIVAApps store during the trial period. Contacts with VIVACOM are still ongoing, and VIVACOM expressed their interest to include an enhanced MODUM app in their VIVAApps store after the end of the project.
3 Planned Exploitation

The first part of this chapter describes the features, components, and outcomes of the MODUM project, which can be exploited. For each of these identified exploitable elements a brief business description as well as an indication of the expected socio-economic impact and relevant IPR issues is given.

The second part of this chapter lists the individual exploitation plans of all MODUM partners.

The third part gives an outline of the concrete plans for uptake of (parts of) the MODUM system by third parties.

3.1 Exploitable MODUM Results

<table>
<thead>
<tr>
<th>MODUM Outcome / Result</th>
<th>MODUM System as a whole</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owner(s) of this result</td>
<td>All consortium members</td>
</tr>
<tr>
<td>Business description</td>
<td>The MODUM “package”, which basically comprises of two parts - the MODUM Integrated Simulation Model, and the MODUM applications for mobile phones and in-car devices, is interesting for city councils as on the one hand it supports and facilitates sustainable traffic management, and on the other hand it provides the citizens with sustainable routing suggestions and thus helps them to take better informed mobility decisions.</td>
</tr>
<tr>
<td>Socio-economic impact</td>
<td>The priority trip planning with public transport will promote carbon emission awareness and will be a good step in public authorities’ effort for reduction of urban traffic and exhaust emissions.</td>
</tr>
<tr>
<td>Type of result</td>
<td>Scientific and/or Technical knowledge (Basic research)</td>
</tr>
<tr>
<td></td>
<td>Guidelines, methodologies, technical drawings</td>
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<tr>
<td></td>
<td>Software code</td>
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<td></td>
<td>Database, Data Source</td>
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<td></td>
<td>Experimental development stage (laboratory prototype)</td>
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<td></td>
<td>Prototype/demonstrator available for testing</td>
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<td></td>
<td>Results of demonstration trials available</td>
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<tr>
<td></td>
<td>Other (please specify):</td>
</tr>
<tr>
<td>Patent(s), License(s), other IPR protection</td>
<td>Licensing plans for the foreground knowledge are mainly covered by the GA and CA, with the addition of possible commercial fees to be paid by the clients (cities) to Technolution in order to have access to their server infrastructure.</td>
</tr>
<tr>
<td>MODUM Outcome / Result</td>
<td>Design, development, deployment and testing of an infrastructure that allows untrusted entities safe participation in a trusted environment</td>
</tr>
<tr>
<td>------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Owner(s) of this result</td>
<td>These elements were developed by, and will be exploited by Technolution.</td>
</tr>
<tr>
<td>Business description</td>
<td>The development of the Execution Environment (and associated Systems Design) within MODUM has allowed experimenters to deploy systems within the Traffic Control Centres at Nottingham and Sofia and to have live access to real time, potentially sensitive, data. This capability is completely novel and was hitherto not available. The consequence of this capability is that now researchers can observe and react to events in real time, and the control centre operators are safe in the knowledge that their data remains within the Control Centre environment, and the researchers are contained within their own constrained, but highly capable, operating environment. This concept of having a safe 'sandboxed' capability for experimental and investigative use in an otherwise secure and data-sensitive environment has been taken into other projects - most notably the M2MGrids project, where exactly the same approach is being used, and extended, for the observation and management of power grid systems. In that project the extension is in the structure of the remote power nodes, which are initially virtualised in the operating environment before being substituted by the 'real thing' in later phases of the project.</td>
</tr>
<tr>
<td>Socio-economic impact</td>
<td>The ability to 'experiment' with different algorithms and approaches to solving problems helps to deliver more performant and scupted solutions to customer problems.</td>
</tr>
<tr>
<td>Type of result</td>
<td></td>
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<td>Guidelines, methodologies, technical drawings</td>
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<tr>
<td>Other (please specify):</td>
<td></td>
</tr>
<tr>
<td>Patent(s), License(s) or other IPR protection plan</td>
<td>All foreground knowledge developed by Technolution within the project is available for licensing on suitable terms. The facilities offered by these Execution Environments are available on commercial terms to be determined for any specific opportunity. The product and process innovations made possible by these innovations are considered open and are made available in the form of articles, presentations and literature by the company on a widespread basis. The company recognised that this enables other companies to develop competing solutions, but by the time these are in the market Technolution will have moved on with further innovations which will continue to differentiate its offer.</td>
</tr>
<tr>
<td>MODUM Outcome / Result</td>
<td>Integration of the UTMC protocol suite into the MobiMaestro product range</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------------------------------------------------</td>
</tr>
<tr>
<td>Owner(s) of this result</td>
<td>These elements were developed by, and will be exploited by, Technolution.</td>
</tr>
<tr>
<td>Business description</td>
<td>MobiMaestro is a highly sophisticated traffic (and increasingly, personal) mobility management suite which is widely deployed in mainland Europe where it has already been used to address challenges that the UK is only just starting to face or recognise. Integrating UTMC into MobiMaestro gives Technolution access to a new market (the UK) and gives that market access to sophisticated mobility management applications that were previously not available in the UK.</td>
</tr>
<tr>
<td>Socio-economic impact</td>
<td>Exploitation of this outcome helps to increase the competitiveness of European industry (specifically Technolution) on the global market.</td>
</tr>
<tr>
<td>Type of result</td>
<td>Scientific and/or Technical knowledge (Basic research) X</td>
</tr>
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<td>Guidelines, methodologies, technical drawings X</td>
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<td>Software code X</td>
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<td>Database, Data Source X</td>
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<td>Experimental development stage (laboratory prototype) X</td>
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<td></td>
<td>Prototype/demonstrator available for testing X</td>
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<tr>
<td></td>
<td>Results of demonstration trials available X</td>
</tr>
<tr>
<td>Patent(s), License(s) or other IPR protection plan</td>
<td>All foreground knowledge developed by Technolution within the project is available for licensing on suitable terms. The product and process innovations made possible by these innovations are considered open and are made available in the form of articles, presentations and literature by the company on a widespread basis. The company recognised that this enables other companies to develop competing solutions, but by the time these are in the market Technolution will have moved on with further innovations which will continue to differentiate its offer.</td>
</tr>
<tr>
<td>MODUM Outcome / Result</td>
<td>MODUM’s route planning subengine for passenger cars</td>
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<tr>
<td>------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Owner(s) of this result</td>
<td>Katholieke Universiteit Leuven, Nottingham Trent University, Technolution, University of Manchester</td>
</tr>
<tr>
<td>Business description</td>
<td>A core component of the MODUM project (in the form of the route planning subengine for passenger cars) can be made available to European cities (e.g., pilot cities within the HoPE project). MODUM’s routing engine core component can be licensed to these partner cities. The MODUM consortium does not provide source code, but rather all the publicly available documentation, as well as a binary module for the cities. To run the binary, the cities can choose to do this on their own, or they can ask Technolution for a licence on their server (probably implying paying a commercial fee). Note that there is still a lot of customisation required per city; this can be the subject of further subcontracting of one or more MODUM core partners in order to facilitate the implementation.</td>
</tr>
<tr>
<td>Socio-economic impact</td>
<td>MODUM provides additional gains by supplying the cities with a core component. The local governments in these cities and country will directly benefit from the added value that MODUM provides (i.e., real-time traffic-aware routing suggestions for passenger car users), which is typically not directly widespread available on the market.</td>
</tr>
<tr>
<td>Type of result</td>
<td>Scientific and/or Technical knowledge (Basic research)</td>
</tr>
<tr>
<td></td>
<td>Guidelines, methodologies, technical drawings</td>
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<td>Results of demonstration trials available</td>
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<tr>
<td>Other (please specify):</td>
<td></td>
</tr>
<tr>
<td>Patent(s), License(s), other IPR protection</td>
<td>Background knowledge is the one needed to complete MODUM’s routing engine (cf. WP2); licensing plans for the foreground knowledge are mainly covered by the GA and CA, with the addition of possible commercial fees to be paid by the clients (cities) to Technolution in order to have access to their server infrastructure.</td>
</tr>
<tr>
<td>MODUM Outcome / Result</td>
<td>Design, development, deployment and testing of an Android application and web-portal</td>
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<tr>
<td>------------------------</td>
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</tr>
<tr>
<td><strong>Owner(s) of this result</strong></td>
<td>These elements were developed by, and will be exploited by MUSAT.</td>
</tr>
<tr>
<td><strong>Business description</strong></td>
<td>The android application and web-portal developed within MODUM will be offered by MUSAT in their AVL (automatic vehicle location) and RTPI (real-time passenger information) systems as trip planning tool. The tool can use different algorithms according to the planning task that has to be solved and according to the available data for the traffic situation. This feature is completely new for MUSAT’s systems and will make them more attractive and functional.</td>
</tr>
<tr>
<td><strong>Socio-economic impact</strong></td>
<td>The ability to communicate with different algorithms and route-planning approaches makes the applications flexible for development and improvement, and supports the users in autonomous and flexible decision-making for finding their optimal routes. Exploitation of this outcome helps to increase the competitiveness of European industry (specifically MUSAT) on the global market.</td>
</tr>
<tr>
<td><strong>Type of result</strong></td>
<td>Scientific and/or Technical knowledge (Basic research)</td>
</tr>
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<td></td>
<td>Other (please specify):</td>
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<tr>
<td><strong>Patent(s), License(s), other IPR protection</strong></td>
<td>All foreground knowledge developed by MUSAT within the project is available for licensing on suitable terms.</td>
</tr>
</tbody>
</table>
**Outcome / Result**
Integration of the GPS-system for control and management of the public transport in Sofia

**Owner(s) of this result**
These elements were developed by, and will be exploited by MUSAT.

**Business description**
The integration interface, which was designed and developed by MUSAT within the MODUM project for communication with other MODUM partners, can be utilised for universal way of data exchange with other systems. The ability for universal transfer of data concerning the public transport vehicle location and departure times of the vehicles on stops from MUSAT's GPS-system for control and management of the public transport can be used to easily expand the features of the system in Sofia.

**Socio-economic impact**
The ability to communicate with different applications makes the applications autonomous and flexible for development and improvement. Exploitation of this feature helps to increase the competitiveness of European industry (specifically MUSAT) on the global market.

**Type of result**
*Ticking appropriate categories from the list below*

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<thead>
<tr>
<th>Category</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific and/or Technical knowledge (Basic research)</td>
<td></td>
</tr>
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<td>Database, Data Source</td>
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<td>Experimental development stage (laboratory prototype)</td>
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<td>Prototype/demonstrator available for testing</td>
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<td>Results of demonstration trials available</td>
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**Patent(s), License(s) or other IPR protection plan**
All foreground knowledge developed by MUSAT within the project is available for licensing on suitable terms.

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**3.2 Partners’ Exploitation Plans**

In this chapter an outline of the individual exploitation plan of each of the MODUM partners is given.
**Partner 1: TML**

TML’s core activities are mainly centred around knowledge development, research, and policy support through quantitative analyses, as opposed to a more development-oriented approach for commercially-ready products. That said, the main benefits from the MODUM research project for TML are the expanding of its expertise and knowledge base, mainly in the field of traffic flow theory, traffic engineering, and policy support through quantitative analyses.

For starters, TML has initially developed the Link Transmission Model, a first-order hydrodynamic macroscopic traffic flow model that physically models how traffic behaves as a compressible fluid. Continued development on the model is one of the main research activities undertaken by TML. In MODUM, that same model was used to predict traffic flows in the future, allowing us to have a more accurate estimation of travel times throughout one’s journey. TML is using the information gathered during the MODUM development process, in order to ameliorate its own travel time prediction tools. It will thereby benefit from the advancement in the current state-of-the-art.

In addition, TML also intends to use the model that acts as a traffic state estimator, mainly for dealing with regions that have incomplete measurements. Examples of this are the studies that TML undertakes, in which it is necessary to investigate the mobility aspects of a selected geographical region, and the impact certain policy decisions may have. To that end, it is important that TML’s models are calibrated, which implies a rather large amount of solid and qualitative measurements. To increase TML’s prediction accuracy, TML intends to reuse the traffic state estimator from the MODUM project, thereby allowing TML access to information on every link in the selected road network.

Furthermore, TML’s core ambitions are to support policy makers with key insights that are based on scientifically sound and quantitative analyses. MODUM mainly revolved around the cities as end users, in the sense that they will benefit from a larger uptake of the system by commuters, or (by extension) any type of traveller. For TML, those insights are of paramount importance, as they allow to translate certain measures into identifiable impacts. The work TML did during the field trials enabled TML to increase expertise related to behavioural modelling. Given that a certain amount of TML’s studies require such analyses, it is a clear benefit to have done the MODUM project and to be able to translate these results into future research and commercial studies.
Finally, given that TML also created MODUM’s evaluation and validation framework that was based on the EC’s internationally-accepted CONVERGE and MAESTRO guidelines, TML can reuse that framework virtually as-is for all currently running and future studies that TML undertakes.

TML’s mode of operation is such that the company is mainly dependent on tenders by both public (local, regional, national, and European governments) and private organisations (e.g., constructors, stakeholders, member organisations, …). As the employees knowledge is TML’s most primary asset, it is imperative that TML (1) retains and (2) updates this expertise. Having that, gives TML an advantage in contrast to the competitors, by allowing TML to win future tenders and having more opportunities that fit within TML’s portfolio of activities.

Examples of these are the EC project calls (framework contracts, DG tenders, Horizon 2020 calls, ERA-NET calls, …) in which TML can more actively participate due to the increase in the company’s knowledge. Such calls are directly responsible for the continued research and development activities within TML, translating on the longer term to an increase in TML’s knowledge base and hence TML’s portfolio and successful bids on tenders. The upshot of using the expertise gained by TML throughout MODUM is that TML can now also be more competitive in relation to larger research institutes and specialised laboratories (because TML no longer needs to rely on them to furnish specific information, thereby being able to take on more opportunities than before). A commercial exploitation of TML’s core competences is what makes TML both a unique and profitable company, even at an international scale.

Given the current national market for mobility-related studies in Belgium, it is vital that TML also participates in calls at those levels, as well as undertakings in the private sector. Some of our competitors are already within that field, and it is important that TML also breaks into those markets (an example of this is TML’s Data Enrichment Group, which uses quantitative modelling and statistical analyses to better predict user behaviour in light of a taken set of policy measures). Not entering such markets mostly implies an exit from that type of activities.

As already explained, TML gains more from the scientifically-developed methods and models, than from the pure technically-developed applications in the MODUM project. That said, most of this knowledge has been disseminated through the proper channels, for examples via private and public lectures, conference participation, and internationally peer-reviewed journal articles. External valorisation of these developments is a necessary step if TML wants to be able to successfully use the information the own activities.
Partner 2: NTU

One of the key outcomes from the MODUM project for the Nottingham Trent University is to create a setup in the City of Nottingham suitable for the creation of a “Living Lab”. The MODUM setup currently comprises a server room machine connected to the SCOOT system, a number of roadside devices (6) at different locations in the city, contradiction-free simulation model, prediction and visualisation model. All these models fit nicely with the concept of the “Living Lab”, but need extending the facility in terms of active nodes. The setup will create Wireless Infrastructure for staging wireless research experiments in real environment by installing devices (it is envisaged that 100 new nodes will be added) alongside Nottingham’s main roads and in the Nottingham City Centre and link this infrastructure to Nottingham Traffic Control Centre’s wireless equipment for traffic control. In this way the whole traffic control centre already deployed wireless infrastructure (multi-million pound investment on its own) will become part of the Living Lab and a tool for testing research hypothesis and building new applications.

The Purpose of the „Living Lab“ will be to:

- Improve the traffic data gathering using the lab’s setup for both Nottingham Traffic Control Centre and for research purposes, historical data will be collected on a permanent basis.
- Stage Research Experiments and test in real life new algorithms for ad-hoc networking and car-2-X communications
- Use the data gathered for inventing new algorithms and procedures for identifying traffic conditions and as a test bed for future EU H2020 projects.

There are noticeable results in the exploitation of the results so far:

- Nottingham Trent University decided to invest in the building of the “Living Lab” concept and allocated £50 000 capital investment to be completed in 2015.
- Coventry City Council will use the MODUM setup as a starting point for the implementation of the currently running EU FP7 project HoPE
- Nottingham Trent University and Nottingham City Council will use the MODUM setup as a starting point for the implementation of a new 5 year long 25m Euro H2020 project REMOURBAN (started on the 01 January 2015)

Nottingham Trent University is motivated to exploit MODUM by establishing such a Living Lab, since this brings benefits not only to NTU but also to the Nottingham City Council and to the commuters in Nottingham:
− Benefits to Nottingham Trent University:
The Wireless Living Lab will significantly enhance the research in building wireless information systems - both traffic and others – e.g., Location Based Services, building mobile phone network applications, applications for social interaction and inclusion that can be deployed in the lab and real-life experiments staged for the benefit of the users.
The knowledge gained will be used for the preparation of new academic articles (journal or conference publications) and also for preparing state of the art lectures in the area of mobile communications.

− Benefits to Nottingham City Council:
The Nottingham Traffic Control Centre will be able to connect its wireless traffic control devices in a single network controlled by the centre main control room in Loxley House, Station Road in Nottingham. This process needs Nottingham Trent University’s participation to be accomplished.

− Benefits to all commuters in Nottingham:
Better traffic control, less pollution, faster traffic journeys, better information delivery, creation of new services and deployment in a network environment of advanced Intelligent Transportation Systems.

Partner 3: UNIMAN

The University of Manchester has brought into MODUM as background knowledge the core mechanism for agent-based route guidance enabling dynamic “road pricing” to ensure even distribution of load throughout the transportation network. The idea has been developed further into a detailed algorithm and consequently into a route planning module during the project, and this added detail constitutes foreground knowledge. A different yet still exploitable body of foreground knowledge is the understanding of requirements and needs of commuters in four European cities.

The University of Manchester aims to exploit both types of foreground knowledge in the following ways:

- The understanding of commuter needs and requirements will be published and then used to develop a number of further research directions and ideas in collaboration with local transport authorities in the United Kingdom. Two project proposals for investigating integrated information provision for transport users have been submitted, and a proposal on integrated transport solutions for local authorities is currently in preparation.
• This understanding and knowledge in the area will also be used to train Master-level students in terms of setting up related Dissertation projects, and Undergraduate students in terms of setting up Final Year Projects and coursework examples.

• The algorithms behind the route advisory system will be developed further to allow parametrisation of different trade-offs, according to the knowledge gathered about commuter preferences. These will then be exploitable as a part of the other exploitable results listed here, and the University of Manchester will enter in licensing agreements with the other exploiting partners.

• The route advisory system itself will also be updated with the parametrisation features, and will also be licensed to the other exploiting partners following the exploitation directions in this deliverable.

The motivation of the University of Manchester behind this exploitation is to continue to create grounded and relevant knowledge in terms of research models, algorithms and systems which are relevant to the needs of their users and are grounded in real-world cases and requirements. The University of Manchester can then feed this knowledge into further knowledge-transfer activities and educating students, thus completing the university’s mission of benefitting the society through knowledge creation, dissemination and education.

Partner 4: KU Leuven
KU Leuven has mainly been involved in the research aspects of the route guiding algorithms and real-time forecasting of traffic flows. It provided as background knowledge regarding two distinct aspects:

- Its ant-based multi-agent system to provide distributed scheduling and real-time forecasts, which had been successfully applied to multiple application domains in the past.

- Traffic models which model traffic flows in the links and nodes of a road network based on several years of research in the domain of intelligent traffic systems.

During the MODUM project these aspects have been combined into the real-time traffic forecasting tool, which uses the traffic models and ant-based multi-agent system to forecast travel times. This constitutes foreground knowledge, which KU Leuven plans to exploit in the following ways:

- Further development of traffic models and real time forecasting in future dissertation projects, master theses or other project work.
- Publish results from both background and foreground knowledge
- Use the results from both background and foreground knowledge in future project proposals.
- Licensing of real-time traffic prediction tool to other exploiting partners

The motivation behind this exploitation is to continue research in both traffic modelling and real-time (distributed) forecasting in various domains such as e.g., mobile robotics, order picking in e-warehouses, and connected cars.

**Partner 5: Technolution**

The primary contribution that MODUM has delivered for Technolution is the design, development, deployment and testing of an infrastructure that allows untrusted entities safe participation in a trusted environment. Specifically, the development of the Execution Environment (and associated Systems Design) which has allowed experimenters to deploy systems within the Traffic Control Centres at Nottingham and Sofia and to have live access to real time, potentially sensitive, data. This capability is completely novel and was hitherto not available. The consequence of this capability is that now researchers can observe and react to events in real time, and the control centre operators are safe in the knowledge that their data remains within the Control Centre environment, and the researchers are contained within their own constrained, but highly capable, operating environment.

This concept of having a safe 'sandboxed' capability for experimental and investigative use in an otherwise secure and data-sensitive environment has been taken into other projects - most notably the M2MGrids project, where exactly the same approach is being used, and extended, for the observation and management of power grid systems. In that project the extension is in the structure of the remote power nodes, which are initially virtualised in the operating environment before being substituted by the 'real thing' in later phases of the project.

The ability to 'experiment' with different algorithms and approaches to solving problems helps to deliver more performant and sculpted solutions to customer problems.

This idea is expanded in the following article: [http://edition.pagesuite-professional.co.uk//launch.aspx?eid=da224c9f-c3c6-4a71-ba09-3c6b09263a54&pnum=16](http://edition.pagesuite-professional.co.uk//launch.aspx?eid=da224c9f-c3c6-4a71-ba09-3c6b09263a54&pnum=16)

As can be seen from this article this concept has been further extended as a result of the basic knowledge gained during the project.
Technolution has already deployed this approach in some of its new Traffic Management Systems, allowing third parties, with specific focused expertise, to deliver algorithms to fix specific traffic issues.

The company is also entering into discussion with the UK Transport Catapult with a view to deploying this sandbox environment across multiple Urban Traffic Management Centres in the UK to give researchers and developers early access to live environments, and thus help them to improve their research and product offers.

A second, highly significant, development from MODUM from the perspective of Technolution is the integration of the UTMC protocol suite into the MobiMaestro product range. This required quite some extension to the MobiMeastro product to accommodate. Technolution is going to exploit this extended MobiMaestro® system in the UK market. The product itself is also extended for deployment into other markets.

The other partners within MODUM are fully aware, and indeed have made use of the facilities offered by these Execution Environments, and they are available on commercial terms to be determined for any specific opportunity. All foreground knowledge developed by Technolution within the product is available for licensing on suitable terms. The product and process innovations made possible by these innovations are considered open and are made available in the form of articles, presentations and literature by the company on a widespread basis. The company recognized that this enables other companies to develop competing solutions, but by the time these are in the market Technolution will have moved on with further innovations which will continue to differentiate its offer.

Partner 6: FGM-AMOR

As a consultancy in the field of sustainable mobility, FGM-AMOR is working in close cooperation with public authorities and decision makers on national, regional, and local level, as well as with cities’ transport departments, and with public transport operators. FGM-AMOR’s core business is design, development, implementation and evaluation of sustainable mobility solutions tailor-made for the needs of its customers. Part of its business portfolio is the development of real-time information and static routing systems for public transport providers. The MODUM system enables FGM-AMOR to enlarge its business branch of information systems from public transport to a comprehensive set of transport modes and multimodality as well as from static routing systems to real-time, traffic based, routing systems. The enlargement of FGM-AMOR’s skills and knowledge in this business fields allows FGM-AMOR to actively promote the MODUM system to its clients (especially to cities
in Austria and to other cities the company is in contact with) and to offer them support with the implementation of the system in close cooperation with the technical MODUM partners.

In addition, MODUM increases FGM-AMOR’s ability to participate in future national and international research and development activities in the field of real-time routing systems for intermodal trips, as well as in the fields of effective management of urban traffic and nudging people towards more sustainable mobility options. Such further research and development can for example focus on fine-tuning of the products created by MODUM, it could involve adding applications for specific user groups, or it could deal with enhancing the application with features serving special interest areas such as e.g., leisure and tourism.

**Partner 7: NCC**

Existing data collected within the UTC (urban traffic control centre) environment has been enhanced within the MODUM project, and development of the execution environment by the MODUM partners has allowed Nottingham City Council (NCC) to experiment and deploy the MODUM system within the Traffic Control Centre at Nottingham, and to have live access to real time data.

This now allows the researchers to observe and react to events in real time. This infrastructure will be used by Nottingham City Council for further development in the area of real time information provision to other interested parties such as trams, trains and taxis.

As the data collected is available in real time and can be made available through the MODUM system to commuters who are unable to use alternative modes of transport, these elements of the MODUM Application will help NCC in future to actively manage the commuter congestion at peak times within the urban environment.

During the Conference held in Nottingham NCC representatives were able to engage with other interested groups such as Public transport, Municipalities and City Councils within UK and Europe, Scientific Groups and Manufacturers within the traffic industry. Since the feedback from this conference for the local authorities was that this development would be of interest and could be deployed in other areas of the UK, as the MODUM system will not only help the local authorities in achieving reduced congestion within the urban and inter urban areas, and accurate real-time information for urban traffic, public transport and highways, but it will also help the local authorities with exchange of real time information and data with other interested parties and the public. Thus NCC is willing to share its experience with the MODUM system with other local authorities.
Nottingham City will be looking at making the MODUM application available to all citizens, to help reduce congestion by encouraging the use of greener transport modes and making it a better experience for the people of Nottingham and those who are visiting the area for the first time.

During the MODUM trial phase, those who participated whilst using the Application experienced benefit from a faster/ greener commute to and from work. Nottingham intends to exploit and further develop this in areas that are under development. As the new Tram routes are introduced and additional Park and ride Car parks come on line. With additional transport modes available later on in the year the use of the application will enhance the customer experience when receiving information through the MODUM application. Below are two corridors that Nottingham intends to use for further development:

![Map of Nottingham](image1)

![Map of Nottingham](image2)
**Partner 8: MUSAT**

The android application and web-portal developed within MODUM will be offered by MUSAT in their AVL (automatic vehicle location) and RTPI (real-time passenger information) systems as trip planning tool. The tool can use different algorithms according to the planning task that has to be solved and according to the available data for the traffic situation. This feature is completely new for MUSAT's systems and will make them more attractive and functional. MUSAT is going to exploit the android application and web-portal in the Bulgarian market. The product itself is also extended for deployment in other markets.

MUSAT will use the integration interface, which was designed and developed by MUSAT within the MODUM project for communication with other MODUM partners, for universal way of data exchange with other systems. Specifically, MUSAT will utilise the ability for universal transfer of data concerning the public transport vehicle location and departure times of the vehicles on stops from MUSAT’s GPS-system for control and management of the public transport in order to easily expand the features of the system in Sofia.

MUSAT will promote the developed system to big city municipalities in Bulgaria together with MUSAT’s own AVL (automatic vehicle location) and RTPI (real-time passenger information) systems. The route planning feature through the possibilities of the MODUM system will make the entire solution more attractive and useful for the passengers. It will also make the solution more attractive for city authorities, since the priority trip planning with public transport will promote carbon emission awareness and thus will be a good step in public authorities’ effort for reduction of urban traffic and exhaust emissions.

**Partner 9: SUMC**

One of the priorities of SUMC is optimising the degree to which public transport is used in Sofia. This also implies optimising the use of the transport infrastructure and decongesting roads which public transport shares with other vehicles, thus improving reliability of timings and travel times of public transport. This in turns results in more predictable and constant travel times, and encourages people to get off their cars and use public transport, creating a virtuous circle leading to more ecologically friendly travel. As this is entirely in alignment with the approaches and technologies developed on MODUM, SUMC is willing to support the operation of a system derived from the MODUM prototype in the following manner:

- Continue to provide GPS data from public transport, allowing the calculation of their speed of movement and of their estimated arrival time at the next bus stop.
This is useful for the real-time journey planner in MODUM, allowing high-reliability advice to commuters. The data from the busses and trolleybuses is also used as floating probe data to indicate the situation of traffic on roads where there are no bus lanes.

- Continue to maintain the Bluetooth sensors and any additional Bluetooth sensors installed in conjunction with the MODUM system, reserving the right to reuse the data they provide for other transport management purposes.

- As availability of traffic data improves with the installation of smart traffic control systems, support the feeding of information into any system derived from MODUM to ensure high accuracy of current traffic estimates and traffic predictions.

- Continue to host a server on which the MODUM system can run, and provide network connection to the server.

- In case that the MODUM app can no longer be hosted by VIVACOM, SUMC will also be able to provide a download point for the personal app derived from the MODUM app, and instructions about the installation and operation of the app at its site www.sofiatraffic.bg

- SUMC will also support any further development of the app (undertaken by other partners and projects), with the view of making it suitable for a wider range of purposes such as:
  - Use by commuters without a mobile phone by hosting an equivalent functionality dynamic webpage on SUMC website;
  - Use by people between two random points in the whole of Sofia;
  - Use by despatch agencies and fleet car operators.

The funds for providing this continual support are minimal and will be offset by improved performance of public transport in Sofia and reducing the congestion on the streets, which will in turn reduce the fuel bill of SUMC vehicles.

In addition to providing this continuous support to such a system derived from the MODUM prototype, SUMC will also reuse MODUM results and expertise on other ongoing projects about integrated planning of public transport and inter-city trains.
3.3 Take-up of MODUM by Third Parties

The concepts and products developed by MODUM as well as the knowledge and information elaborated in the project will also be used by third parties, such as telecommunication providers, other European project consortia, and local/regional transport control centres: Currently MODUM partners are in close contact with the British Telecom and Vivacom, two telecommunications providers that are considering to offer the MODUM app to their clients. Two recently started European projects, HoPE and M2MGrids, are going to use parts of the MODUM outcomes, and the MODUM route planning sub-engine will be implemented in the pilot cities/regions Athens, Coventry and Basque County. The following sections give more details about these planned (and partly already ongoing) take-up activities.

European Project HoPE

The recently started EC ICT-PSP HoPE project will use key insights and one core component of MODUM. The use of a part of the MODUM application is foreseen within the IPR framework of the project, as well as discussed with the various consortium partners. MODUM will mainly provide key insights of which the HoPE project will benefit.

In addition to these key insights, a core component of the MODUM project (in the form of the route planning sub-engine for passenger cars) will be made available to the 3 pilot cities within the HoPE project. This MODUM component is seen as a centre piece within the HoPE development. Thus MODUM will be further exploited in the HoPE partner cities of Athens, Coventry and Basque Country. The local governments in these cities and country will directly benefit from the added value that MODUM provides (i.e., real-time traffic-aware routing suggestions for passenger car users), which is typically not directly widespread available on the market.

MODUM’s routing engine core component is licensed to the 3 HoPE partner cities. The MODUM consortium does not provide source code, but rather all the publicly available documentation, as well as a binary module for the pilots. To run the binary, the HoPE pilots can choose to do this on their own, or they can ask Technolution for a licence on their server (probably implying paying a commercial fee). However, as there is still a lot of customisation required per pilot city; this can be the subject of further subcontracting of one or more MODUM core partners in order to facilitate the implementation.
European Project M2MGrids

The project M2MGrids has been funded under the auspices of the ECSEL programme and began in November 2014. Technolution has adapted the experimentation and isolation systems that they developed within MODUM for use within M2MGrids. The MODUM approach allows for lab based experimentation using ‘live’ field data from power systems in a safe and secure model.

During Phase 1 of the M2MGrids programme data are backhauled from the field based infrastructure and delivered to the back end systems; The back end systems present these flows to applications that run in an environment similar to the MODUM one. A similar processing infrastructure to the one from MODUM is made available to experimenters to allow them to develop their control and monitoring algorithms in a highly performant and secure environment within the operations control centre of the power company. Virtual machines and VPN connectors to them allow for very flexible experimental structures to be built. The advantage of this arrangement is that although data are collected from the field (i.e. are ‘real’) the algorithms that operate on them are executed in a lab environment and hence can be monitored, modified and upgraded at will. From the perspective of the algorithms themselves then, apart from non-functional aspects such as delay and communication reliability, it is transparent to them if they are running in the back end system or out in the field.

During Phase 2 of the project these processing elements are devolved to the field based equipment so that the developments from the programme are demonstrated in a ‘real’ environment close to a production deployment.

This structure of controlled development in a lab within the firewall of the power operator together with ‘real world’ field proving has been a key factor in the award of the M2MGrids project and is expected to significantly aid the researchers in the development of their systems.

Vivacom

Vivacom is one of the main mobile operators in Bulgaria. It maintains an application store for Android smartphones named “VIVAApps”. Vivacom sees the provision of interesting applications through its store as one of its unique value points. Thus it is in the core of Vivacom’s interest to deploy the MODUM App on VIVAApps.

The MODUM consortium, represented by SUMC and University of Manchester, has initiated discussions with Vivacom about collaborating with them during the trials and after the end of the project. As a result Vivacom supported the MODUM trial as follows:
- Vivacom deployed the MODUM app on their application store.
- Vivacom provided non-metered mobile internet access to the app for all their customers.
- Vivacom printed 3000 copies of the MODUM trial brochure and distributed it in its retail shops which were positioned in the catchment area of the trials.
- Vivacom send promotional SMS two times to 10,000 customers, who live in the trial area.
- Vivacom provided 3G mobile internet for communication between the Bluetooth Roadside Sensors and the back-end system.

Upon the conclusion of the trials, the ongoing discussions with Vivacom identified continuing interest in exploring the possibilities for shared revenue exploitation between Vivacom and the MODUM Consortium. This is, however, subject to management approval at Vivacom, and subject to a number of amendments to the MODUM software. The required amendments to the MODUM software can be divided into two groups:

(a) Amendments to remove features introduced in MODUM to support the experimental nature of the trials:
   a. Remove the limitation for travelling between two points only.
   b. Remove the limitation for travelling within one trial zone only.
   c. Remove the reporting and trip counting functionality in the MODUM app.

(b) Amendments to enhance the scope and market for the MODUM prototype:
   a. Create a direct interface to dispatch systems so that the origin and destination data can be set automatically in the software.
   b. Consider white-label versions to be sold to corporate customers with their own branding.
   c. Consider deploying in other big cities in Bulgaria – Plovdiv, Varna, and Burgas would be the first wave of deployment. The key to success would be to establish compatibility of the MODUM design solutions with the local infrastructural context, and to adapt the MODUM interfaces to the local ones.
   d. Consider integrating with transport control systems in the cities, where MODUM is deployed.

The amendments under (a) would be short-term and easy to organise, whilst the amendments under (b) would be subject to additional investment and commercial agreements.
The discussion with Vivacom is also exploring the appropriateness of certain business models to the nature of the application and to the context of its deployment. The business models under consideration include:

(a) Consumer revenue: distribute the application using a version of the “freemium” model, where the full features of the software are available for free for a limited length of time, after which the software remains working but with reduced functionality, unless the application is purchased. The reduced functionality version may require GPS tracing to help with predicting the traffic speeds on the streets of Sofia.

(b) Commercial revenue: distribute the MODUM system to courier companies and taxi despatch companies. This distribution can happen within a white-labelled bundle prepared by Vivacom. Adaptation of the system would be required to plug directly into the system infrastructure of the client, and this would be charged to the potential clients.

The next steps planned in the exploitation collaboration with Vivacom are as follows:

(a) The MODUM consortium creates a proposal for functionality restrictions in the free version of the software.

(b) Vivacom seeks authorisation from management, and starts to prepare collaboration models and statements.

(c) A version of exploitable software is determined and partner licensing issues are explored by the MODUM consortium.

(d) Contract is prepared and signed

(e) Work for the commercial version of the software starts.