Large Scale Collaborative Project

7th Framework Programme

INFSO-ICT 224067

D4.7.4 Operational Business Models

Deliverable n.	D4.7.4	Opertional Business Models	
Sub Project	SP4	Evaluation and Assessment	
Workpackage	WP4.7	Business models and user uptake assessment	
Task n.	T4.7.3	Operational business models	
Author(s)	Stig Franzén Oskar Rexfelt	File name	TeleFOT_D4.7.4 OBMs_20130222.doc
Status	Final		
Distribution	Public (PU)		
Issue date	2013/02/22	Creation date	2012/08/15
Project start and duration	1st of June, 2008 – 54 months		

European Commission
Information Society and Media

Project co-funded by the European Commission

(DG-Information Society and Media)
DG-Communicatiuons Networks, Content and Technology

in the 7th Framework Programme

SEVENTH FRAMEWORK PROGRAMME

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

ABBREVIATION	DESCRIPTION
CAN	Controller Area Network
D	Deliverable
DAS	Data Acquisition System
DoW	Description of Work
D-FOT	Detailed FOT
FOT	Field Operational Test
GDS	Green Driving Support
GPS	Global Positioning System
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communication
IPv6	Internet Protocol, version 6
L-FOT	Large Scale FOT
LTE	Long Term Evolution
MANET	Mobile Ad-hoc NETwork
NAV	Navigation System
PAYD	Pay As You Drive
PI	Performance Indicator
RFID	Radio-Frequency IDentification
SA	Speed Alert
SP	Sub Project
TI	Traffic Information
IR	Internal Report
WP	Work Package

REVISION CHART AND HISTORY LOG

REV	DATE	AUTHOR	REASON
0.1	2012/08/15	Stig Franzén	Background matrial collected
0.2	2012/09/01	Oskar Rexfelt Stig Franzén	First instructions to partners prepared and sent out
0.3	2012/10/31	Oskar Rexfelt Test site managers invovled	First compilation of results made
0.4	2012/12/01	Stig Franzén	First draft of report prepared
0.5	2012/12/20	Stig Franzen Oskar Rexfelt	Second draft of report prepared
1.0	2012/12/22	Stig Franzén	Final draft distributed for internal review
1.1	2013/01/09	Reviewers	Minor comments from reviewers received by author
2.0	2013/01/16	Stig Franzén	The comments are addressed The final version is submitted
2,1	2013/02/22	Stig Franzén	Some small amendments made (as a response to reveiwers' comments)

EXECUTIVE SUMMARY

The main objective of this Deliverable is to identify and discuss the operational business models found in the context of the functions/systems tested in TeleFOT, but also to provide a foresight into what can be expected in the year 2017, mainly depending in the rapid development in the area of information and communication technologies.

A checklist encompassing the basic elements of modern business model generation methods was prepared. The seven systems (with several functions) that were studied were those available at the local test sites of the countries from where the partners involved in the Task 4.7.3 Operational business models resided.

A compilation of the answers to the questions of the checklist as related to the functions/systems used and studied in the TeleFOT FOTs is found. A technology foresight in the area of information and communication technologies for mobile applications was performed. It was used in the analysis of the last question of the checklist about the "validity of business models in 2017".

The analyses of the devices used in TeleFOT (and their business models) all point towards a decreased market for dedicated aftermarket devices. Depending on the functions offered by the devices, it seems that embedding the functions in cars or offering those through Smartphone apps have become advantageous.

When considering future business models, one would need to thoroughly analyse future scenarios regarding technology development. Also the prospect of new applications based on emerging new technologies (based on the technology foresight made) is really a threat to the dominating actors of today.

The further analyses of the business models show that there is a big difference, from the users' point of view, to having access to *a function* and having access to *a high quality function*. Overall, it is important to distinguish between *purchase* and *use* when discussing the user acceptance of an aftermarket device. It seems that the price of the device and the functions of the device are central factors at the moment of purchase. However, when using the functions of the device (or choosing not to), the users compare the functions' usefulness with the effort needed to use them.

The Smartphone alternative has an appeal in the moment of purchase, as it is so cheap and offers the same functions as the other alternatives. In the moment of use, a function already installed in the vehicle seems advantageous both regarding the effort needed from the user and the perceived usefulness (e.g. the quality of the function).

Also other factors come into play such as obtrusiveness on driving behaviour, obtrusiveness on other behaviour, optional use or not, type of help offered by the function, competing services and efforts needed for updates.

As a conclusion, dedicatd aftermarket devices have and are losing market shares.The reason for this is not that the users' need for the functions themselves have decreased. It is the way the functions are 'delivered', and the impact this delivery has on the quality of the functions, price and user effort that is the issue. Functions delivered via Smartphone applications and Technology embedded in cars is deemed more favourable by more and more users, in comparison to dedicated aftermarket devices.

While the Smartphone revolution may be viewed as one of a kind occurrence, it is wise not to do so, at least in relation to future business models. The rate of technology development is not likely to slow down, meaning that it is a central factor to consider for any business model in this field. New technology will sometimes enable breakthroughs with regards to functions or even enabling new functions never offered to customers before.

1. INTRODUCTION

TeleFOT is a Large Scale Collaborative Project under the Seventh Framework Programme, co-funded by the European Commission DG Information Society and Media (today DG Communications Networks, Content and Technology) within the strategic objective "ICT for Cooperative Systems". It started officially on June 1st 2008 and TeleFOT aims to test the impacts of driver support functions on the driving task with large fleets of test drivers in real-life driving conditions.

In particular, TeleFOT assesses via Field Operational Tests the impacts of functions provided by aftermarket and nomadic devices, including future interactive traffic services that will become part of driving environment systems within the next five years. Field Operational Tests developed in TeleFOT aim at a comprehensive assessment of the efficiency, quality, robustness and user friendliness of in-vehicle systems, such as ICT for smarter, safer and cleaner driving.

The main objective of this Deliverable is to identify and discuss the operational business models found in the context of the functions/systems tested in TeleFOT, but also to provide a foresight into what can be expected in the year 2017, mainly depending in the rapid development in the area of information and communication technologies.

This deliverable builds to some extent on the work of Work Package 2.6 (with the deliverables D2.6.1 and D2.6.2) where the work was focused on what constitutes the potential and limitations of new ICT solutions, infrastructure equipment, on-board devices and innovative functions and services in the market (as of the year 2011).

This document is structured in four different sections (apart from the introduction). The second chapter deals with the approach taken in the work describing the methodology used and other limitations imposed on the work. The functions/systems studied are presented and the checklist used is described. A short background presenting different ways of developing business models is also presented. A limitation in the work has been that only functions/systems available at the local test sites of partner countries involved in this task (Task 4.7.3 Operational Business Models) have been addressed.

In the third chapter a compilation of the answers to the questions of the checklist as related to the functions/systems used and studied in the TeleFOT FOTs is found. The

results are summarised in several tables (on per checklist area) and the findings are discussed and critically assessed.

The fourth chapter starts with a technology foresight in the area of information and communication technologies for mobile applications. It is followed by the compilation of results from the checklist question about the “validity of business models in 2017” and ends with a short discussion on the findings and the platforms used related to each of the systems/functions addressed in the work.

In the fifth chapter the present and the future situations are combined (as found in the preceding chapters) and the result are presented as some conclusions about what can be expected in the field of mobile applications.

2. FRAMEWORK APPLIED

Companies and organizations are constantly innovating to create added value for their customers and to improve their market position. The true value of innovative concepts and technologies is largely determined by the business models in which they are embedded.

Business model innovation requires a carefully substantiated vision that takes into account developments in the market (expectations, competition, new players), environment (social development, legal issues, trust) and technology (standardization, interoperability, self-service).

Making choices is difficult due to the complex interplay of needs, opportunities and rapidly changing conditions. The right and timely adjustment of your business model, i.e. business model innovation, plays a major role in sustaining competitive advantages and capitalizing on innovation. There are several approaches that can help in designing a business model, e.g. the Business Model Canvas or STOF approach (See Annex I)

In practice there are several threats to business models. They are *Commoditization,* i.e. over time many products and services become commoditized; *Business model continuous viability*, i.e. costs and value are no longer balanced if new entrants to a market start offering cheaper alternatives that disrupt the market; *Lack of alignment with trends,* i.e. business models need to be in agreement with evolving trends; and *Narrow focus and single future strategies*, i.e too strong convictions on future trends and developments can lead to vulnerable business models.

As the world of technological products and services is evolving rapidly, the logics for the business one year may be completely different the following year. The subtask (Task 4.8.3) of WP4.8 in TeleFOT sets out to explore that challenge.

2.1 METHODOLOGY USED

The idea behind the approach used is that recommendations can be compiled based on the experiences in the TeleFOT project. The unit of analysis is the *business model,* i.e. the rationale of how an organization creates, delivers, and captures (economic) value.

The goal of Task 4.7.3 is to answer the following questions:

1. Which were the business models of the functions/devices used in the FOTs?
2. What are key aspects and success factors in these business models?
3. How fast do the prerequisites for business models in the field change?
4. How do these prerequisites change? Are certain types of factors more unstable than others?
5. How can such changes be predicted and addressed when constructing a new business model in this field?

Each participating partner in Task 4.7.3 was asked to analyse the functions/devices used in the TeleFOT FOTs performed in their own country.

Table 1 TeleFOT partners (involved in Task 4.7.3) and the functions/systems analysed

Partner	Devices to analyse	Contains functions	Used in FOT
Chalmers	Garmin Nüvi 205 WT	Navigation support, Traffic information, Green driving support	SE
VTT	DriveECO	Traffic information, Speed info/alert, Green driving support	FIN
VTT	LATIS	Navigation support	FIN
CRF	Easyroad	Navigation support, Speed info/alert	IT
Loughborough	MobilEYE	Lane keeping	UK
Loughborough	FootLITE	Green driving support	UK
Loughborough	BLOM	Speed alert on satnav	UK

Table 1 illustrates all the partners and what function/system they analysed. There was available a template of a checklist (see Annex II) for grasping the basic elements of the business model of their function/device. The functions/devices to be analysed were the ones used in the different FOT(s).

For each device (containing a number of TeleFOT functions e.g. speed alert, green driving support etc.) the business model (as it was understood when the FOTs were carried out) was to be mapped out. At the end the validity and soundness of the business model in 5 years (2017) was to be addressed.

2.2 THE WORK PLAN APPLIED

Firstly, a description of the business model of each device was compiled using the checklist (Annex II). The checklist was based on two business model generation methods, Business model canvas[1] and STOF[2] (See Annex I).

Secondly, a short analysis of the mapped out business models were carried out. Questions to explore were for example:

- How successful was the business model?
- What factors contributed the most to its success (or failure)?

Thirdly, the validity/soundness of each business model was analysed. The main objective was to predict the success of the business model in five years, i.e. in the year of 2017, and to explain the reasons behind its success (or failure). Here each part of the business model had to be addressed and discussed in relation to changes that might affect it, such as:

- New technologies are available
- New laws have been introduced
- There is and increased (or declined) request of the function
- New habits of the users
- New competitors on the market

[1] *Business Model Generation*, Osterwalder et al. (2009)
[2] *Mobile Service Innovation and Business Models,* Bouwman et al. (2008)

3. COMPILATION AND ANALYSIS OF RESULTS

3.1 OVERVIEW OF DEVICES

Seven devices (with different functions) used in the TeleFOT project were analysed (table 2). Four of them incorporated a *Green Driving support* function, three a *Navigation support* function, two a *Safe driving support* function and three a *Traffic information* function. One of them (LATIS) also had the functions *Speed limit* information and *Speed alert*. The price range of the devices was 99-780 €, and they were used in FOTs in Finland, Italy, Sweden and United Kingdom.

Table 2 Overview of the analysed devices with their functions

Device	Price	Used in FOT	Functions
Garmin Nüvi 205 WT	99 € (in store)	Gothenburg	-Navigation support -Traffic information -Green Driving Support
EC-Tools Driveco	about 205 €[3] + monthly service fee 89 €/year[4]	Finland	Green Driving Support
LATIS	Free during tests	Finland	-Traffic information -Speed limit information -Speed alert
Magneti Marelli Easyroad personal navigation device integrated with the Blue&Me system.	300€ (OEM optional price)	DFOT1 Italy	-Navigation support -Traffic information -Green Driving Support

[3] purchase price by the TeleFOT project prior to the tests

[4] offer by EC-Tools to the TeleFOT tests participants at the end of the tests

Mobil-Eye C2-270	780 €	UK	Safe Driving Support
Foot-LITE demonstrator system	System was a proof of concept demonstrator, therefore no commercial price. Potential Target Price in mass production (excluding Smartphone) was thought to be 100 €	UK, Nuneaton	Smart Driving Support, incorporating Green Driving Support and Safe Driving Support
BLOM N-Drive 800	250 €[5]	UK	Navigation support

3.2 DEVICE SET UP AND OPERATION

The most frequent set up of the devices in this analysis was the one that consisted of a separate nomadic device with built in functions (see Table 3). New functions could not be added to these devices. The hardware comparison shows that there are mainly two characteristics that differ between the devices: Vehicle integration and Smartphone connection. Some devices (Driveco, Marelli Easyroad, Foot-LITE) are highly integrated with the vehicle. This enables real-time data retrieval from the vehicle's current status which in turn may enable more advanced functionality for e.g. Green Driving Support. The set ups that includes Smartphones mainly do so to use the phones as GUIs for the functions.

[5] devices bought by Loughborough DS in the TELEFOT project from BLOM distributor; no knowledge of a UK “market price”

Table 3 Comparison of the devices' set up and operation

Device	Hardware	Effort to install and use
Garmin Nüvi 205 WT	Separate nomadic device with built in functions.	-Install in car, read instructions, update maps and/or software. For Green driving: make some settings and calibrate. -Easy to install and use. -Main concerns include installation and risk of theft. The latter may create a barrier for using the device, if one has removed it from its intended position to avoid theft (and needs to put it back).
EC-Tools Driveco	-DRIVECO-Bluetooth module, connected to the vehicle's OBD-2 connector. -Bluetooth enabled Smartphone with DRIVECO applications installed. -DRIVECO-internet service, providing driving journal and driving style comparisons.	-Bluetooth module can be installed by customers with some technical knowledge. The DRIVECO Bluetooth module is installed at the OBD-2 connector, which is in most cases located under the dashboard or in the middle console. For most vehicles, the module does not cause any physical obstructions or esthetical problems. Through the use of extension cables the modules can in most cases be placed in an unobtrusive place. Only for a few models the connector is located behind the dashboard and the module or the extension cable connectors do not find in the gap between the connector and the dashboard panel. -The driver installs the application on the phone, according to the guidelines of the service provider. Installation of the application on the phone is straightforward for persons having expertise on installing applications on their phones. However, due to the large amount of phone models and different phone operating systems, the installation procedure depends between phones.

		-During use, the solution uses both the phone's screen and Bluetooth connection. Other phone functionalities may want to use the screen or the Bluetooth connection during driving. This may cause problems with either the functioning or the reliability of the service.
LATIS	Application on Smartphone with Symbian S60	-The application is installed using a link provided by the service provider. The effort for installation is comparable to the installation of other phone applications. -Keep Blue-tooth activated on phone
Magneti Marelli Easyroad personal navigation device integrated with the Blue&Me system.	Separate nomadic device with fixed, built in functions integrated with an OEM device able to access car variables and to communicate with the user's phone.	-Install in car, read instructions, update maps and/or software. For Green driving: make some settings and calibrate. -Easy to install and use. -Main concerns include installation and risk of theft. The latter may create a barrier for using the device, if one has removed it from its intended position to avoid theft (and needs to put it back).
Mobil-Eye C2-270	Separate nomadic device with built in functions	-Easy to use, but requires professional installation and calibration. - After installation (semi- permanent) the device is activated on ignition on and provides feedback when appropriate during driving. Main features include a small tell-tale based multiple display interface with some user definable content.
Foot-LITE demonstrator	Separate nomadic device based upon a	-Install in car, read instructions and use. System

system	Smartphone platform. Additional interfaces to Automotive camera, OBD interface and ECU.	proved to be intuitive. -The device creates easily assimilated real-time feedback on driving behaviour in relation to safe and green driving within a convenient Smartphone environment.
BLOM N-Drive 800	Separate nomadic device with fixed, built in functions.	-Install necessary mounting bracket in the car, read instructions, update maps and/or software as necessary. -Easy to install and use but with some usability issues related to destination entry and overall operability, particularly with start up time to satellite acquisition.

3.3 USER BENEFITS

The functions offered by the devices vary in the sense that some are only needed by the users in certain situations, while others are used continuously (Table 4). Furthermore, it can be concluded that the "unique selling points" of many of the devices are not very distinct, e.g. they sometime offer limited advantages compared to competing products/ services.

Table 4 Utility and benefit of the devices, compared to alternatives.

Device	Functions and Utility	Comparison with alternative products/services
Garmin Nüvi 205 WT	-Navigation: for travel to unknown places. -Green driving support: for all trips. -Traffic info: When congestion is expected and longer trips.	- Low price, green driving support function included, well known brand. -*Traffic info*: Faster, more detailed and easier to access traffic info available on local radio (at least in Sweden). -*Navigation*: Smartphone applications may be cheaper, more portable, effortless installation, but generally a

		function of lower quality and requires more effort to use. However, Smartphones were not so frequent among people during the FOT as it is now. -*Green Driving*: Better green driving support (with e.g. current fuel usage) available in many cars.
EC-Tools Driveco	Teaches how to drive more efficient. Provides real-time green driving support through warnings (e.g. too high motor speed) and offers an internet application allowing the driver to compare driving style with other drivers. It also offers automatic driving journals.	- Many of the real-time functionalities (e.g. warning to change gear) are already integrated in newer vehicles
LATIS	-Traffic info: During all trips. The service can work concurrently with other navigation services, as it is not linked to the navigator. Warnings are reported to the user through audio messages. - Speed alert: in all driving conditions.	-Low price, easy to install -Provision of information optimised for Nordic countries (road weather, winter speed limits). -No need to enter data (e.g. destination) into the navigator in order to access traffic information. -The traffic information was similar to the information provided over radio, and was not always relevant to the user, or the information provided was not clear.
Magneti Marelli	-Navigation: for travel to unknown places.	- Directly offered by the car manufacturer at a reasonable price, integrated with the BLUE&ME hands-

Easyroad	-Green driving support: for all trips. -Traffic info: When congestion is expected and longer trips.	free phone kit and media player. -*Navigation*: Smartphone applications may be cheaper, more portable, effortless installation, but generally a function of lower quality and requires more effort to use. -*Traffic info*: it may be considered equivalent to radio information. The on-board device may provide the plus of recalculating an alternative route both suggested by the device itself or after choices forced by the driver. -*Green Driving*: Good green driving support already available in many cars and new ones with improved features and HMI are expected.
Mobil-Eye C2-270	Provides safe driving support for all trips. Provide real-time feedback on interaction and vehicle control while driving. Offers headway, lane positioning, collision warning and pedestrian detection.	- Little else available on the aftermarket to provide this form of driver support. However, better green driving support (with e.g. current fuel usage) available in many cars.
Foot-LITE demonstrator system	Mainly driving skill support, to deliver improved driving skills and anticipation in traffic. Green driving support functions considered as core features, augmented by safe driving support such as headway and lane positioning control.	-No combined Smart driving support systems existed at time of trial. -*Green Driving*: Improved green driving support (with e.g. current fuel usage and gear change feedback) available in current generation of cars. -*Safe Driving* : Some In-built system functionality available on current generation of cars. Very limited aftermarket systems available.

BLOM N-Drive 800	Provides navigation support when needed, and speed alerts.	This system is relative typical of navigation support systems on the market. Current emerging market Smartphone applications for navigation support may be cheaper, more efficiently portable, but may generally offer a lower level of functionality and perceived quality/usability.

3.4 ACTORS AND BUSINESS LOGICS

The device manufacturers' business models are also dependent on external actors (Table 5). Mainly these are map and traffic information providers. In cases where the vehicle integration of the device is more significant, that could make actors such as car manufacturers important partners.

The business logics for the devices differ. The main factors here are seemingly the price of the device itself, and the cost associated with updating it (e.g. the maps).

Table 5 Actors and business logics comparison.

Device	Actors	Business logic
Garmin Nüvi 205 WT	-Garmin (device manufacturer) -Navteq (Map provider) -Destia (Traffic info provider) -End users	Device cheap to buy, expensive to update.
EC-Tools Driveco	-EC-Tools (provision of DRIVECO module, Smartphone application and internet application) -End users	Customer pays contract to EC-Tools.
LATIS	-Nokia (Phone manufacturer)	Unclear, service so far only offered during the TeleFOT project.

	-Logica (service provider) -Mediamobile Nordic (Traffic info provider -Map provider -End users	
Magneti Marelli Easyroad	-FIAT (OEM) -Magneti Marelli (device manufacturer) -Navteq (map provider) -Targa (traffic info provider) -End users	To use an aftermarket designed device for supplying as TIER1 an OEM. This was possible through the integration with the Blue&Me which is originally supplied by Magneti Marelli. In this sense the device can be seen as an extension of the Blue&Me device.
Mobil-Eye C2-270	-Mobil Eye (device manufacturer) -National distributors	- Unknown, but assumed that driver or fleet owner purchases the device and installation services -Device higher cost, expensive to update and to a fleet management tool, but potentially cost-effective if set within the context of a fleet risk reduction strategy.
Foot-LITE demonstrator system	-Foot-Lite system and software app distributor[6] -Automotive component Supplier -Web Service Support (if implemented) - End-Users	Not applicable, proof of concept system only.

[6] Proof of concept demonstrator system only, therefore only *potential* actors.

BLOM N-Drive 800	-BLOM (Device manufacturer) -End users	Device relatively inexpensive, and sufficiently feature laden to be competitive within the market.

3.5 BUSINESS MODEL SUCCESS

3.5.1 Garmin Nüvi 205 WT

The business model of Garmin Nüvi worked successfully for several years. These devices have historically gone from very expensive to very cheap, resulting in an expanding customer base. The devices finally became so inexpensive that it basically could be acquired for a single trip to an unknown destination, or by people being curious and wanting to by the device 'for fun'. However, during the time span of TeleFOT, the business model became out-dated (see next chapter).

Success factors of this business model:

- Low price of device
- Device contains functions requested by the customers
- Customers did not reflect much on the quality of each function at the purchase, it was more important which functions the device had.

3.5.2 EC-Tools Driveco

This device only had limited success. The device competes regarding real-time warnings with in-vehicle functionalities. Driving style analysis is a new and growing area, in which there is much competition.

Success factors of this business model:

- Ease of installation
- Automatic driving journal – no need to keep track of trips using paper documents
- Easy comparison of driving style
- Possibility for more economic driving style.

3.5.3 LATIS

The service was not much used outside of the TeleFOT tests.

During the test period, the navigation services market changed dramatically. Navigation became free of charge on mobile phones, e.g. on certain Nokia phones. During the project duration speed limit information and speed alert was hence provided both by Nokia Maps and Logica's service.

Success factors of this business model:

- Low multi-functional device, which almost all drivers have. No need to purchase a dedicated device.
- Traffic information without entering destination/use of navigator (so, the service is especially useful for trips in familiar environments, e.g. commuting trips).
- Information optimised for Nordic needs.

3.5.4 Magneti Marelli Easyroad

The business model was generated by the high-success encountered by the Blue&Me device. It was decided to use an add-on system instead of a full re-design which would have implied a higher engineering cost, new investments and a longer time to product.

This solution can be considered interesting each time existing solutions need a fast integration. This was possible due to the open Bluetooth connection of the Blue&Me, originally conceived for easily integrating mobile phones (audio, namelist, messages,….) but also able to export car variables.

Success factors of this business model:

- Reasonable price of the device although if higher than the stand-alone version.
- Accurate integration design in the car, including the Audio system
- Navigation offered as a plus of the Blue&Me system.

3.5.5 Mobil-Eye C2-270

This was (and is) a commercial product available as a stand-alone ND Safe driving support function. The example used in FOT trials was bought from a UK distributor of this system as a "commercial" product, aka we were quoted a price and paid for one! No contact was able to be concluded with the equipment designer/manufacturer to "understand" their forward business plan.

Possible success factors of this business model:

- Niche functionality for device

3.5.6 Foot-LITE demonstrator system

This was a proof of concept demonstrator system developed as a working example of an integrated Green and Safe driving Support system (= SMART driving). The system was designed, developed and implemented for a research project without any specific plan for eventual mass-market exploitation. While the partners did explore the potential route to market and multiple business models (confidentially) none of these will be implemented….so it is all a little hypothetical.

3.5.7 BLOM N-Drive 800

In order to try and establish a basis for cross-FOT site capability Loughborough/UK decided to base the UK LFOT on the same Navigation support system as that being deployed by CIDAUT in Spain. However because at the time (and probably still now) the specific model was not available via UK distributors, Loughborough had to engage in a purchase of multiple units for the UK via a distribution company associated with BLOM in Spain. The units delivered had additional data logging capability to support TELEFOT so were probably NOT part of any standard business model.

Therefore the success of this business model is unknown. No commercial data on BLOM navigation support products in comparison with the navigation market were available. These devices/navigation support systems have emerged as a major aftermarket accessory for the private motorist and others in the last ten years. As capability (mapped areas, sophistication) and price has dropped, a significant market has arisen.

More recent trends have been the availability of similar functionality available as cheap apps for Smartphones. While the capability of such platforms for delivering a successful HMI has been compromised by physical attributes (small display screens) and technical performance (high power consumption GPS), the basic technology platform in a Smartphone is becoming more capable.

This is likely to have a significant impact into the market for nomadic device navigation support in the future.

Success factors of this business model are

- Relatively Low price of device
- Device contains adequate functionality desired/expected by the customers

4. BUSINESS MODELS IN 2017

This chapter starts with a review of the trends and the emerging new information and communication technologies. It is followed by an analysis of the answers regarding "business model validity in 2017" in the light of the emerging new technologies.

4.1 EMERGING NEW TECHNOLOGIES

The area GNSS (Global Navigation Satellite System) started with GPS (Global Positioning System) in 1994 and it has been enhanced in several steps, e.g. by EGNOS (European Geostationary Navigation Overplay Service), starting in 2005. In order to gain integrity of the information, the EU has commissioned its own GNSS system – GALILEO. It is operating along with GPS2 (from 2007) and GPS3 (expected 2015) as well as with GLOSNASS – the Russian system. New systems based in China, India and Brazil are also introduced. GNSS can be characterised by the following elements; The information is dynamic and you can calculate direction, velocity, vehicle/infrastructure status and location with high accuracy. Very high precision (a few centimetres) is available at a price for dedicated services but medium level precision can be used for a majority of services. High reliability and high availability over a wide area can be expected.

Radio-frequency identification (RFID) is the use of a wireless non-contact system that uses radio-frequency electromagnetic fields to transfer data from a tag attached to an object, for the purposes of automatic identification and tracking. Some tags require no battery and are powered and read at short ranges via magnetic fields (electromagnetic induction). Others use a local power source and emit radio waves (electromagnetic radiation at radio frequencies). Unlike a bar code, the tag does not need to be within line of sight of the reader and may be embedded in the tracked object.

RFID tags are classified into five classes:

- Class 0 – factory programmed with a simple ID during manufacture which cannot be updated. Passive. Used for anti-theft applications.
- Class 1 – user programmed with a simple ID in the field which cannot be updated. Passive. Used for stock control applications.
- Class 2 – data can be written to the tag and re-written many times. Passive. Tags usually contain sufficient memory for data logging applications.

- Class 3 – tags contain on-board sensors for measuring temperature, pressure and motion. Active or battery-assisted sensors must be monitored when no reader is present. Used for sensitive cargo.
- Class 4 – tags can communicate with each other in the absence of a reader. Active. They can support ad-hoc networked applications.

A Mobile Ad-hoc NETwork (MANET) is a collection of mobile computing devices which cooperate to form a dynamic network without using fixed infrastructure. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each device must forward traffic unrelated to its own use, and therefore becomes a router. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. Such networks may operate by themselves or may be connected to the larger Internet.

LTE (Long Term Evolution) is marketed as 4G (LTE) and is a standard for wireless communication of high-speed data for mobile phones and data terminals. LTE is anticipated to become the first truly global mobile phone standard, although the use of different frequency bands in different countries will mean that only multi-band phones will be able to use LTE in all countries where it is supported.

Table 6 The following table shows a summary (as of 2011) of the main characteristics of LTE technology (from TeleFOT D2.6.1 Communication technologies)

Description	LTE (Long Term Evolution) is a new standard of the 3GPP regulations. LTE is, sometimes, defined as an evolution of the 3GPP standard UMTS (3G) or as a new concept of the architecture (4G). In fact LTE will be the key to the uptake of mobile Internet. Services such as data transmission over 300 meters and high-definition video, will be used widely in the mature phase of the technology, thanks to OFDMA (Orthogonal Frequency-Division Multiple Access) modulation schema used in LTD.
Maturity	Not mature. Tests of the technology where done during 2009 and first real deployments started in the last quarter of 2010
Availability	Available only in some countries (Norway, Sweden, Finland, Austria, Poland and Germany in Europe)
Price	N/A
Bandwidth	100 Mbps on the downlink, and up to 50 Mbps.
Frequency	The LTE standard can be used with many different frequency bands: 900, 1800, 2600 MHz in Europe

Application to vehicular environment	Yes, by using the capabilities provided by the network operator
Infrastructure requirements	Integrated in mobile network operators
Legal issues	Some regulation uncertainties, mainly due to spectrum availability, still to be solved
Standardization	3GPP
Use in TeleFOT test site	No

LTE is the next step in the user experience, enhancing more demanding applications such as interactive TV, mobile video blogging, advanced gaming, and professional services. Data rates are significantly higher. LTE supports a full IP-based network and harmonization with other radio access technologies. LTE reduces the cost per Gigabyte of data delivered, which is essential to address the mass market.

The LTE or Long Term Evolution arises from the need to meet the growing demand of users and networks, and. This technology, based on the use of IP protocols, was tested during the second part of 2009 and the first commercial deployments have started to come to the market in 2010. [LTE1]
The novelty of LTE is the use of radio interface based on OFDMA for the downlink (DL) and SC-FDMA for uplink (UL). The modulation chosen by the 3GPP standard makes the different antenna technologies (MIMO: Multi Input, Multi Output) have greater ease of implementation, this provides a much better (sometimes even quadrupling) data transmission efficiency.

To clarify the functionality of a MANET a comparison between 4G (LTE) networks and MANETs can be made:

- In 4G networks WLANs are used to provide a single hop access to the Internet when a mobile device is within range of an Access Point (AP)
- In MANETs devices themselves provide routing services so that a device can access the Internet even where no direct wireless connection exists between the device and an AP

The MANET architecture can be described as that computing nodes themselves become an integral part of the communications infrastructure bypassing traditional network operators and allowing unfettered third-party access to mobile devices and their users. MANETs can be constructed using a wide range of computing devices and communications technologies such as IEEE802.11WiFi, Bluetooth and wireless sensors.

The so called nomadic networks are networks that support direct connection of users to the system. That is, instead of connecting two remote locations, such as a control centre and a base station, these nomadic networks connect individual users (computers, smartphones, pdas, etc.) to a network. These networks are designed to provide a low level of mobility to the users. IEEE 802.11b/g (WiFi) and IEEE 802.16 are common standards for such networks, and can be called nomad technologies.

To be completely portable, the user device must be small, low power and the antennas used should be small and omnidirectional. The effects of loss of signal through walls or other objects reduce the area covered by these types of networks. Despite its short coverage range, the nomadic networks are very common in the market, offer and have become the first step taken to provide the users with high speed access data in many public and private areas.

Table 7 A summary with the characteristics of WiFi (from D2.6.1) is given

Description	Wireless LAN (Local Area Network) based in Ethernet protocol
Maturity	Highly robust and proven technology.
Availability	Available everywhere.
Price	Free to use.
Bandwidth	11 Mbps
Frequency	2.400 GHz
Coverage	10-30 meters from the access point indoor. 100 meters outdoors.
Infrastructure requirements	Omnidirectional antenna and wifi receiver like a card wifi Receiver
Legal issues	Maximum transmission (Tx) power must be less than 100mW.

	[Tx max power < 100mW]
Standarization	802.11
Use in TeleFOT test site	No

At the edge of the integrated communications infrastructure promised by 4G and augmented by MANETs, will be wireless sensor networks. It implies that large pervasive networks of simple devices will be deployed to gather information about the environment. Such networks have been termed and defined as a macroscope that enables us to observe and interact with physical phenomena in real time and at a fidelity that was previously unobtainable

Wireless sensor networks contain a microprocessor, a two-way radio link and a number of sensors to measure light level, temperature, pollution levels, vehicle movement, etc.. The devices will autonomously form networks, forward each other's information and act as a bridge to the roadside wired or wireless infrastructure. These devices are indistinguishable from class 4 RFID tags.

Different versions of wireless sensor devices (also called *motes*) have been designed and built and the size of these motes varies from the size of a box of matches to the size of a pen tip. The ultimate aim is to implement a mote that fits into a volume of one cubic millimetre. These motes have been nicknamed Smartdust. Current motes communicate using proprietary protocols but standards are emerging (eg IEEE 802.15.4 Zigbee) which will eventually allow motes and sensors from different manufacturers to be combined in the same network

Some trends can be noted in communication and positioning. A new and open standard is now in place for mobile communication called CALM – Overall Communications Access for Land Mobiles – and it will provide user transparent continuous communications. CALM is the first open way to combine existing "old" technologies like GPRS with vehicle-optimised WLAN technology and it is therefore NOT a complicated collection of new, unproven radio technologies. But what is most obvious is that there is an increased speed and increased accuracy and it is more accessible. (Vehicle to Infrastructure) V2I

and (Vehicle to Vehicle) V2V communication is introduced and more integration (e.g. GPS in smart phones) is found. The trends in information databases are that they include more content, they are service oriented, and they provide new business opportunities.

The latest trends are found in the following areas; Hyper-connectivity, Convergence, Cloud computing, and Internet of Things.

The term “hyper-connectivity” has the following background. The world has, over the last decade, become increasingly “hyper-connected” and we live in an environment

- where the Internet and its associated services are accessible and immediate
- where people and businesses communicate with each other instantly
- where machines are equally interconnected to each other

There is an exponential growth of mobile devices, big data, and social media that drive this process of hyper-connectivity. However, there are still some unknown effects of hyper-connectivity that must be considered as hyper-connectivity is redefining relationships between individuals, between consumers and enterprises, and between citizens and the state.

Convergence of information and communication technologies gains momentum and one of the drivers are the proliferation of web-enabled mobile devices that allow access to cloud computing services. Convergence is applicable when the communication technologies are transforming from voice services to services supported by integrated mobile networks and when information technology is evolving from traditional data centres to cloud computing.

Cloud computing is seen by many as the next wave of information technology for individuals, companies and governments. The abundant supply of information technology capability at low cost offers many enticing opportunities. However, the optimism is tempered by a realistic perspective of the significant barriers to the widespread adoption of cloud services. It is important that consumer, business and government data and systems are kept secure. Maintaining the privacy of people and organisations is crucial and you must avoid being locked into one single cloud provider. The right regulatory balance between customer protection and business efficiency must be created.

Internet of Things (IoT), also called Ubiquitous Computing or M2M, is a new concept and a technology with which computers and sensors are imbedded in various objects and places in our surroundings. They communicate with each other and process information in a coordinated manner; they offer information services for humans and they perform environmental control. As the next generation of Internet applications will be using Internet Protocol Version 6 (IPv6) they would be able to communicate with devices attached to virtually all human-made objects because of the extremely large address space of the IPv6 protocol. This system would therefore be able to identify any kind of object.

RFID is often seen as a prerequisite for the Internet of Things. If all objects and people in daily life were equipped with radio tags, they could be identified and inventoried by computers. However, unique identification of things may be achieved through other means such as barcodes. But it is certain that by equipping all objects in the world with minuscule identifying devices could transform the daily life in many ways. For consumers the integration of smart devices with peripheral devices, ubiquitous networks (or IoT) and robust cloud data centres is changing experiences involving entertainment, travel, healthcare, shopping, etc..

It may seem that mobile and Internet technologies are developing rapidly while transport systems only improve slowly. However these two domains have started to converge and this is already bearing fruit. The convergence goes towards the Internet of Things, the Internet of People and the Internet of Services. Cloud computing can make physical infrastructure virtual, breaking down boundaries between systems and thus between organisations too.

The use of connected devices has become a part of everyday life, and connection on the move is becoming a central expectation for users. Flexible, future–proof and cost–efficient connectivity will be delivered by the new communication and network technologies, for example LTE. But resilience is also becoming one of the most important aspects of communication technology so that a network remains viable despite disasters such as earthquakes. It is important to organise a communication network that can

provide comfortable connectivity for everyday life while also being highly resilient in a disaster.

The widespread adoption of internet-linked devices – smartphones, tablets, laptops, vehicles – has changed the way we communicate, work, shop, as well as our travel behaviour. Information about travel patterns derived from the movements of millions of smartphones opens the way for new transport policies. How information and technology developments such as 'Cloud Computing', new services, potential industry strategies and business policies will help us keep our cities alive is on the agenda.

Being connected while on the move has become a central expectation of consumers. This has many facets ; this trend, to some extent, is driven by the overall shift in consumer behaviour: The use of apps and connected mobile devices has become a part of everyday life, and the expectation that cellular networks provide the required connectivity comes with it. In addition, for safety-related applications the complementing role of cellular networks is becoming ever-increasingly important, especially as budget constraints make it difficult to argue for dedicated infrastructure. The on-going introduction of a pan-European eCall system adds to the demand for cellular connectivity in vehicles.

We are no longer discussing whether cars will be connected in the future – the question is more how can we do this in a flexible, future-proof and cost-efficient manner? Here, there is naturally a technological dimension; the exciting new capabilities of LTE networks being just one example. This technology must be used in an optimal manner in order to deliver a superior service experience – simply just using the network to move the bits around is often not good enough. But the business case for connected services also has to be taken into account. Doing things smarter and more efficiently is a necessity for enabling innovative services.

4.2 BUSINESS MODEL VALIDITY 2017

The answers to the question regarding business model validity 2017 have been compiled and commented upon in the light of the new emerging technologies (see section 4.1).

4.2.1 Garmin Nüvi 205 WT

The need for *Navigation support* was quite apparent. It was also apparent that for most car drivers, this is a function that is used only occasionally. The manufacturers have until recently dealt with this through making the products differentiated in price so that occasional users can buy a cheap navigator with a smaller low-fi screen and few extra functions. This market segment is however being filled by Smartphones today. Dedicated devices for navigation support does however have their advantages, one being that they are better designed (than Smartphone apps) to be used while keeping the eyes on the road.

Green driving support was a function that the participants in the study thought very useful. They were however quite disappointed with the actual device's performance. Probably integration with the car is important for a green driving support-function's performance and the closer the integration the better. This raises the questions as to whether green driving support is better handled by car manufacturers. The request for this function is likely to increase until 2017. However, the request will probably change from "I need a Green driving support function" to "I need one of the most efficient Green driving support functions".

The request for *Traffic information* is likely to be rather stable in the next five years. However, as mentioned earlier, faster, more detailed and easier to access traffic info is available on local radio (at least in Sweden) than the device could offer. Besides this, the nomadic device has another disadvantage. It may be nomadic, but in practice it is seldom moved from the car. Route planning due to congestion is often carried out before a trip (for instance with a web-service like Google maps), and that is cumbersome to do using a nomadic device. In addition, the traffic information function in this device lacked any support for how to deal with traffic information, e.g. if there was congestion due to an accident, the function provided no route planning that considered that information. In sum, the need for a traffic information function on a dedicated nomadic device is likely to be small in 2017.

The market for nomadic *devices* such as this one has already decreased substantially. The main reason is the increased use of Smartphones, which with their integrated GPS can deliver similar functions as the nomadic device. There are still advantages of

dedicated hardware, but since the difference in price between a nomadic device and a Smartphone application is so large the future does not look bright.

4.2.2 EC-Tools Driveco

Green driving support was a function that the participants in the study thought would be very useful. They were however quite disappointed with the actual device's performance. Probably integration within the car is important for a green driving support-function's performance and the closer the integration the better. This raises the question whether real-time green driving support is better handled by car manufacturers. The request for this function is likely to increase until 2017. In-vehicle warnings will be mainly handled directly by vehicle manufacturers.

The market for *driving style analysis* is still growing, and the function has possibilities when providing an easy-to-use service which corresponds to the user's needs regarding more economical and more safer driving.

Regarding the pricing of the service, for a driver driving about 10 000 km, a 10% saving of fuel would correspond to a yearly saving of about 100 Euro (6 l/100 km, 1.66 €/l for fuel), which is comparable to the current price of the service. So, economical driving cannot be the only driver for purchasing the tool. Other services, for instance reduced insurance costs for improved driving style may be needed. But then the service may suffer competition from PAYD services offered by insurance companies.

The product, as tested in the TeleFOT project is however outdated. EC-Tools has developed a second version of the service, in which the DRIVECO module, which is attached to the OBD-2 connector, directly sends the data (including location data) to the internet server, without passing over the smart phone. In this way, problems related to the support of continuously changing phone models and operating systems, and the reliability of the Bluetooth communication, are avoided. The service also becomes completely unobtrusive for the user, as no action of the driver is needed.

4.2.3 LATIS

During the test period, the market changed dramatically. Regarding the applications, navigation became free of charge. The Nokia Maps application also included the speed alert functionality, which was available in LATIS. Regarding traffic information, the data

was comparable to the data transmitted over radio. Traffic information is free of charge on several mobile phone navigators, e.g. Google Maps Navigation (beta).

The phone market changed dramatically. Nokia lost a large part of its market share on mobile phones. For service developers, this causes huge problems regarding the number of phone operating systems and phone models to be supported.

As such, the competition with free services which are native in phones, is almost impossible. In sum, the need for a separate traffic information function on a smart phone is likely to be small in 2017.

4.2.4 Magneti Marelli Easyroad

All the three functions analyzed in the FOT could be considered as basic functions with a very wide diffusion in 2017.

For *navigation* three basic business models are currently in place:

- OEM device as part of a complete infotainment system
- Aftermarket devices
- Apps running on user Smartphone

Currently very sophisticated info-telematic systems featuring a large display are entering into market as high-end systems as well as examples of OEM integration of aftermarket devices or Smartphones.

It is very probable that, considering the 2017 horizon a nice display with good performances will be a standard. This display will be sharable by a variety of functions, some of them embedded and some provided by user devices, typically Smartphones. It is not clear what will be the evolution of dedicated navigators that, from a technological viewpoint, will be very similar to Smartphones. This is clear to the producers of aftermarket devices(e.g. TomTom, Garmin,…). As a consequence the high level know-how developed by these companies is already the basis of high-end apps for Smartphones sold in the apps markets.

It is also very probable that the *Traffic Information* distributed through the info-telematics system will be quite diffused and, possibly, more reliable than the one currently available. Many possibilities are available for the business model of this kind of services:

- user subscription of service bundle with a specialized operator
- user subscription of a service bundle with the OEM or Tier 1 supplier.
- user subscription of a service bundle with a telecom operator (some services may be a free add-on to the basic internet-phone contract)
- free of charge distribution provided by public authorities and/or road operators
- offered in bundle with the device by the OEM or Tier1.

One key point to be considered is represented by *maps*. It is reasonable that in 2017 maps could be real-time or semi-real-time updated. And this updating service will be provided by the user front-end contractor (car-maker, telecom operator,….)

Green Driving is typically an OEM application that needs first of all the dynamic vehicle parameters (speed, inserted gears, brake and accelerator pedal, …) and integration with the electronic horizon (based on map information) plus (for further improvement) the traffic context recognition. Although today dedicated Smartphone apps are available, it is very probable that this function will be embedded in a wide range of cars in 2017 and directly offered as standard by OEMs.

4.2.5 Mobil-Eye C2-270

The need for *Safe Driving support* is a fundamental element of this commercial system. It occupies a unique position in the market in providing aftermarket safe driving feedback and warnings on elements that have only been available in high end vehicles (in 2012).

However in 2017 many elements of MobilEye current functionality will migrate into mass market vehicles. The potential return on investment of further system development would have to be balanced against what the mass market may provide.

The market for specific *nomadic devices* such as this one has already decreased substantially. The main reason is the increased use of Smartphones, which with their integrated GPS can deliver similar basic functions as the nomadic device. However the use of an automotive calibrated camera system within MobilEye shows that there are still advantages of dedicated hardware to enhance functionality and value.

4.2.6 Foot-LITE demonstrator system

The definition of a cost effective *Smart driving support* was the main ambition of the original UK Foot-LITE research project. Early market research indicated that this was perceived as an innovative and welcome function for drivers. It was also apparent that

for most car drivers, this is a function that would be used all the time during driving IF packaged in such a way that was not overtly invasive to normal behaviours.

Other functionality such as navigation has already migrated to a Smartphone environment and it was considered that this was an appropriate design and implementation direction for the UK project. As screen size and processing power in SPs is continuously being improved this appeared to be supportive of increased functionality.

A key element was intelligent *Green driving support* supplemented by safe driving feedback in a combined and easily understood interface and was perceived as very useful at time of trial.

However, by 2017 it is thought that many of these elements will exist within the base vehicle driver information systems. So Foot-LITE had a particular window of opportunity before such vehicles become predominant on the market.

4.2.7 BLOM N-Drive 800

The market drivers for *Navigation support* systems and functions has been noted. This has been an emerging market for some 10 years as purchase costs have dropped and capability has increased.

However the emergence of an alternative portable platform for navigation support in the form of a Smartphone app offering similar function to an independent device, but in a platform with other communication, social and lifestyle support apps tailored to an individual user offers great competition.

Conventional navigation support providers may have to consider how beneficial further investment into hardware/software development to remain competitive to the Smartphone apps may be. A possible logical migration would be for the business model for navigation support becoming an app dominated market by 2017, with re-positioning of the various actors to accommodate. This will undoubtedly have a different business model to that based upon a hardware designer, manufacturer and retailer.

There are also the strategies of the OEMs to consider as the incorporation, support for nomadic and/or Smartphone devices emerge in the next 5 years.

5 DISCUSSION

5.1 DEVICES AND TECHNOLOGY

Hardware-wise, the dominant nomadic devices at the time of the FOTs were either dedicated products or Smartphone-based. Factors indicating the utility of these devices include cost, ease of setup and ease of use. For many devices however, the utility cannot be viewed in relation to hardware only, but the service offering of which the device is part must be included. Factors such as perennial costs, possibilities to upgrade and level of commitment become important.

The analyses of the devices used in TeleFOT (and their business models) all point towards a decreased market for dedicated aftermarket devices (Figure 1). Depending on the functions offered by the devices, it seems that embedding the functions in cars or offering those through Smartphone apps have become advantageous. The most apparent reasons being the possibility to provide functions of higher quality through vehicle integration, or the possibility to offer easy to use functions at a low price (often free of charge) through Smartphone apps.

Figure 1 *The market for dedicated aftermarket devices is decreasing.*

In reflection, one could argue that the increased number of Smartphone users in the recent years is a unique occurrence that was difficult to foresee five or ten years ago. Maybe so, but it would still be possible for manufacturers and service providers in this area to avoid similar mistakes in the future. When considering future business models, one would need to thoroughly analyse future scenarios regarding technology development. For example, having the point of departure that Smartphones will be as popular in ten years as they are now could be a repetition of the same type of ‘mistake’.

Maybe Smartphones have been replaced by augmented reality glasses[7] by then, making the business models based on Smartphones invalid (Figure 2). The prospect of new applications based on emerging new technologies (Section 4.1) is really a threat to the dominating actors of today.

Figure 2 *Emerging technology can rapidly make a business model invalid.*

5.2 FUNCTIONS AND UTILITY

The further analyses of the business models show that there is a big difference, from the users' point of view, to having access to *a function* and having access to *a high quality function*. For example, the users evaluating the green driving support function in Sweden (Garmin Nüvi) and Finland (EC-tools Driveco) were initially positive but later on disappointed with the functions performance.

Overall, it is important to distinguish between *purchase* and *use* when discussing the user acceptance of an aftermarket device. As Figure 3 shows, it seems that the price of the device and the functions of the device are central factor in the moment of purchase. However, when using the functions of the device (or choosing not to), the users compare the functions' usefulness with the effort needed to use them (Figure 4).

Figures 3 and 4 also show that the device is in focus in the moment of purchase, while the moment of use is more dependent on both the device and the quality of the functions.

[7] See http://www.youtube.com/watch?v=9c6W4CCU9M4 for an example.

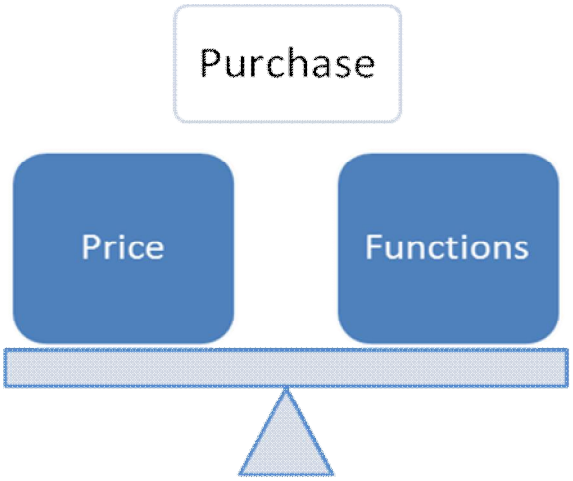


Figure 3 *A simplified description of the moment of purchase.*

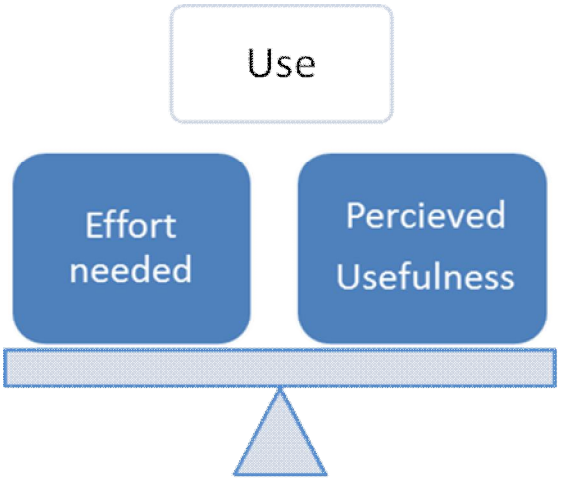


Figure 4 *A simplified description of the moment of use.*

A very generalised analysis of the variants of hardware (Table 6) further illustrate why the dedicated aftermarket device is being outdated.

Table 8 *A generalisation of the advantages of hardware variants.*

	Embedded in vehicle	Dedicated aftermarket device	Smartphone application
Price	-		+
Functions available			
Effort needed	+	-	+
Perceived usefulness	+	-	-

The Smartphone alternative has an appeal in the moment of purchase, as it is so cheap and offers the same functions as the other alternatives. In the moment of use, a function already installed in the vehicle seems advantageous both regarding the effort needed from the user and the perceived usefulness (e.g. the quality of the function). This description of the moments of purchase and use are of course greatly simplified. There are other factors that also come into play:

Obtrusiveness on driving behaviour: Driving a vehicle requires effort in relation to human perception and cognition. The driver for instance needs to keep the eyes on the road most of the time. Here many of today's Smartphone apps are at a disadvantage since the users need to frequently look at them (and pick the phone up, if it is not mounted in vehicle). Systems with good audio feedback are generally better from a driver's point of view.

Obtrusiveness on other behaviour: This may have a huge impact on the effort required from the user to actually use the function. Even the slightest extra effort (Mount device in car each journey, switch on device, start application, activate bluetooth etc.) may result in the user choosing not to use the function, especially if the function is not perceived as highly useful.

Optional use or not: While compulsory use will of course make the user use a function, it may still cause a lot of frustration if the user wants to switch it off but is not allowed. While it could be a good idea for an ignition interlock device, it may not be so for a speed alert function.

Type of help offered by function: The functions in this analyses offer help of different types. In general they *inform the user* about something (traffic congestion, fuel consumption etc.), but in some cases they also *advise the user.* What a user finds most useful is likely to differ between functions, and presumably also over time. While many users today like to get advice on how to drive more economically, in the future they perhaps find this help unnecessary since they are already trained. When the functions include advice for the user, it is also necessary that the advice is useful. Decision making in complex situations is still difficult to handle for computers, which may result in the advice not being so useful.

Competing services: This factor is of course central for both the moment of purchase and the moment of use. As seen in this analysis, traffic information over public radio was sometimes seen as a better alternative than using the traffic information functions offered by the devices. In Sweden for example, the device offered basically the same info as the radio stations, at the same time, but with more effort required from the user.

Updates: Basically one could discuss also the *moment of update* the same way as 'purchase' and 'use'. The user must weigh up factors such as price, effort needed and increased usefulness of function in this situation.

6 CONCLUSIONS

Dedicated aftermarket devices have, and are, losing market shares. The main reason is that many customers perceive the alternatives as more favourable, both in the moment of purchase and in the moment of use.

The reason for this is thus not that the users' need for the functions themselves have decreased. It is the way the functions are 'delivered', and the impact this delivery has on the quality of the functions, price and user effort; that is the issue. Functions delivered via Smartphone applications and Technology embedded in cars are deemed more favourable by more and more users, in comparison to dedicated aftermarket devices.

While the Smartphone revolution may be viewed as one of a kind occurrence, it is wise not to do so, at least in relation to future business models. The rate of technology development is not likely to slow down, meaning that it is a central factor to consider for any business model in this field. New technology will sometimes enable breakthroughs with regards to functions (enabling new functions never offered to customers before), but it will more frequently change the playing field for how the existing functions are realised and delivered to the users.

7 REFERENCES

Bouwman, H., H. De Vos, T. Haaker (Eds.): *Mobile Service Innovation and Business Models*, Springer, 2008/2010

Dutta, S. B. Bilbao-Osirio (Ed.): *The Global Information Technology Report 2012 – Living in a Hyperconnected World,* World Ecomnomic Forum, 2012

Osterwalder et al. : *Business Model Generation*, 2009

TeleFOT D2.6.1 Communication technologies (state-of-the art and trends), 2011

TeleFOT D2.6.2 Upcoming innovations of devices and functions imbedded in services, 2011

ANNEXES

ANNEX I: STOF and CANVAS business model frameworks

Business models have gained enormous popularity since approaches like Business CANVAS Model Generation by Osterwalder and Pigneur were developed. At the same time, the STOF model was developed by a consortium of researchers from Delft University of Technology and Novay. The difference between the two approaches can be best characterized as follows. The Business Model Canvas is marketing and strategy oriented, starting from a single business point of view, and functions as a brainstorm tool. The STOF model is more focused on networked businesses and has a firm emphasis on service design making use of advanced driving and enabling technologies.

Both approaches are largely in agreement on the focus and core elements of a business model. According to Osterwalder and Pigneur a business model `describes the rationale of how an organization creates, delivers and captures value´, whereas the STOF model considers a business as ´a blueprint for how organisations, or network of organisations, cooperate to create and capture value for a specific service offering´. Creating and capturing value is the core element in both approaches.

Description of the Business Model Canvas[1]

The Canvas considers a business model to consist of nine building blocks, see Figure 1.

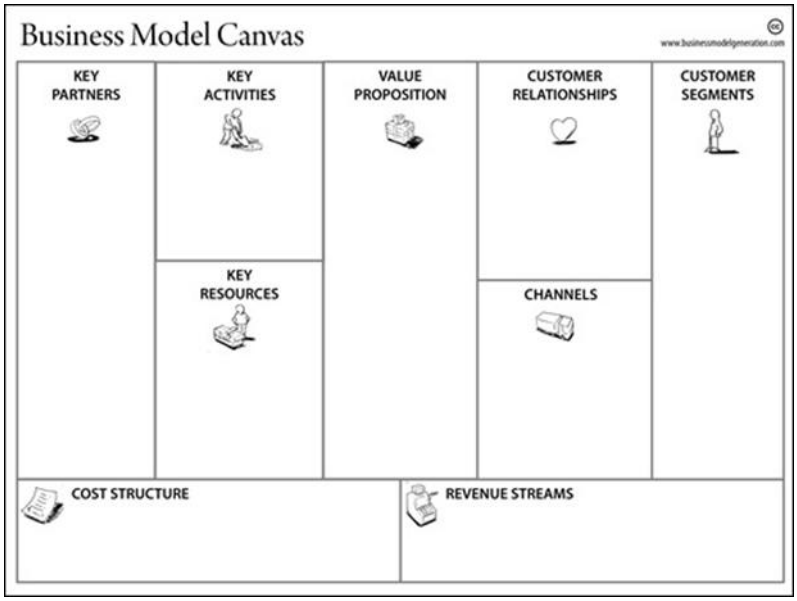


Figure 1: Business Model Canvas

Designing a business model entails filling in these nine building blocks. This is done by answering typical within for each building block. The building blocks are:

- *Key Activities*: The activities necessary to execute a company's business model.
- *Key Resources*: The resources that are necessary to create value for the customer.
- *Partner Network*: The business alliances which complement other aspects of the business model.
- *Value Proposition*: The products and services a business offers.
- *Customer Segments*: The target audience for a business' products and services.
- *Channels*: The means by which a company delivers products and services to customers.
    - *Customer Relationships*: The links a company establishes between itself and its different customer segments.
- *Cost Structure*: The monetary consequences of the means employed in the business model.
- *Revenue Streams*: The way a company makes money through a variety of revenue flows

[1] The Business Model Canvas is a Registered Trademark of Alexander Osterwalder, Yves Pigneur, Business Model Generation, 2009.

Description of the STOF method

The STOF model (Figure 2) and method, developed by Novay and Delft University of Technology, takes a domain design approach and distinguishes the service domain, technology domain, organizational, and financial domain. For each domain, key variables are identified to model the domains and their interrelations.

Designing a STOF business model entails filling in the business model variables within the four domains. For each variable, questions are posed to clarify the meaning of the variable, and to support the design process. A handbook is available to support the design of a business model based on STOF, see *Further reading*.

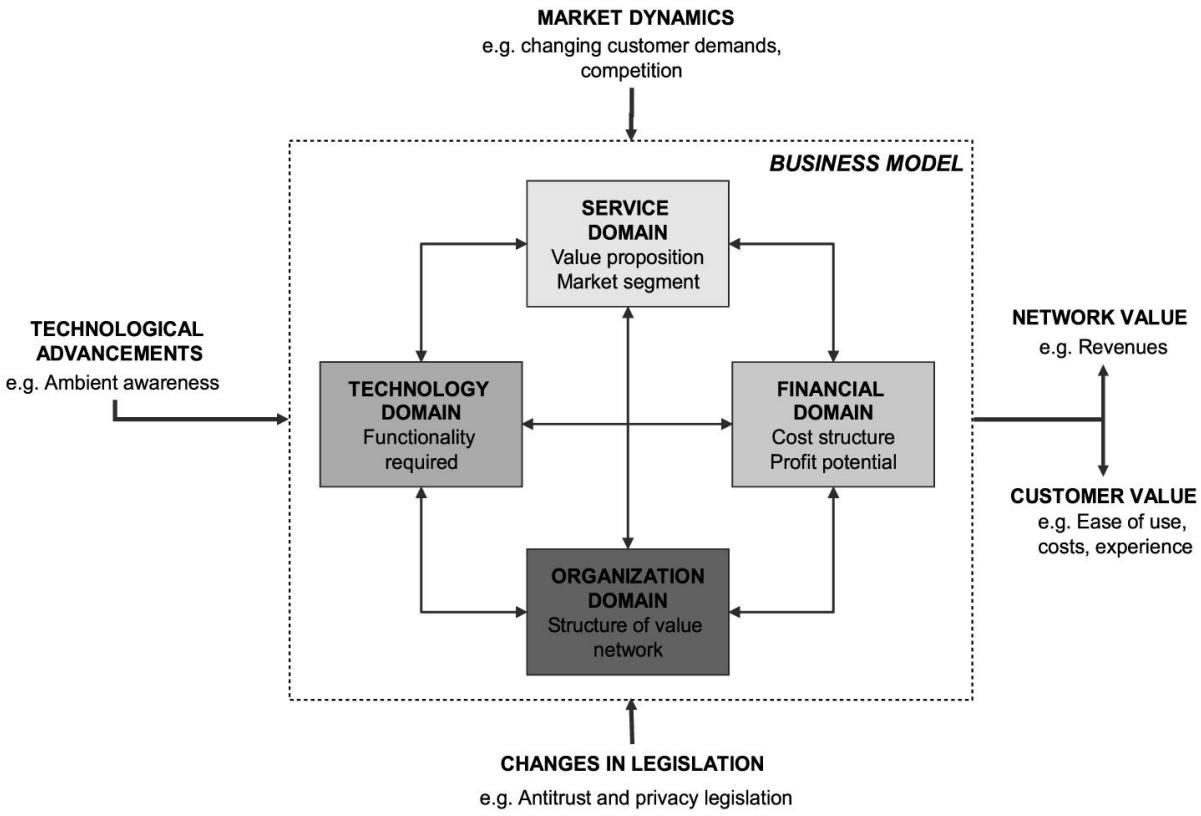


Figure 2: STOF model

Service domain : business model variables

Customers and/or end-users:

- Who is the customer? Who will *pay* for the service?
- Who is the end-user? Who will be *using* the

service? Target group:

- What is the size of the target group?
- What is the size of the installed base?
- How big is the potential

market? Value proposition:

- What does the service do for the customer or end-user?
- Why would people want to buy and use the service?
- What are the unique and distinguishing benefits of the service?
- What is the essence of the

service? Service offering:

- What is the actual offering provided to the customer / end-user composed of?
- What are the distinguishable elements of the

service? Context of use:

- In what specific situation(s) would people want to buy or use the service?
- How does the service fit into the daily or professional lives of the intended customers/users?
- Within which social (cultural or political) context does the service fit?
- Does the service match the behaviour of the customers and

end-users?

Effort for the customer:

- What effort do customers have to make to purchase the service?
- What effort do end-users have to make to use the service?
- How does required effort of customer and/or end-users compare to available alternatives?

Customer relationships:

- What type of relationship do the customer segments expect to be established and maintained with them?
- Which relationships have already been established?
- How are they integrated with the rest of our business model?
- How costly are they?

Technology domain : business model variables

Technical Functionality:

- What (business) functions does the service require and should ?
- Which (sub)systems are needed to deliver the required functions?
- How is the desired level of quality of service (QoS) safeguarded?

Technical Architecture:

- What is the high-level architecture of the system producing the service?

Channels:

- Through which channels do the customer segments want to be reached?
- How are we reaching them now?
- How are the different channels integrated and/or managed?
- Which (combination of) channels work best?

Applications (user applications running on the technological system):

  - What user applications should be running on the technological system (e.g. for communication, interaction, content distribution, transactions)?
  - What are important characteristics of these applications (always on, personalized, context aware)?
- How are customer profiles and privacy managed?
- How is secure access to and use of services arranged?

Devices:

- Which (type of) devices are needed by users to access the service?
  - What are important characteristics of these devices (software capabilities, storage facilities, GPS, bandwidth)?

Service platforms:

- What middle ware platforms are used or needed that enable (generic) business functions?

- How are subsystems integrated (API, SDK, Web services)?
- How is the new service integrated with existing services?
- In what way is the security of the system safeguarded?

Organization domain : business model variables

Actors:

- Which business roles are required in the value network?
- Which actors might be willing to be involved in the value network?
- Which are structural or key actors, i.e. providing essential and non-substitutable resources?
    - Which are contributing actors, i.e. providing less specific resources or substitutable suppliers?

Actors' resources & capabilities:

- What are capabilities and resources that these actors can provide?
- Which resources and capabilities are critical? Hence which actors are preferable?

Value activities:

- What are the key activities that actors perform to enable the value proposition?
- What are the key activities performed by each business role?

Actors' strategic interests:

- What are actors' strategic interests to be involved in delivering the service?
- What goals are actors pursuing with the collaboration?
- How is trust in the cooperation between actors ensured?

Organizational Arrangements:

- How are the business roles divided over the actors?
- How are partners selected?
- How is the value network orchestrated and who is the dominant actor?

Financial domain : business model variables

Investments:

- Which investments are needed?
- Which sources of capital are available to cover the investments?
- How can investments be spread over time (phasing)?

Costs:

- What is the cost structure of the service?
- What are the fixed costs?
- What are variable costs?

Revenues:

- What are the revenue sources of the service?

Financial arrangements :

- How are investments, costs and revenues divided over the actors?
- How is the price of the service determined ?

Risks:

- What are the main (financial) risks that threaten the viability of the business model (investments, costs, adoption, competition, network cooperation and arrangements) ?

Annex II: Checklist for business model mapping

Device:

Price:

Used in FOT:

Functions:

Service domain variables

Customers and/or end-users:
· Who was the customer? Who was *paying* for the device?
· Who was the end-user? Who was the *using* the device?
Target group:
· What was the size of the target group?
· What was the size of the installed base?
· How big was the potential market?
Value proposition:
· What does the device/service do for the customer or end-user?
· Why would people want to buy and use the service?
· What are the unique and distinguishing benefits of the device (in comparison with similar devices)?
Service offering:
· What is the essence of the device's services?
· What was the actual offering provided to the customer / end-user composed of?
Context of use:
· In what specific situation(s) would people want to use the device?
· How does the device fit into the daily or professional lives of the intended customers /users?
· Within which social (cultural or political) context does the device/service fit?
· Does the device/service match the behaviour of the customers and end-users?
Effort for the customer:
· What effort did customers have to make to purchase the device/service?
· What effort do end-users have to make to use the device/service?
· How does required effort of customer and/or end-users compare to available alternatives?
Customer relationships:
· What type of relationship do the customer segments expect to be established and maintained?
· Which relationships have already been established before the purchase?

Technology domain variables

Main device:
· What is the architecture of the device delivering the function(s)?
· Is it easy to install and use?
· Where can it be used?
· Can the device be used for other functions than the ones evaluated? Which functions?
Applications:
· How are customer profiles and privacy managed?
Other devices:
· Which (type of) other devices are needed by users to use the device's services?
Service platforms:
· How is the new service integrated with existing services?

Actors and process variables (this could be described in a flowchart)

Main actors:
· Which are the main actors in the business model?
(Device manufacturer (Garmin), Map provider (Navteq), Traffic information provider (Destia), Customers/End users)
· How does information and money flow between these actors
Value creation:
· Describe the logics of the device manufacturer's business model.

Business model analysis

How successful was the business model?
Success factors of this business model:

Validity of Business model in 2017

(Analyse device and functions in light of change in demand, competitors etc.)

Annex III: Results from use of the checklist

Garmin Nüvi 205 WT

Price: 99 € (in store)

Used in FOT: Gothenburg

Functions: Navigation support, Traffic information, Green Driving Support

Service domain variables

Customers and/or end-users:

· Who was the customer? Who was *paying* for the device?

Private car owners in general.

· Who was the end-user? Who was the *using* the device?

Private car drivers in general.

Target group:

· What was the size of the target group?

Very large, all car owners globally

· What was the size of the installed base?

Unknown

· How big was the potential market?

Very large, all car owners globally

Value proposition:

· What does the device/service do for the customer or end-user?

Provide navigation assistance, traffic information and green driving support

· Why would people want to buy and use the service?

Mainly navigation support, to provide a sense of security when driving. Traffic info and Green driving support functions considered add-ons, although there was a large interest in Green driving support.

· What are the unique and distinguishing benefits of the device (in comparison with similar devices)?

Low price, green driving support function included, well-known brand.

Service offering:

· What is the essence of the device's services?

"Never get lost again"

· What was the actual offering provided to the customer / end-user composed of?

At a fixed price: get device, maps of northern Europe, get traffic information through TMC. Get upgraded maps at an additional cost (cost of updated maps equal to the device itself).

Context of use:

· In what specific situation(s) would people want to use the device?

Navigation: for travel to unknown places.

Green driving support: for all trips.

Traffic info: When congestion is expected and longer trips.

· How does the device fit into the daily or professional lives of the intended customers /users?

In general the device creates little hassle for the users. Main concerns include installation and risk of theft. The latter may create a barrier for using the device, if one has removed it from its intended position to avoid theft (and needs to put it back).
· Within which social (cultural or political) context does the device/service fit?
The culture of car drivers. Green driving may fit environmentalist, but mainly car owners who want to have a bit clearer conscience.
· Does the device/service match the behaviour of the customers and end-users?
Some of them. The navigation support function worked nicely, but was only needed occasionally. The other functions, Green driving support and Traffic info, worked poorer although they could be needed continuously. This meant that the device was rarely used, although always present.
Effort for the customer:
· What effort did customers have to make to purchase the device/service?
Figure out what one needs and compare it to other devices. Make the purchase itself.
· What effort do end-users have to make to use the device/service?
Install in car, read instructions, update maps and/or software. For Green driving: make some settings and calibrate.
· How does required effort of customer and/or end-users compare to available alternatives?
Traffic info: Faster, more detailed and easier to access traffic info available on local radio (at least in Sweden).
Navigation: Smartphone applications may be cheaper, more portable, effortless installation, but generally a function of lower quality and requires more effort to use. However, smartphones were not so frequent among people during the FOT as it is now.
Green Driving: Better green driving support (with e.g. current fuel usage) available in many cars.
Customer relationships:
· What type of relationship do the customer segments expect to be established and maintained?
Almost none, except from updating maps via WWW, and of course guarantee errands if something is wrong with the device.
· Which relationships have already been established before the purchase?
None, generally. The customer may have earlier experience of the brand and the retailer.

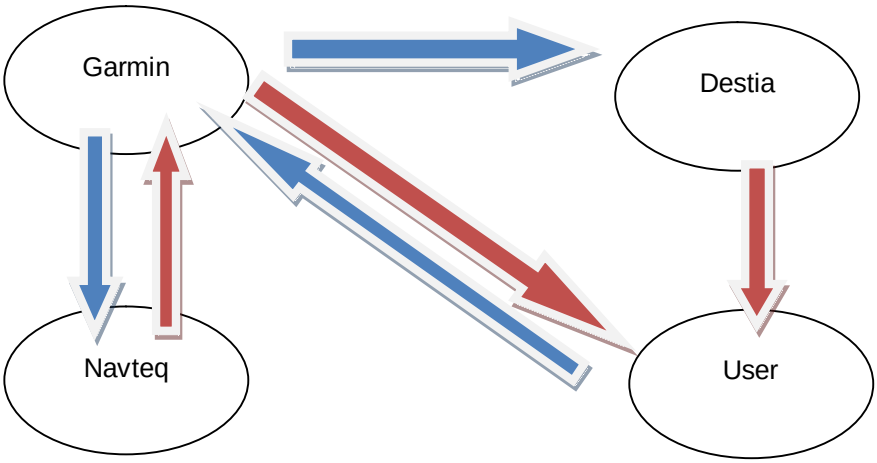
Technology domain variables

Main device:
· What is the architecture of the device delivering the function(s)?
Separate nomadic device with fixed, built in functions.
· Is it easy to install and use?
Yes.
· Where can it be used?
Everywhere, but predominantly in cars.
· Can the device be used for other functions than the ones evaluated? Which functions?
No
Applications:
· How are customer profiles and privacy managed?
Irrelevant for this device.
Other devices:

· Which (type of) other devices are needed by users to use the device's services?
Internet connected computer, if one wants to update.
Service platforms:
· How is the new service integrated with existing services?
Traffic info: From Road administration (?) or Destia (?) through TMC.
Navigation support: Not integrated with other services
Green Driving Support: Not integrated with other services

Actors and process variables (this could be described in a flowchart)

Main actors:
· Which are the main actors in the business model?
(Device manufacturer (Garmin), Map provider (Navteq), Traffic information provider (Destia), Customers/End users)
· How does information and money flow between these actors?



Red arrow: Money. Blue arrow: Information/data

Value creation:
· Describe the logics of the device manufacturer's business model.
Device cheap to buy, expensive to update.

Business model analysis

How successful was the business model?
It worked successfully for several years. These devices have historically gone from very expensive to very cheap, resulting in an expanding customer base. The devices finally became so inexpensive that they could be acquired for a single trip to an unknown destination, or by people being curious and wanted to by the device 'for fun'. However, during the time span of TeleFOT, the business model got outdated (see next section).
Success factors of this business model:

- Low price of device
- Device contains functions requested by the customers

- Customers did not reflect much on the quality of each function at the purchase, it was more important which functions the device had.

Validity of Business model in 2017

The need for *Navigation support* was quite apparent. It was also apparent that for most car drivers, this is a function that is used only occasionally. The manufacturers have until recently dealt with this through making the products differentiated in price so that occasional users can buy a cheap navigator with a smaller low-fi screen and few extra functions. This market segment is however being filled by smartphones today. Dedicated devices for navigation support does however have their advantages, one being that their better designed (than smartphone apps) to be used while keeping the eyes on the road.

Green driving support was a function that the participants in the study thought very useful. They were however quite disappointed with the actual device's performance. Probably integration with the car is important for a green driving support-function's performance and the closer the integration the better. This opens to the thought that green driving support is better handled by car manufacturers. The request for this function is likely to increase until 2017. However, the request will probably change from "I need a Green driving support function" to "I need one of the most efficient Green driving support functions".

The request for *Traffic information* is likely to be rather stable in the next five years. However, as mentioned earlier, faster, more detailed and easier to access traffic info is available on local radio (at least in Sweden) than the device could offer. Besides this, the nomadic device has another disadvantage. It may be nomadic, but in practise it is seldom moved from the car. Route planning due to congestion is often carried out before a trip (for instance with a web-service like Google maps), and that is cumbersome to do using a nomadic device. In addition, the traffic information function in this device lacked any support for how to deal with traffic information, e.g. if there was congestion due to an accident, the function provided no route planning that considered that information. In sum, the need for a traffic information function on a dedicated nomadic device is likely to be small in 2017.

The market for nomadic *devices* such as this one has already decreased substantially. The main reason is the increased use of smartphones, which with their integrated GPS can deliver similar functions as the nomadic device. There are still advantages of dedicated hardware, but since the difference in price between a nomadic device and a smartphone application is so large the future does not look bright.

EC-Tools Driveco

Price: about 205 €[8] + monthly service fee 89 €/year[9],

Used in FOT: Finland

Functions: Green Driving Support

Service domain variables

Customers and/or end-users:

· Who was the customer? Who was *paying* for the device?

Private car owner; fleet owners

· Who was the end-user? Who was the *using* the device?

Private car drivers in general.

Target group:

· What was the size of the target group?

All car owners having a car with an OBD-2 interface and with a smart phone supporting the Driveco applications (Java application working on Nokia Symbian S60 phones)

· What was the size of the installed base?

Unknown

· How big was the potential market?

Finnish car owner market, drivers having smart phones

Value proposition:

· What does the device/service do for the customer or end-user?

The service provides in real-time green driving support through several warnings (e.g. too high motor speed) and offers an internet application allowing the driver to compare his driving style with other drivers. The internet service also offers automatic driving journals, i.e. the trips of the driver, with basic information such as origin, destination, distance driven and fuel consumption are registered. The driver has to option to classify trips as private or business related.

· Why would people want to buy and use the service?

Green driving support

The main interest of personal car drivers is the possibility to save to up to 20% of fuel costs.

For drivers, using their cars also for professional purposes, the Daily driving report, which supports keeping track of personal and business trips, is an important asset.

Fleet owners can compare the driving behaviour of different drivers and use the information for training, maintenance and possible bonus systems.

· What are the unique and distinguishing benefits of the device (in comparison with similar devices)?

[8] purchase price by the TeleFOT project prior to the tests

[9] offer by EC-Tools to the TeleFOT tests participants at the end of the tests

Ease of installation, since it only requires connection to the OBD-2 interface.
Service offering:
· What is the essence of the device's services?
"DRIVECO – New driving style"
· What was the actual offering provided to the customer / end-user composed of?
The service offered consists of the DRIVECO Bluetooth module, an application on a smart phone which provides alarms (i.e. short sounds) related to green driving during driving, e.g. for high motor speeds, harsh braking and accelerating. The trip data are sent to the DRIVECO-server hosted by EC-Tools, providing to the user driving journals, statistics regarding to his driving and comparison of the driver with other drivers.
Context of use:
· In what specific situation(s) would people want to use the device?
Green driving support: for all trips.
Driving journal: when required to keep track of business trips and/or personal trips
Internet service: to learn how to drive more economically
· How does the device fit into the daily or professional lives of the intended customers /users?
The DRIVECO Bluetooth module is installed at the OBD-2 connector, which is in most cases located under the dashboard or in the middle console. For most vehicles, the module does not cause any physical obstructions or esthetical problems. Through the use of extension cables the modules can in most cases be placed in an unobtrusive place. Only for a few models the connector is located behind the dashboard and the module or the extension cable connectors do not find in the gap between the connector and the dashboard panel.
The installation on the phone is no problem for experienced phone users, but can pose problems for normal users, which need more assistance. Issues which can pose problems are e-g- the calibration parameter.
After the installation, the service should start automatically when the driver with his/her Bluetooth enabled phone comes near the vehicle. In the TeleFOT test, the driver had to acknowledge a message allowing to start in real-time keeping track of the driver's position. But in normal cases no action would be required. The DRIVECO module alarms when the driver performs a non-optimal action (e.g. too harsh braking or acceleration, too high motor speed). For each trip, the driver receives an e-mail message with data from the trip (distance, fuel consumption and motor speed statistics), and can view the trip data on the DRIVECO internet service. On the internet service, the driver can also compare himself with other drivers.
· Within which social (cultural or political) context does the device/service fit?
The culture of car drivers. Green driving may fit environmentalist, but mainly car owners who want to have a bit clearer conscience, or want to lower fuel consumption. The service is also suited for drivers using vehicles both for business and personal travel.
· Does the device/service match the behaviour of the customers and end-users?
The real-time service is especially useful directly after taking into use, as the main purpose is to teach the driver how to drive more efficiently. Either the driver then improves his driving style according to the real-time (audio) alarms, so that the amount of warnings reduces, and then there will only be occasionally alarms. If there is no learning effect of the alarms, the amount of alarms will not decrease and the driver gets annoyed by the alarms.

Transmission of the e-mail messages results in several messages per day. The messages contain only basic information, the relevance of which for impacting driving behaviour may be limited, and hence the messages are most likely either deleted immediately or left unread.
The internet service is useful if a daily report is needed. It requires activity of the driver to go to visit the site.

Effort for the customer:
· What effort did customers have to make to purchase the device/service?
The service can be purchased directly from the manufacturer's website. For some vehicle models, the device could be delivered directly with the vehicle.
· What effort do end-users have to make to use the device/service?
Install device in car, install the application on the smart phone, changing some settings and calibration parameters; activating the internet service..
· How does required effort of customer and/or end-users compare to available alternatives?
The installation of two devices is a complex procedure. Support is also complex, since there is a wide range of vehicles (and the location of the OBD-2 connector varies from vehicle model to model, and hence also the possible need for extension cables) and compatible smart phones, and the installation procedure may differ from phone model to phone model.
The solution uses both the phone's screen and Bluetooth connection. Other phone functionalities may want to use the screen or the Bluetooth connection during driving. This may cause problems with either the functioning or the reliability of the service.
A solution in which only 1 device would be needed would be more appropriate.
Many of the real-time functionalities (e.g. warning to change gear) are already integrated in newer vehicles
Customer relationships:
· What type of relationship do the customer segments expect to be established and maintained?
The service provider guarantees the working of the device for its paying customers.
· Which relationships have already been established before the purchase?
None, generally..

Technology domain variables

Main device:
· What is the architecture of the device delivering the function(s)?
DRIVECO-Bluetooth module, connected to the vehicle's OBD-2 connector
Bluetooth enabled smart phone with DRIVECO applications installed
DRIVECO-internet service, providing driving journal and driving style comparison.
· Is it easy to install and use?
Bluetooth module can be installed by customers with some technical knowledge. The driver installs the application on the phone, according to the guidelines of the service provider.
Installation of the application on the phone is straightforward for persons having expertise on installing applications on their phones. However, due to the large amount of phone models and different phone operating systems, the installation procedure depends between phones.
· Where can it be used?
In personal vehicles with an OBD-2 interface

· Can the device be used for other functions than the ones evaluated? Which functions?
No

Applications:
· How are customer profiles and privacy managed?
Irrelevant for this device.
Other devices:
· Which (type of) other devices are needed by users to use the device's services?
PC with internet connection to access the internet service
Service platforms:
· How is the new service integrated with existing services?
In the TeleFOT project, the service was integrated with Logica's LATIS service. The LATIS service received traffic information from Mediamobile Nordic and from other LATIS users. The LATIS service also provided speed limit info and speed limit alert. The LATIS service is in standby when the phone is switched on and activates automatically when the DRIVECO Bluetooth module is detected.

Actors and process variables (this could be described in a flowchart)

Main actors:
· Which are the main actors in the business model?
EC-Tools: provision of DRIVECO module, smart phone application and internet application, Customers/End users
· How does information and money flow between these actors?
Customer pays contract to EC-Tools.
Value creation:
· Describe the logics of the device manufacturer's business model.

Business model analysis

How successful was the business model?
The device only had limited success.
The device competes regarding real-time warnings with in-vehicle functionalities. Driving style analysis is a new and growing area, in which there is much competition.
Success factors of this business model:

- Ease of installation
- Automatic driving journal – no need to keep track of trips using paper documents
- Easy comparison of driving style
- Possibility for more economic driving style.

Validity of Business model in 2017

Green driving support was a function that the participants in the study thought would be very useful. They were however quite disappointed with the actual device's performance. Probably integration with the car is important for a green driving support-function's performance and the closer the integration the better. This opens to the thought that real-time green driving support is better handled by car manufacturers. The request for this function is likely to increase until 2017.

In-vehicle warnings will be mainly handled directly by vehicle manufacturers.

The market for driving style analysis is still growing, and the function has possibilities when providing an easy-to-use service which corresponds to the user's needs regarding more economical and safer driving.
Regarding the pricing of the service, for a driver driving about 10 000 km, a 10% saving of fuel would correspond to a yearly saving of about 100 Euro (6 l/100 km, 1.66 €/l for fuel), which is comparable to the current price of the service. So, economical driving can not be the only driver for purchasing the tool. Other services, for instance reduced insurance costs for improved driving style may be needed. But then the service may suffer competition from PAYD services offered by insurance companies.

The product, as tested in the TeleFOT project is however outdated. EC-Tools has developed a second version of the service, in which the DRIVECO module, which is attached to the OBD-2 connector, directly sends the data (including location data) to the internet server, without passing over the smart phone. In this way, problems related to the support of continuously changing phone models and operating systems, and the reliability of the Bluetooth communication, are avoided. The service also becomes completely unobtrusive for the user, as no action of the driver is needed.

Figure 5: Second version of the DRIVECO module with OBD-2 connector

LATIS

Price: free of charge during tests

Used in FOT: Finland

Functions: Traffic information, Speed limit info/Speed alert

Service domain variables

Customers and/or end-users:
· Who was the customer? Who was *paying* for the device?
Private car owners in general.
· Who was the end-user? Who was the *using* the device?
Private car drivers in general.
Target group:
· What was the size of the target group?
All car owners with a smart phone supporting the LATIS application (Symbian S60 phones)
· What was the size of the installed base?
Unknown
· How big was the potential market?
Finnish car owner market, drivers having smart phones
Value proposition:
· What does the device/service do for the customer or end-user?
The service provides in real-time traffic and road weather information and speed limit information. The traffic information comes from different sources, such as Mediamobile Nordic and from information entered by LATIS users.
· Why would people want to buy and use the service?
Provision of real-time traffic information, without the need to enter data in the navigator. According to Logica, most drivers do not enter the destination for their trip, e.g. during commuting trips.
· What are the unique and distinguishing benefits of the device (in comparison with similar devices)?
Low price, provision of information optimised for Nordic countries (road weather, winter speed limits).
Service offering:
· What is the essence of the device's services?
Provision of real-time information adapted to Finnish needs.
· What was the actual offering provided to the customer / end-user composed of?
The LATIS service provides traffic information and road weather information, provided by Mediamobile Nordic and from other sources, such as information provided by LATIS users. The application has an FCD feature, which could foster additional sources for traffic information. The driver can also provide information on traffic disturbances through the phone user interface.
Context of use:

· In what specific situation(s) would people want to use the device?
Traffic info: During all trips. The service can work concurrently with other navigation services, as it is not linked to the navigator. Warnings are reported to the user through audio messages.
Speed alert: in all driving conditions.
· How does the device fit into the daily or professional lives of the intended customers /users?
The driver has to activate the function. In the TeleFOT project, LATIS was integrated with DRIVECO function, and the LATIS function, which was always in standby mode, activated when the DRIVECO Bluetooth module was discovered (hence the driver had to have Bluetooth activated).
· Within which social (cultural or political) context does the device/service fit?
The culture of car drivers, especially drivers encountering daily heavy traffic.
· Does the device/service match the behaviour of the customers and end-users?
Some of them. The traffic information was similar to the information provided over radio, and was not always relevant to the user, or the information provided was not clear.
Effort for the customer:
· What effort did customers have to make to purchase the device/service?
The service was only offered to TeleFOT users.
· What effort do end-users have to make to use the device/service?
Install the application on the mobile phone and keep Bluetooth activated. When the DRIVECO module was working, the application activated automatically.
· How does required effort of customer and/or end-users compare to available alternatives?
The user has to install the application, and the application had a different map interface than the navigation services on the mobile phone. Functionalities overlap with the functionalities of the native navigation application in the mobile phone (i.e. Nokia Maps).
Customer relationships:
· What type of relationship do the customer segments expect to be established and maintained?
Almost none.
· Which relationships have already been established before the purchase?
None, generally.

Technology domain variables

Main device:
· What is the architecture of the device delivering the function(s)?
Smart phone with Symbian S60 .
· Is it easy to install and use?
Yes. The application is installed using the link provided by the service provider. The effort for installation is comparable to the installation of other phone applications.
· Where can it be used?
Everywhere, but predominantly in cars.
· Can the device be used for other functions than the ones evaluated? Which functions?
A smart phone can be used for many other applications…
Applications:
· How are customer profiles and privacy managed?
Irrelevant for this device.
Other devices:

· Which (type of) other devices are needed by users to use the device's services?
None.
Service platforms:
· How is the new service integrated with existing services?
Traffic info: From Mediamobile Nordic.
Speed limits: from Finnish Road Administration
Green Driving Support: The service uses the DRIVECO module for detection if the driver is in the car, in order to activate the service.

Actors and process variables (this could be described in a flowchart)

Main actors:
· Which are the main actors in the business model?
Device manufacturer: mobile phone manufacturer (mainly Nokia). They are not really part of the business model, but the changing market (new operating systems, new phone models) drives the need for continuously updating the application.
Map provider; Traffic information provider: Mediamobile Nordic,
Service provider: Logica
Customers/End users
· How does information and money flow between these actors?
Information: Mediamobile Nordic (and other sources) >> Logica >> end user
Money: no information, depends on contracts between Logica and Mediamobile Nordic.
During the tests the service was free of use for the users.
Value creation:
· Describe the logics of the device manufacturer's business model.

Business model analysis

How successful was the business model?
The service was not much used outside of the TeleFOT tests.
During the test period, the navigation services market changed dramatically. Navigation became free of charge on mobile phones, e.g. on certain Nokia phones. During the project duration speed limit information and speed alert was hence provided both by Nokia Maps and Logica's service.
Success factors of this business model:

- Low multi-functional device, which almost all drivers have. No need to purchase a dedicated device.
- Traffic information without entering destination/use of navigator (so, the service is especially useful for trips in familiar environments, e.g. commuting trips).
- Information optimised for Nordic needs.

Validity of Business model in 2017

The need for *Navigation support* was quite apparent. It was also apparent that for most car drivers, this is a function that is used only occasionally. Smart phones have positioning capability. LATIS provides traffic information without the need to enter the destination.
During the test period, the market changed dramatically. Regarding the applications, navigation became free of charge. The Nokia Maps application also included the speed alert functionality,

which was available in LATIS. Regarding traffic information, the data was comparable to the data transmitted over radio. Traffic information is free of charge on several mobile phone navigators, e.g. Google Maps Navigation (beta). The phone market changed dramatically. Nokia lost a large part of its market share on mobile phone. For service developers, this causes huge problems regarding the number of phone operating systems and phone models to be supported. As such, the competition with free services which are native in phones, is almost impossible.
In sum, the need for a separate traffic information function on a smart phone is likely to be small in 2017.

Magneti Marelli Easyroad

Personal navigation device integrated with the Blue&Me system.

Price: 300€ (OEM optional price)

Used in FOT: DFOT1 Italy
Functions: Navigation support, Traffic information, Green Driving Support

Service domain variables

Customers and/or end-users:
· Who was the customer? Who was *paying* for the device?
Private car owners in general.
· Who was the end-user? Who was the *using* the device?
Private car drivers in general.
Target group:
· What was the size of the target group?
Very large, all car owners globally
· What was the size of the installed base?
Unknown
· How big was the potential market?
Very large, all car owners globally
Value proposition:
· What does the device/service do for the customer or end-user?
Provide navigation assistance, traffic information and green driving support
· Why would people want to buy and use the service?
People main interest is for navigation support, which provides good chance not to get lost while travelling. Traffic info and Green driving support functions are considered add-ons, although there was a good interest in Traffic Info. Participant expressed interest in Green driving support but the current implementation was not considered enough mature. Nevertheless, in this configuration, a significant saving of about 3% of fuel was measured. Currently new research project are running in order to integrate maps and cooperative functions (e.g. EcoMove) and to find optimized HMI solutions (EcoDriver project) in Green Driving. The findings of these projects are expected to increase significantly the fuel saving.
· What are the unique and distinguishing benefits of the device (in comparison with similar devices)?
Directly offered by the car manufacturer at a reasonable price, integrated with the BLUE&ME hands-free phone kit and media player.
Service offering:
· What is the essence of the device's services?
Navigation
· What was the actual offering provided to the customer / end-user composed of?
At a fixed price: get device, maps of northern Europe, get traffic information through TMC. Get upgraded maps at an additional cost.

Context of use:
· In what specific situation(s) would people want to use the device?
Navigation: for travel to unknown places.
Green driving support: for all trips.
Traffic info: When congestion is expected and longer trips.
· How does the device fit into the daily or professional lives of the intended customers /users?
In general the device creates little hassle for the users. Main concerns include installation and risk of theft. The latter may create a barrier for using the device, if one has removed it from its intended position to avoid theft (and needs to put it back).
· Within which social (cultural or political) context does the device/service fit?
The DFOT partners were all medium/high level educated people. However, currently, navigation is largely diffused in Italy in a wide range of population (for technical difficulties are excluded low level of education elder people).
Traffic information is widely accepted.
Green driving may fit environmentalist first but, due to the high cost of fuel it becomes interesting for all the people wanting to save not only the environment but also money.
· Does the device/service match the behaviour of the customers and end-users?
This aspect was not assessed in IT-DFOT1, due to the controlled structure of the test. All the participants used the functions all the test-time according to a specified pre-defined protocol.
Effort for the customer:
· What effort did customers have to make to purchase the device/service?
Figure out what one needs and compare it to other devices. Make the purchase itself.
· What effort do end-users have to make to use the device/service?
Install in car, read instructions, update maps and/or software.
· How does required effort of customer and/or end-users compare to available alternatives?
Navigation: without the navigation support when travelling along unknown route the driver should be concentrated on indication sign or reading road names or more in general to consult manual maps. All these kind of efforts may require a higher effort and a higher level of distraction.
In the next future it is expected that a very important role will be played by smartphones, which are already providing a large varieties of supporting functions. The current drawback is the lack of integration. Car maker are quite aware of this trend and in the new generation of telematic systems smartphone integration is considered a priority.
Traffic info: it may be considered equivalent to radio information. In this sense the effort is quite similar. The on-board device may provide the plus of recalculating an alternative route both suggested by the device itself or after choices forced by the driver who may initially decide to follow alternatives not suggested by the device. Clearly, in order to succeed a sound data acquisition network able to provide reliable information is needed.
Green Driving: Good green driving support already available in many cars and new ones with improved features and HMI are expected (see answer to a previous question).
Customer relationships:
· What type of relationship do the customer segments expect to be established and maintained?
Few relationships are expected for the analyzed functions (except for map or SW update). However, the evolution of the devices like this one, properly integrated with a communication device (embedded or the driver phone connected via Bluetooth or WiFi) may be an important

opportunity to maintain a close relationship between the OEM and the car owner, simplifying maintenance and driver assistance.
· Which relationships have already been established before the purchase?
None, generally. The customer may have earlier experience of the brand and the retailer.

Technology domain variables

Main device:
· What is the architecture of the device delivering the function(s)?
Nomadic device with fixed, built in functions integrated with an OEM device able to access to car variables and to communicate via Bluetooth with the user phone.
· Is it easy to install and use?
Yes.
· Where can it be used?
Everywhere, but predominantly in cars.
· Can the device be used for other functions than the ones evaluated? Which functions?
Not with the current SW.
Applications:
· How are customer profiles and privacy managed?
Irrelevant for this device.
Other devices:
· Which (type of) other devices are needed by users to use the device's services?
Internet connected computer, if the device must be updated.
Service platforms:
· How is the new service integrated with existing services?
Traffic info: through TMC.
Navigation support: Not integrated with other services
Green Driving Support: Not integrated with other services, but it uses
Note: All functions use the car audio system thank to the integration with the blue&me device.

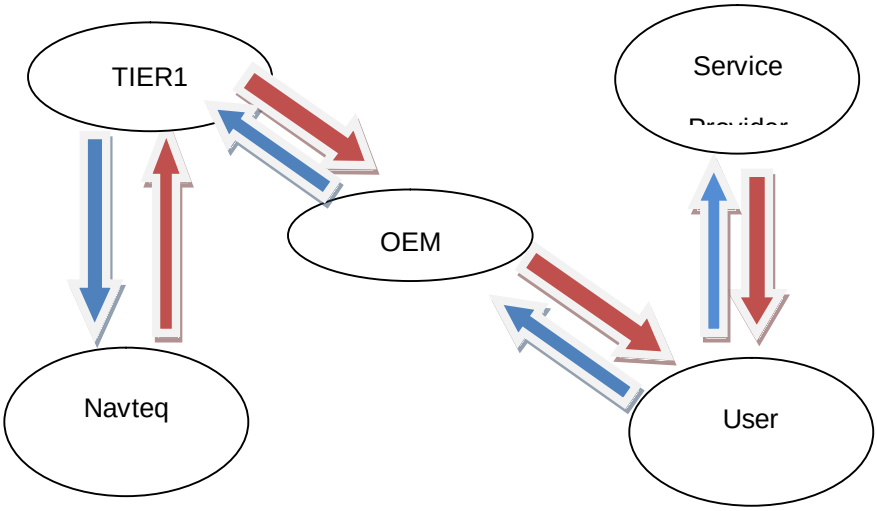
Actors and process variables (this could be described in a flowchart)

Main actors:

· Which are the main actors in the business model?

OEM (FIAT) - Device manufacturer (Magneti Marelli), Map provider (Navteq), Traffic information provider (Targa), Customers/End users

· How does information and money flow between these actors?



Red arrow: Money. Blue arrow: Information/data

Value creation:

· Describe the logics of the device manufacturer's business model.

To use an after market designed device for supplying as TIER1 an OEM. This was possible through the integration with the Blue&Me which is originally supplied by Magneti Marelli. In this sense the device can be seen as an extension of the Blue&Me device.

Business model analysis

How successful was the business model?

The business model was generated by the high-success encountered by the Blue&Me device. It was decided to use add-on systems instead of a full re-design which would have implied a higher engineering cost, new investments and a longer time to product.

This solution can be considered interesting each time existing solutions need a fast integration. This was possible due to the open Bluetooth connection of the Blue&Me, originally conceived for easily integrating mobile phones (audio, namelist, messages,....) but also able to export car variables.

As previously explained, the current design approach of new telematic systems consider a priority an open architecture able to easily integrate existing and future devices at higher level (including HMI- graphics and data entry). An interesting initiative is Mirror-link aiming at standardisation of this interface.

Success factors of this business model:

- Reasonable price of the device although if higher than the stand-alone version.

- Accurate integration design in the car, including the Audio system
- Navigation offered as a plus of the Blue&Me system.

Validity of Business model in 2017

All the three functions analysed in the FOT could be considered as basic functions with a very wide diffusion in 2017.
For navigation three basic business models are currently in place:

- OEM device as part of a complete infotainment system
- After market devices
- Apps running on user smartphone.

Currently very sophisticated info-telematics systems featuring a large display are entering into market as high-end systems as well as examples of OEM integration of aftermarket devices or Smartphones.
It is very probable that, considering the 2017 horizon a nice display with good performances will be a standard. This display will be sharable by a variety of functions, some of them embedded and some provided by user devices, typically Smartphones. It is not clear what will be the evolution of dedicated navigators that, from technological viewpoint, will be very similar to Smartphones. This is clear to the producers of aftermarket devices (e.g. TomTom, Garmin,...). As a consequence the high level know-how developed by these companies is already the basis of high-end apps for smartphones sold in the apps markets.

It is also very probable that the "traffic Info" distributed through the info-telematic system will be quite diffused and, possibly, more reliable than the one currently available. Many possibilities are available for the business model of this kind of services:

- user subscription of service bundle with a specialized operator
- user subscription of a service bundle with the OEM or Tier 1 supplier.
- user subscription of a service bundle with a telecom operator (some services may be a free add-on to the basic internet-phone contract)
- free of charge distribution provided by public authorities and/or road operators
- offered in bundle with the device by the OEM or Tier1.

One key point to be considered is represented by maps. It is reasonable that in 2017 maps could be real-time or semi-real-time updated. And this updating service will be provided by the user front-end contractor (car-maker, telecom operator, ...)

Green Driving is typically an OEM application that needs first of all the dynamic vehicle parameters (speed, inserted gears, brake and accelerator pedal, ...) and integration with the electronic horizon (based on map information) plus (for further improvement) the traffic context recognition.
Although today dedicated smartphone apps are available, it is very probable that this function will be embedded in a wide range of cars in 2017 and directly offered as standard by OEMs.

Mobil-Eye C2-270

Price: 780 €

Used in FOT: UK

Functions: Safe Driving Support

Service domain variables

Customers and/or end-users:
· Who was the customer? Who was *paying* for the device?
Probably aimed at professional car/van drivers in a fleet in general. Potential for adoption by private motorists, but unit has high cost.
· Who was the end-user? Who was the *using* the device?
In the TELEFOT trial private car drivers.
Target group:
· What was the size of the target group?
Unknown
· What was the size of the installed base?
Unknown
· How big was the potential market?
Unknown
Value proposition:
· What does the device/service do for the customer or end-user?
Provide safe driving support
· Why would people want to buy and use the service?
Mainly safe driving support, to provide real-time feedback on interaction and vehicle control while driving. Model offered headway, lane positioning, collision warning and pedestrian detection.
· What are the unique and distinguishing benefits of the device (in comparison with similar devices)?
Little else available on the aftermarket to provide this form of driver support.
Service offering:
· What is the essence of the device's services?
"Avoid potential risky road situations"
· What was the actual offering provided to the customer / end-user composed of?
At a fixed price: customers get the base device, which requires additional expert installation and calibration (additional cost) . UK distributor also offers a data upload and web based driving performance analysis (additional cost) for fleet driver management?
Context of use:
· In what specific situation(s) would people want to use the device?
Safe driving support: for all trips.
· How does the device fit into the daily or professional lives of the intended customers /users?
After installation (semi- permanent) the device is activated on ignition on and provides feedback when appropriate during driving. Main features include a small tell-tale based multiple display interface with some user definable content.

· Within which social (cultural or political) context does the device/service fit?
Probably most appropriate context is for fleet drivers as part of a risk reduction company policy.
· Does the device/service match the behaviour of the customers and end-users?
Unknown. In limited trials users remarked on the potential usefulness of headway warning as an indication that their habitual driving behaviour was to use "unsafe" headway and acted as a beneficial reminder to maintain "better" headway maintenance. Lane departure and collision warning experienced less in normal driving and traffic and therefore appeared to be valued less. Finally pedestrian warning was experienced very rarely during trial and was perceived as being potentially valuable but difficult to judge usability.
Effort for the customer:
· What effort did customers have to make to purchase the device/service?
No effort, trial only.
· What effort do end-users have to make to use the device/service?
Install in car, be guided through functionality pre-trial.
· How does required effort of customer and/or end-users compare to available alternatives?
Safe Driving: Better green driving support (with e.g. current fuel usage) available in many cars.
Customer relationships:
-What type of relationship do the customer segments expect to be established and maintained?
Unknown, no feedback from manufacturer.
· Which relationships have already been established before the purchase?
Unknown, no feedback from manufacturer.

Technology domain variables
Main device:
· What is the architecture of the device delivering the function(s)?
Separate nomadic device with fixed, built in functions.
· Is it easy to install and use?
Yes, but requires professional instillation and calibration.
· Where can it be used?
Everywhere, but predominantly in cars.
· Can the device be used for other functions than the ones evaluated? Which functions?
No
Applications:
· How are customer profiles and privacy managed?
Unknown
Other devices:
· Which (type of) other devices are needed by users to use the device's services?
None
Service platforms:
· How is the new service integrated with existing services?
It does not integrate

Actors and process variables (this could be described in a flowchart)

Main actors:

· Which are the main actors in the business model?

Device manufacturer (Mobil Eye) and national distributors

· How does information and money flow between these actors?

Unknown, but assumed that driver or fleet owner purchases the device and installation services

Red arrow: Money. Blue arrow: Information/data

Value creation:

· Describe the logics of the device manufacturer's business model.

Device higher cost, expensive to update and to a fleet management tool, but potentially cost-effective if set within the context of a fleet risk reduction strategy.

Business model analysis

How successful was the business model?

Unknown. Sales volume not definable.

Success factors of this business model:

Niche functionality for device

Validity of Business model in 2017

The need for *Safe Driving support* is a fundamental element of this commercial system. It occupies a unique position in the market in providing aftermarket safe driving feedback and warnings on elements that have only been available in high end vehicles (in 2012).

However in 2017 many elements of MobilEye current functionality will migrate into mass market vehicles. The potential return on investment of further system development would have to be balanced against what the mass market may provide.

The market for specific nomadic *devices* such as this one has already decreased substantially. The main reason is the increased use of smartphones, which with their integrated GPS can deliver similar basic functions as the nomadic device. However the use of an automotive calibrated camera system within MobilEye show that there are still advantages of dedicated hardware to enhance functionality and value.

Foot-LITE demonstrator system.

Price: System was a proof of concept demonstrator, therefore no commercial price. Potential Target Price in mass production (excluding SmartPhone) was thought to be 100 €

Used in FOT: UK, Nuneaton

Functions: Smart Driving Support, incorporating Green Driving Support and Safe Driving Support

Service domain variables

Customers and/or end-users:
· Who was the customer? Who was *paying* for the device?
No customers/end-users as a proof of concept demonstrator system.
Eventual target market : Private car owners in general.
· Who was the end-user? Who was the *using* the device?
Trial subject participants representing private car drivers in general.
Target group:
· What was the size of the target group?
See above, potential market very large, all vehicle owners/drivers and smartphone users globally
· What was the size of the installed base?
N/a – only trial vehicle installation realised
· How big was the potential market?
See above, potentially very large, all car owners globally
Value proposition:
· What does the device/service do for the customer or end-user?
Provide smart driving assistance, green and safe driving support
· Why would people want to buy and use the service?
Mainly driving skill support, to deliver improved driving skills and anticipation in traffic. Green driving support functions considered as core features, augmented by safe driving support such as headway and lane positioning control.
· What are the unique and distinguishing benefits of the device (in comparison with similar devices)?
Innovative and delivering both green driving and safe driving support. Incorporation within a SmartPhone application augmented by additional plug-in sensors and interfaces.
Service offering:
· What is the essence of the device's services?
"Learn to drive better"
· What was the actual offering provided to the customer / end-user composed of?
Proof of concept demonstrator system only therefore no "customers" as such. Potential to extend the system functionality to post journey driver feedback and tutoring via web data upload and processing .
Context of use:
· In what specific situation(s) would people want to use the device?
Green and safe driving support: for all trips.
· How does the device fit into the daily or professional lives of the intended customers /users?

Proof of concept demonstrator system only therefore no “customers” as such. The device creates easily assimilated real-time feedback on driving behaviour in relation to safe and green driving within a convenient SmartPhone environment.

· Within which social (cultural or political) context does the device/service fit?

Green driving aspects realising “real” fuel saving benefits added to “safe” driving feedback may most likely fit with drivers who would be responsive to improved driving performance.

· Does the device/service match the behaviour of the customers and end-users?

Yes. The system was designed and configured in-line with surveys of potential users perceived needs. System functionality and HMI were developed through repeated optimisation trials in a driving simulator and subsequent on-road usage evaluations. The system was intended to be always available when in driving.

Effort for the customer:

· What effort did customers have to make to purchase the device/service?

Proof of concept demonstrator system only therefore no “customers” as such.

· What effort do end-users have to make to use the device/service?

Install in car, read instructions and use. System proved to be intuitive.

· How does required effort of customer and/or end-users compare to available alternatives?

No combined Smart driving support systems existed at time of trial.

Green Driving: Improved green driving support (with e.g. current fuel usage and gear change feedback) available in current generation of cars.

Safe Driving : Some In-built system functionality available on current generation of cars. Very limited aftermarket systems available.

Customer relationships:

· What type of relationship do the customer segments expect to be established and maintained?

Unknown

· Which relationships have already been established before the purchase?

Proof of concept demonstrator system only therefore no “customers” or purchase as such.

Technology domain variables

Main device:

· What is the architecture of the device delivering the function(s)?

Separate nomadic device based upon a SmartPhone platform. Additional interfaces to Automotive camera, OBD interface and ECU.

· Is it easy to install and use?

Yes.

· Where can it be used?

Everywhere, but predominantly in cars.

· Can the device be used for other functions than the ones evaluated? Which functions?

No

Applications:

· How are customer profiles and privacy managed?

Irrelevant for this device. Would be considered if produced as a product.

Other devices:

· Which (type of) other devices are needed by users to use the device’s services?

Internet connected computer, IF a post-journey web based tutoring based upon uploaded driving data were to be implemented.
Service platforms:
· How is the new service integrated with existing services?
Green and Safe Driving Support: Not integrated with other services

Actors and process variables (this could be described in a flowchart)

Main actors:
· Which are the main actors in the business model?
Proof of concept demonstrator system only therefore no "actors" as such.
Potential actors :

- Foot-Lite system and software app distributor
- Automotive component Supplier
- Web Service Support (if implemented)
- Cutomers/End-Users

· How does information and money flow between these actors?
Proof of concept demonstrator system only therefore no "actors" as such and no information about what could possibly a business model. However as a potential mass market item. Customer would provide funding and be provided with goods and services.

Red arrow: Money. Blue arrow: Information/data

Value creation:
· Describe the logics of the device manufacturer's business model.
Proof of concept demonstrator system only therefore no "customers" as such.

Business model analysis

How successful was the business model?
N/a
Success factors of this business model:
N/a

Validity of Business model in 2017

The definition of a cost effective *Smart driving support* was the main ambition of the original UK Foot-LITE research project. Early market research indicated that this was perceived as an innovative and welcome function for drivers. It was also apparent that for most car drivers, this is a function that is would be used all the time during driving IF packaged in such a way that was not overtly invasive to normal behaviours.

Other functionality such as navigation has already migrated to a SmartPhone environment and it was considered that this was an appropriate design and implementation direction for the UK project. As screen size and processing power in SPs is continuously being improved this appeared to be supportive of increased fuctionality.

A key element was intelligent *Green driving* support supplemented by safe driving feedback in a combined and easily understood interface and was perceived as very useful at time of trial.

However by 2017 it is thought that many of these elements will exist within the base vehicle driver information systems. So Foot-LITE had a particular window of opportunity before such vehicles become predominant on the market.

BLOM N-Drive 800

Price: 250 € (devices bought by Loughborough DS in the TELEFOT project from BLOM distributor) no knowledge of a UK "market price"

Used in FOT: UK

Functions: Navigation support

Service domain variables

Customers and/or end-users:

· Who was the customer? Who was *paying* for the device?

Private car owners in general for market. Project partner organisations (eg LDS) in TELEFOT trials.

· Who was the end-user? Who was the *using* the device?

Private car drivers in general. TELEFOT LFOT trial subjects in particular.

Target group:

· What was the size of the target group?

Very large, all car owners globally?

· What was the size of the installed base?

Unknown

· How big was the potential market?

Very large, all car owners globally in target markets served.

Value proposition:

· What does the device/service do for the customer or end-user?

Provide navigation assistance

· Why would people want to buy and use the service?

Mainly navigation support

· What are the unique and distinguishing benefits of the device (in comparison with similar devices)?

Little distinguishing features/benefits from other nomadic device navigation support functions on the market at the time of the TELEFOT trial.

Service offering:

· What is the essence of the device's services?

"Never get lost again", as with other navigation support devices.

· What was the actual offering provided to the customer / end-user composed of?

At a fixed price: get device, digital map copy.

Context of use:

· In what specific situation(s) would people want to use the device?

Navigation: for travel to unknown places.

Speed Alert : To display possible non-compliance with legal speed limits

· How does the device fit into the daily or professional lives of the intended customers /users?

In general this facilitates navigation support in common with many other similar systems on the market. Main observations about the use in daily life are some issues with use of post code destination entry which could prove frustrating to users.

· Within which social (cultural or political) context does the device/service fit?

The perceived usefulness of navigation support for vehicle drivers, when on a planned route or the need for re-routing when road/traffic circumstances dictate, is the main cultural factor.

· Does the device/service match the behaviour of the customers and end-users?

Some of them. The navigation support function worked adequately, with some issues with destination entry and overall operability particularly with start up time to satellite acquisition. Perhaps this is not a "market leading example" of navigation support. Some information generated from the LFOT give indications as to how often navigation support is used in local/regular routing as opposed to irregular, longer distance, less familiar journeys. In conclusion indication that navigation was only employed in some 5% of journeys. Some perceived locational inaccuracies in speed alert "zones".

Effort for the customer:

· What effort did customers have to make to purchase the device/service?

In the TELEFOT trial the device was supplied free to users. As a commercial product the consumer would perhaps select the most appropriate navigation support system based upon cost, appearance, consumer market reviews etcetera. The consumer would then make the purchase themselves.

· What effort do end-users have to make to use the device/service?

Install necessary mounting bracket in the car, read instructions, update maps and/or software as necessary.

· How does required effort of customer and/or end-users compare to available alternatives?

This system is relative typical of navigation support systems on the market.
navigation: Current emerging market Smartphone applications for navigation support may be cheaper, more efficiently portable, but may generally offer a lower level of functionality and perceived quality/usability. However, this is still an evolving market trend as Smartphones and apps become more capable.

Customer relationships:

· What type of relationship do the customer segments expect to be established and maintained?

Almost none, except from updating maps via WWW.

· Which relationships have already been established before the purchase?

None known. A customer may have earlier experience of the brand and/or the retailer.

Technology domain variables

Main device:

· What is the architecture of the device delivering the function(s)?

Separate nomadic device with fixed, built in functions.

· Is it easy to install and use?

Yes, with some usability issues as discussed.

· Where can it be used?

In any vehicle , but predominantly in passenger cars.

· Can the device be used for other functions than the ones evaluated? Which functions?

No
Applications:
· How are customer profiles and privacy managed?
Irrelevant for this device.
Other devices:
· Which (type of) other devices are needed by users to use the device's services?
Internet connected computer, if updating digital maps.
Service platforms:
· How is the new service integrated with existing services?
Navigation support: Not integrated with other services

Actors and process variables (this could be described in a flowchart)

Main actors:
· Which are the main actors in the business model?
Device manufacturer (BLOM), Customers/End users
· How does information and money flow between these actors?
Direct payment from consumer to distributor/manufacturer.

Red arrow: Money. Blue arrow: Information/data

Value creation:
· Describe the logics of the device manufacturer's business model.
Device relatively inexpensive, and sufficiently feature laden to be competitive within the market.

Business model analysis

How successful was the business model?
Unknown. No commercial data on BLOM navigation support products in comparison with the navigation market were available.

These devices/navigation support systems have emerged as a major aftermarket accessory for the private motorist and others in the last ten years. As capability (mapped areas, and sophistication) and price has dropped, a significant market has arisen.

More recent trends have been the availability of similar functionality available as cheap apps for Smartphones. While the capability of such platforms for delivering a successful HMI has been compromised by physical attributes (small display screens) and technical performance (high power consumption GPS), the basic technology platform in a Smartphone is becoming more capable.

This is likely to have a significant impact into the market for nomadic device navigation support in the future.

Success factors of this business model:

- Relatively Low price of device
- Device contains adequate functionality desired/expected by the customers

Validity of Business model in 2017

The market drivers for *Navigation support* systems and functions has been noted. This has been an emerging market for some 10 years as purchase costs have dropped and capability has increased.

However the emergence of an alternative portable platform for navigation support in the form of a Smartphone app offering similar function to an independent device, but in a platform with other communication, social and lifestyle support apps tailored to an individual user offers great competition.

Conventional navigation support providers may have to consider how beneficial further investment into hardware/software development to remain competitive to the Smartphone apps may be. A possible logical migration would be for the business model for navigation support becoming an app dominated market by 2017, with re-positioning of the various actors to accommodate. This will undoubtedly have a different business model to that based upon a hardware designer, manufacturer and retailer.

There are also the strategies of the OEMs to consider as the incorporation, support for nomadic and/or Smartphone devices emerge in the next 5 years.