# Changing the change proceedings

Edited by
Carla Cipolla
Pier Paolo Peruccio

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Edited by Carla Cipolla (Politecnico di Milano), Pier Paolo Peruccio (Politecnico di Torino)

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Changing the change
DESIGN VISIONS PROPOSALS AND TOOLS

# Service Design to foster premium prize and sustainable mobility in urban contexts*

Anna Meroni[1], Daniela Sangiorgi[2], Giulia Simeone[3], Beatrice Villari[4]

## Abstract

Some of the problems facing present-day urban mobility could be solved by the so called Intelligent Transport System Sector. Thanks to the Electronic Toll Collection (ETC) technology currently used to collect tolls from urban traffic, which is based on Onboard Units endowed with a Smart Card that can communicate with Antennas placed at specific points of transit, it is now possible to introduce a new approach to urban mobility management and imagine a new generation of services.

In this paper we will explain how ETC technology platforms can bring about sustainable scenarios where new positive social behaviours are enabled by service innovation. Presenting the main results of two research-projects on the Italian mobility system, we will describe a vision of future mobility, based on the development of ETC platforms and the adoption of a series of key service elements.

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* This paperi s the result of a collective work, but, for the puroposes of this pubblication, A.Meroni has written the paragraph 3, D. Sangiorgi has written the paragraphs 1-2, G. Simeone has written the paraghraphs 4.1 - 5, B. Villari has written the paragraph 4.2.

# 1. Problematic background

New services adopting Intelligent Transport System (ITS) technologies could contribute to solve some of the problems of present-day urban mobility (Urry 2004; Dennis and Urry, 2007; Urry, 2007). This paper presents the results of two Service Design projects working on a new generation of mobility services that seek to answer the needs of contemporary urban mobility by stimulating more sustainable social behaviours.

In recent decades people mobility has increased and become less standardised; traditional collective transport services are unable to meet new requirements and individual car-based mobility is no longer sustainable. There is therefore a need for integrated, flexible and hybrid mobility services able to give a wider choice to users while orienting toward more sustainable behaviours. The challenge is to move away from toll-based policies and solutions which are detached from the mobility system and do not provide users with alternatives, to service oriented ones; this paper describes a vision of future mobility that uses Electronic Toll Collection (ETC) technology to make the mobility service system more efficient and enable more aware behaviours. Electronic Toll Collection (ETC) technology is currently used to collect tolls from urban traffic thanks to Onboard Units endowed with Smart Cards that communicate with Antennas placed at specific points of transit. This technology can:

1. help integrate services, promote multimodality and make mobility systems more user accessible;

2. enable a series of mobility-related services providing context aware information and a seamless mobility experience that makes travelling more pleasant and personalised to the needs, expectations and characteristics of the traveller.

This new logic presupposes significant changes in user habits: in order to succeed in a sustainable perspective such innovation in technology must stimulate some kind of social innovation, meaning innovation in the way people act to obtain results. For this to occur, social innovation, which is typically a bottom-up process (Meroni, 2007), needs to be recognised by users as more advantageous than their usual habits. So, the service design challenge is to use ETC technology to facilitate “open” (Cottam and Leadbeater, 2004) mobility services, where the user can actively “arrange” his own solutions and strategies and, in doing so, orient the system.

The two Service Design research projects therefore combined technological and social innovation perspective. On one hand the research projects developed ETC technology as a platform for the implementation of different service elements able to generate integrated, flexible and hybrid mobility solutions (modular architecture); on the other they developed these solutions adopting a “positive psychology” approach that recognises and rewards sustainable behaviours.

# 2. ETC platform

The current challenge in orienting mobility-related behaviour towards a more sustainable pattern is to create an integrated, flexible and hybrid mobility system able to give users a wider choice, therefore reducing the use of private transport (AA.VV. 1999). Recent innovative technologies, like the ETC systems and electric or light vehicles, combined with an innovative vision of the service, could facilitate the development of such a new system.

ETC technology, currently used to collect tolls from urban traffic, is based on Onboard Units endowed with a Smart Card. This is able to communicate via microwaves with specific points of transit and is currently adopted both for motorway and urban traffic, enabling vehicles to be tolled without having to pass through specific toll plazas or reduce their speed. This benefits the

environment, because it eliminates queues and deters the use of private cars in urban areas if the system is installed in towns (road pricing).

Since it is able to recognise and track the user, ETC technology could be further developed into win-win solutions that encourage and reward sustainable behaviour, such as using public instead of private transport, sharing cars instead of owning them or using green vehicles instead of polluting ones. This is because the technological system is made up of three main components that track the mobility of a person or vehicle: (1) antennas placed at specific points of transit; (2) Onboard Units placed in the vehicles; (3) Smart Cards, generally inserted in the Onboard Unit, that can also be used separately as personal cards to access various public transport, personal and public services. It is therefore possible to profile users and encourage them to adopt virtuous behaviour by providing access to different mobility modes and services, rather than through punishments and constraints, while communicating the impact of each choice and rewarding sustainable ones.

Electric vehicles offer further opportunities for sustainable mobility. Considering the use of electric vehicles in new mobility service ideas was the starting point for the Archimede-Ecomobility research: these kinds of vehicles (cars, microcars, bikes) can be integrated into public and private mobility systems.

# 3. Key service concepts

This vision considers mobility services as nodes of an integrated and flexible system where people are stimulated to adopt certain behaviours by ease of access to the system, its effectiveness and by premium-prize logic.

In order to do this urban mobility has been rethought in the light of a series of key-service-concepts that, when combined together, complement each other and offer the city-user a brand new range of mobility solutions.

The two main mobility concepts in this vision are:

1_ *mobility credits* using ITS technologies to manage each individual mobility pattern through *fees and rewards*;

2_ *intermodality* through connected inter-change nodes all around the city.

*1_ Mobility Credits*

Thanks to the ETC technology, it is possible to implement the concept of mobility credits, where the user can buy, spend and gain credits according to his/her behaviour, in the light of a multimodal mobility scenario. A credit is a unit which can be used to access operations inside a given system: ETC technology enables credits to be collected and stored automatically in the Smart Card, which becomes the main means of activating the services. Since the same Smart Card can also be used in the main public transport electronic ticketing devices and, in several cases, even be used to manage car-sharing services, it enables a set of interlinked and sequential actions. The principle of mobility credits is currently being explored in several places and conditions in order to determine the feasibility of such a radical shift in urban mobility behaviour (Fondazione Italiana Accenture, 2006; Kalmaje, Kockelman, 2004).

Adopting a credit system allows us to see mobility services in terms of Positive Psychology (Seligman, 2002; Inghilleri, 2003). That's to say, instead of frustrating the user with prohibitions, services can be designed to reward positive behaviour (with credits) and to provide a clear picture of the available mobility choices. These to overcome the difficulty users have in today multimodal mobility system to understand the alternatives and choose the best solution for his/her needs. A credit-collection based system (exploiting ETC technology) should and could systematically overcome this problem by: 1) providing both an analogical and digital map of the

system (info-mobility and advanced navigation systems); 2) effectively fluidizing transition between the different means of transportation and giving access in real time to real alternatives; 3) rewarding sustainable behaviour and choices (i.e. the adoption of public instead of private transport).

The aim of the two research projects was therefore to turn a series of mobility prohibitions, restrictions and constraints into new opportunities, where limited freedom of use for private vehicles is overcome by a set of real and feasible alternatives. This means adopting a positive approach (Csikszentmihalyi 1991) to restrictions using ITS and green technologies as significant drivers of change.

*2_ Intermodality*

Both the projects adopted a user-profile oriented approach. An analysis of current lifestyles and ways of moving around in the city suggested the need to shift from the current, apparently more convenient, one-vehicle trip model, to a more expedient multi-vehicle trip model. In the latter scenario, users are asked to exchange apparent convenience for tangible benefits in terms of real time-saving, money-saving and rewards for good practice. The aim of the projects was to create real opportunities for an *intermodality* attitude to kick in as a winning strategy in everyday mobility solutions (Jegou, Manzini, 2003).

The user profile approach resulted in a series of *travel demand models* (Kalmaje, Kockelman, 2004), where destinations, needs and time choices of different *personae* were used to stimulate the design of services with a modular architecture, that's to say, made of "service elements" differently combinable by the user according to the specific situation.

Moving on from these two main concepts, and from real to abstract scenarios, some crossing and transferable key concepts have been explored as promising directions for the mobility sector:

- *mobility credits*: units that can be used for operations inside a given system, which the user can buy, spend and gain according to his/her behaviour;
- *user profile personalisation:* thanks to the use of the smart card, every user can decide how to spend his/her gained mobility credits, choosing the most convenient, personalized service and routes;
- *multimodality in inter-change nodes:* inter-change nodes offer the user the possibility to choose among different mobility services depending on his/her needs and the city mobility conditions;
- *privileged access:* users can benefit from signing up to the system e.g. in gaining access to reserved lanes and specific services and privileges;
- *green shared mobility access:* users can access green vehicles located around the city, using the smart card to activate them;
- *mobility info-points:* mobility info-points can communicate with the OBU, on the car or other means of transport, to provide local mobility information such as real time traffic conditions and the availability of parking spaces;
- *all-inclusive personalization or pay per use:* users can choose between paying a flat rate for all services, or just paying for those actually used per unit of time, according to his/her involvement in the system and willingness to take advantage of the benefits available;
- *integrated mobility in a bounded space:* in a closed environment, like a fair, it is possible to integrate mobility services and access to different facilities to enable a seamless experience and increase efficiency;
- *integrated private and public transport:* technology enables private cars to be used in combination with public transport to form an integrated mobility system. A user can

leave his/her car in an inter-change node and catch a bus or a train to get to his/her final destination. This implies a change in mobility model that integrates and facilitates access to different means of transport;

- *advanced technology integration:* in some contexts it is necessary to integrate some advanced technology such as GPS and GPRS (satelite technologies used to map objects in a wide area) to trace or to map a user's movements in an extensive, open space, such as an alpine environment, where traditional ETC radio frequency is not enough to localise a person;
- *road pricing:* road pricing, traditionally used for motorways, is now becoming a common way to combat the increasing pollution in cities. If considered in a service-oriented perspective, road pricing could be a concrete answer to air pollution problems in contemporary urban environments.

# 4. Case studies

This vision of future mobility has been developed in two applied research projects by a team of design and engineer researchers from the Poli.design consortium:

- a scenario building exercise for the Norwegian company Q-Free, dealing with ETC technology, aiming to explore new service ideas for the Italian context;
- a product-service-system development for the Italian company Archimede Energia, aiming to provide green mobility services, using electric vehicles plus solar energy provision, for the city of Milan and its hinterland.

The common purpose of these projects was to reduce material and psychological dependency on private vehicles and foster the adoption of multi-modal and inter-modal commuting.

Both projects were interested in developing the concept of *road pricing* (recently introduced in different European cities, among which Milano). Nowadays, road pricing is a way of charging for the use of given roads at certain times and conditions: such a solution lacks flexibility as it charges the same amount of money for different mobility profiles (differentiating tariffs only in relation to the kind of vehicle) and is therefore missing the opportunity of developing into a new generation of urban mobility services.

Combined with ETC technology and with a fleet of green powered vehicles (from cars to bikes) for public use, the road pricing strategy could really foster a new generation of urban mobility services. The service design issue, in such a framework, is how to conceive interconnections between different transport options and make them fluid and accessible for the user, so to provide a positive experience in moving around in town.

In addition, extra mobility benefits and services have been added and integrated within the credit system, so as to make it possible for users to benefit from supporting offers connected to his/her needs and preferences.

### 4.1 Q-Free: mobility scenarios for the Italian market

Italy was selected as the research context because of the peculiarities of its geo-social conditions: historical cities, small metropoli, areas of natural beauty attracting tourism, mountains and sea.

Firstly, six *metacontexts*, that's to say typologies of emblematic urban or extra-urban settlements with recurring features, were identified as characterising the Italian peninsula from a mobility perspective. Each of them was analysed moving from a real case study:

- the metropolis, Milan;
- its hinterland with trade fair centre , Rho;
- the historic/productive town, Como; the motorway system;
- the skiing area, Alta Val Badia;
- the inhabited natural park, Parco Nazionale delle 5 Terre;
- the motorway system.

While exploring the context, the technological state-of-the-art of the main mobility related functions (paying, access, tracing and tracking) were also examined in order to define the corresponding metafunctions (recurring activities that constitute functional typologies).

With these metacontexts and their related metafunctions in mind, the scenario building activity moved from an awareness of the complexity of contemporary mobility behaviour and from the necessity to work on motivations, rewards and values, to seek ways of stimulating relevant changes in lifestyles. Service design is in fact more and more about designing behaviour and may use technological platforms as significant drivers of change.

As a result of the research work, six scenarios of possible solutions were built:

1) Milan: Providing multimodal possibilities to integrate public and private transportation;
2) Rho-Fiera: Access to organized mobility and fair services for exhibitors;
3) Como: Multimodal mobility system based on the use of green vehicles to access a historic city centre;
4) Alta Badia: Skiing services integration through the ETC system and built-in additional technologies;
5) Parco Nazionale delle 5 Terre transformed into a harbour scenario, where the ETC system is adopted in the marine sector;
6) Motorways: Introduction of the ETC system on the motorway adopting a mobility credits model.

Every scenario used mobility credits to foster a premium prize mobility and stimulate potential users to join the system, changing their behaviour as regards the way of moving around. In some cases the mobility credits gained were used to pay for public transport or shared green vehicles, in others to obtain discounts or benefits from services which have special agreements with the system, and which the user had chosen at the moment of adhesion.

Thanks to mobility credit it is now possible to change attitudes towards more sustainable mobility, not only through deprivation of comfort and materials as commonly perceived, but also by enhancing a system where virtuous users are stimulated to act more sustainably because they have something to gain from good practice. Users are really free to choose between paying and being restricted, or joining the system and being awarded for their positive actions.

In the Qfree Project scenarios, the user can always decide which is the best way for him/her to move. Contrary to the mindset where one is really only free to move when using private cars, thanks to ETC technology, a user can decide to maximise freedom of movement, using all the means available, from private cars, to green shared vehicles and the public transport system, with the maximum of flexibility and reliability. The smart card permits intermodality because it can be separated from the OBU, so the user can keep it with him/herself on all means of transport belonging to the service.

### 4.2 EcoMobility – Archimede Energia

Ecomobility is a research project focusing on sustainable mobility services for the Milan city context developed in 2007. Three design service scenarios were built, based on the Archimede Energia company and its electric vehicle products. The scenarios focused on the integration of different existing urban mobility services (electric vehicles, car sharing, car renting and so on). In accordance with the Archimede Energia strategies, the Ecomobility research scenarios considered the use of renewable energy for the vehicles (green Km concept) produced by photovoltaic panels.

Starting from the Milano city area, the design scenarios aimed to promote a strategic development of the Archimede enterprise towards a sustainable way of living the city of Milan.

The solutions were structured in service ideas mainly based on offering maps, service scenarios and design concepts for the infrastructures to be adopted.

The research approach was based on the integration of context of use (places, mobility user profiles, actors involved) and innovative services ideas based on ITS technologies.

Some design scenarios were created after a preliminary analysis of existing mobility services and infrastructures situated in the city of Milan. Some ideas were described in depth, merging Archimede enterprise strategies with innovative levels of mobility services, and visualizing the main characteristics as described in the following three scenarios:

1. *Greensharing*. A mobility service integrated with a car-sharing company. It considers the use of electric vehicles with GPS technology. The scenario includes the possibility of:

- programming the route on a website before using the cars;
- using the mobility credit cards and the OBU for the TLZ;
- using special parking areas equipped to recharge the vehicles.

The final solution is a car-sharing service performed by electric microcars (also fuelled by photovoltaic energy) that integrates different technological solutions:

- The *Electronic Toll Collection technology*. The microcar can be 'traced' in order to use Urban Road Charging "mobility credits". The microcar includes an On Board Unit able to identify the user when the Smart Card is inserted;
- *Personal Smart Card.* This activates the vehicles and integrates with public transport and car park services..It also enables the use of Mobility Credits;
- *GPS*. This enables access to internet booking services and route programs. The route programs can also be recorded on the personal GPS;
- *Web Site*. This is the interface for the entire service.

The microcar can be recharged in special car parks provided with charging points, often situated in supermarkets. The service also gives the user access to the city center or special car parks. Thanks to the ETC system, the user can manage his mobility credits and use different mobility services offered in the city of Milan.

The idea is to promote an integrated sustainable mobility system using public transport where users gain credits to spend in future when using the Greensharing service.

2. *Micromobility for Milan neighborhoods*. This is a mobility service offered by local supermarkets. It supports individual users in their daily or weekly shopping at the local markets. The service is part of a widening supermarket offer dedicated to user members. For example, people can rent an electric bike with special baskets for a whole day using also the Supermarket card points.

The service includes electric microcars or bikes available in supermarkets or local shops. The service is supposed to facilitate shopping activities on the one hand and on the other it facilitates short trips around the city. For example the users can rent an electrical bike in the

supermarket park area using their personal card. The vehicles can be charged in the supermarket parking area using the charge points.

3. *Company Fleet*. A mobility service that provides electrical vehicles for small enterprises. The service includes green-energy supply and vehicle maintenance.

This mobility service offer includes:

- electrical vehicles customized for different enterprise activities using the ETC technology and the GPS navigators;
- sustainable energy supply (produced by photovoltaic cells);
- photovoltaic infrastructures;
- smart cards to manage access to the service and other integrated services connected to the city;
- vehicle maintenance and charge points;
- mobility management (access, routes, etc.).

This service could be used to deliver goods or as a home delivery service.

By integrating Electronic Toll Collection the vehicles can also be traced for direct payment of urban road charges.

# 5. Conclusions and replicability

This vision can contribute to foster sustainable moblity as it is potentially transferable and replicable in different urban contexts, with minor or major adjustments.

Conceived as modular architecture, the key-concepts work as guidelines to develop a set of interlinked service-elements that will constitute the final mobility system. To transfer and implement this vision into different contexts, service designers need to match the set of concepts with the different mobility needs and local habits.

As mobility issues are strictly dependent on contextual needs, but at the same time connected to wider and complex systems and dynamics, design can contribute to *changing the change* by building overall visions and concepts that can orient the development of the overall technological platform and of single situated solutions. Working on the overall technological infrastructure and modular service elements, designers can therefore link the vision with local requirements and mobility profiles, combining technological and social innovation.

This means working both with technology stakeholders potentially able to build the infrastructure, and at the same time with local communities and city councils (Landry, 2000) to translate the vision into effective and useful solutions that motivate changes in mobility habits.

Such a system could, also, foster the development of so-called “local currencies”, represented here by the mobility credits. Local currency enables a community to use its existing resources more fully, which has a catalytic effect on the rest of the local economy. It also enables people to join a system where economic transaction and payment are not a punishment, but a way to use the resources in the best possible way, because of the attribution of a value that is defined within the community itself.

From a designer point of view, these kinds of projects require careful attention to accessibility and usability issues, because of the complexity and flexibility of the system, and a clear communication strategy (transparency) able to effectively show the possible mobility choices as well as the benefits/rewards associated with the use of certain kinds of services. Service design is, in fact, more and more about designing behaviours and can use technological platforms as significant drivers of change (Sangiorgi and Villari, 2006; EMUDE, 2007). The point, is creating solutions that not only satisfy a function or solve a problem, but that are also desirable,

aspirational, compelling and delightful (Burns, Cottam, Vanstone and Winhall, 2006): the way to reach this objective has been the adoption, for both projects of a user-centered approach, where technology has been rethought in the light of the user experience and viewpoint.

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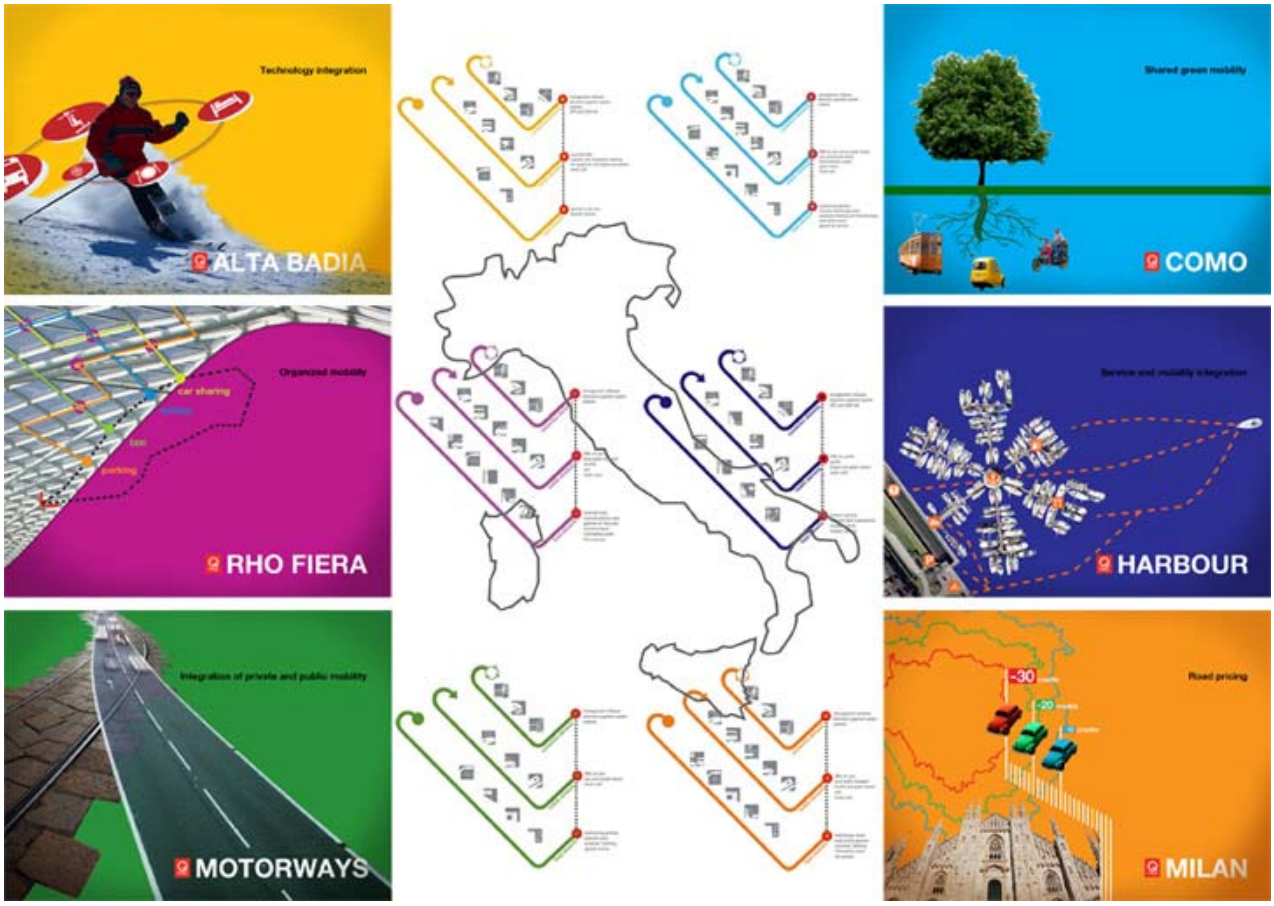


Fig. 1: this picture shows the six Qfree Project scenarios, with the elements needed to implement the system. They are divided into fixed elements, as for infrastructures; mobile, as for vehicles; and communication elements, as for smart card and electronic management system.

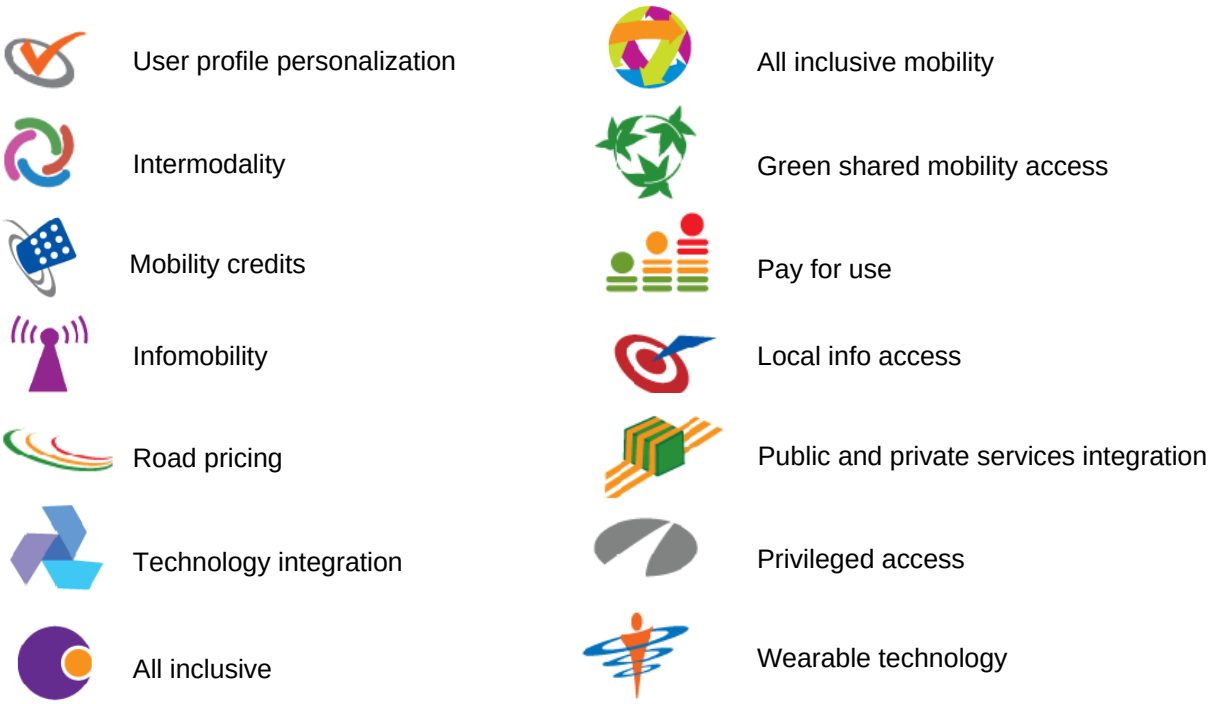


Fig. 2: This is the legenda of Key concepts icons system drawn for Qfree project and available also for Ecomobility.