Incentive Scheme within a Sustainability CRM for Mobility

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Abstract
The ecological dimension of sustainability in the meaning of consumption of natural resources is one important topic of our times. The transportation of goods and persons has a major impact on resource consumption and emissions. Electric vehicles are not solving these problems but they are offering a chance for a change of the mobility behaviour towards an eco-friendly mobility. This change of behaviour needs new transportation offers, new business models and new information systems. Intermodal transportation and the switch from individual mobility with combustion engine cars to public transport is here a key factor. Also new offers like car-sharing and car-pooling are playing an important role. Mobility management and mobility marketing addressing this switch of mobility on a municipal and on a company level. New and existing mobility provider like Deutsche Bahn sustainable mobility issues in their information and marketing policy. At the end the customer has to change his behaviour and has to accept the more sustainable offers. With the integration of a Customer Relationship Management approach this change of behaviour might be brought forward. Incentive schemes are playing an important role within the CRM, because they can directly motivate the costumer to accept certain offers. Incentive schemes can be based on different ideas like game-based or reward-based approaches and have a high ability to be operationalized in software systems.

In this paper should be described the idea of a Sustainability CRM and how an incentive scheme can influence customer behaviour to change his mobility to a more sustainable way. Also a software prototype build as a smart phone application for travel assistance is presented that is based on the presented incentive scheme.

1. Introduction
Today companies, governments and the public are recognizing that resources are limited (e.g. oil) and different other problems are occurring in the economic, environmental and social dimension that are resulting from our economic acting and our consumption behaviour (Belz & Peattie, 2009). Because of this, sustainability is growing into a major topic for companies as well as for customers.

Especially the energy sector is seeking for alternatives, because it has to deal with huge environmental impacts (hazardous nuclear power, carbon dioxide -CO2- emissions by fossil burning plants) and upcoming shortages (peak oil). An actual report of the Intergovernmental Panel on Climate Change (IPCC) proclaims that it is possible to produce 77% of the worldwide needed energy with regenerative power plants like wind energy, solar and others (Edenhofer et al., 2011).

Mobility has a huge impact in the energy and sustainability context. So 26% of worldwide CO2 emissions by combustion of fuel are coming from transport and 35% of total energy consumption in Europe is coming from transport with 71% by road traffic (EEA, 2011). Switching to electric vehicles (EV) seems to have a huge potential for a fundamental change to a more sustainable transportation with less CO2 emissions and less energy consumption. But also EVs have environmental impacts and furthermore technical shortages. So a 1:1 substitution of conventional cars (CV) by EVs is both not sufficient according sustainability and on basis of today’s technology not possible (Wagner vom Berg et. al., 2010). Multimodal or intermodal transportation provides a logistic solution to compensate the technical shortages of EVs and

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also a solution for moving more sustainable. Very important are also new function-oriented mobility offers like car-sharing and car-pooling. (Arnold et. al. 2010).

According to an international study in the field of EV’s of the automotive company Continental revealed that for 80% or more of the attendees of the study depending on the country (China, Germany, USA and France) it is still very important to have an own car. 67 % of the attendees of China (17% Germany, 20% USA, 31% France) will change their behaviour to a more eco-friendly way only when other people will do so too. But 71% of the attendees of China (58% Germany, 47% USA, 44% France) are willing to pay more money for eco-friendly products (Sommer 2011).

Mobility management and mobility marketing try to shift the mobility of people to more sustainable means of transport especially from individual mobility with combustion engine cars to travelling with public transport. Mobility management is done on a municipal level but also on a company level (Wappelhorst 2011). But also companies who are providing mobility offers like carsharing or public transport are getting aware of sustainability issues and are integrating sustainability into their marketing concepts.

Marketing is the instrument to provide offers to customers and also to influence consumption behaviour (Kantsperger 2006). The integration of environmental aspects in the marketing area was already happening at end of the 80’s within Green Marketing e.g. by eco-labeling (Peattie, 1995) and in sustainability marketing that takes all dimensions of sustainability into account (Belz & Peattie 2009). An important brick within sustainability marketing is to shape consumer lifestyle and behaviour in a way that would both expand the market for the offered products and to achieve sustainability goals (Belz & Peattie 2009).

These approaches have also consequences for Customer Relationship Management (CRM) as a part of marketing but these consequences and the effects are not discovered in all aspects, especially when we are talking about CRM in a technical way as an information system. One important goal of such a Sustainability CRM has to be the modification of customer behaviour towards a more sustainable consumption according to the above mentioned approach of sustainability marketing.

Within CRM incentive schemes are playing an important role, because customers are only participating in a certain offer as long as they are getting a subjective positive incentive. Incentive schemes have different approaches to motivate the user in an intrinsic or extrinsic manner. Examples are reward-based or game-based incentive schemes (Steinle 2005). In this work we will focus on a further approach, with a reporting-based incentive scheme that uses especially intrinsic motivation mechanisms.

2. **Sustainability**

Today the term sustainability is used very frequently and with a sometimes fuzzy meaning. For example in the CRM context a sustainable customer relation just means a long-term profitable relation to the customer (Homburg, 2008). A similar interpretation is related to terms of sustainable customer binding or sustainable customer satisfaction (Reichmann 2011).

The understanding of sustainability in this paper is based on the usually quoted definition for sustainability of the Brundlandt commission from the year 1987: "Permanent development is development, which satisfies the needs of the present, without risking that future generations do not satisfy their own needs (Hauff, 1987)". This definition makes clear, that sustainability means more than a long-term protection of profits and enterprise maintenance. Sustainable management means to act resource and environment protective and to take further goals from the social and also the cultural range into focus. To classify the dimensions of sustainability the three pillars of sustainability according the Lower German House of parliament can be differentiated: ecological dimension, social dimension, financial (economical) dimension (Deutscher Bundestag, 1998).
3. Sustainable Mobility

Mobility is what is commonly referred to as the possibility of movement. The term includes the movement of persons and items, in the sense of moving them in a physical manner. (Zängler 2000).

A definition for sustainable mobility that is close to the general definition of sustainability by the Brundlandt commission is given by Gottschalk (Gottschalk et al. 2001) who defines sustainable mobility as the following: “Sustainable Mobility is the ability to meet society’s need to move freely, gain access, communicate, trade and establish relationships without sacrificing other essential human or ecological values, today or in the future.”

In the context of this paper also the term of mobility management is important. One definition of mobility management was quoted by the European Platform on Mobility Management (EPOMM): “Mobility Management is a concept to promote sustainable transport and manage the demand for car use by changing travellers’ attitudes and behaviour. At the core of Mobility Management are "soft" measures like information and communication, organizing services and coordinating activities of different partners.” (EPOMM 2007)

One dimension of mobility is the mobility marketing. The Mobility Marketing is a field which deals with supplying target-group-specific information and consulting as well as providing incentives to confirm the behaviour of users who already make use of sustainable mobility and also to convince customers to use sustainable means of transport (Wappelhorst, 2011). So in mobility marketing we have directly integrated the idea of sustainability and also the link to CRM as a subsystem of marketing.

4. Sustainability CRM

The goals of a Sustainability CRM can be derived from Green marketing and Sustainability marketing. Green marketing is focusing on environmental aspects (Grant 2007). In contrast to that sustainability marketing keeps environmental, social and economical aspects in mind. The managerial approach of sustainability marketing according to Belz and Peattie takes the intersection of socio-ecological problems and consumer wants as root for all issues in marketing (values and objectives, strategy, marketing mix, marketing transformation) that have to be adapted to sustainability. Sustainability Marketing applies planning, coordination, enforcement and control of all market and non-market transaction activities for prevention or decrease of ecological and social problems (Belz & Peattie 2009). Additionally Schaltegger defines the tasks of Eco-Marketing not primarily as a task of rising the environmental awareness of customers, but to lower barriers for action and information leaks to influence the consumption behaviour of potential customers based on their existing environmental awareness (Schaltegger et al. 2007).

CRM provides management methods and information systems as well to support acquisition, retention and loyalty of customers as sub goals of marketing (Hippner & Wilde 2006). CRM is an instrument to influence customer behaviour as Kantsparger describes in his article „Modification of customer behavior as the core duty of CRM“, e.g. on basis of learning theory, instrumental conditioning and model learning by using mechanisms of reward and punishment (Kantspurger, 2006).

Based on this just shortly introduced ideas a first definition of a Sustainability CRM was given in Wagner vom Berg et al. 2012:“A Sustainability CRM (SusCRM) extends the outcome of CRM from the economic dimension in the meaning of sustainability by a social and an environmental dimension. For this it uses the methods and techniques of traditional CRM with a modified objective. Main objective is therefore to influence the customer in the way that he aligns his consuming behaviour with the principles of sustainability. Furthermore the operative process of CRM has to be designed sustainable.”

For a CRM approach it is crucial to determine the customer relation, to identify the customer and the vendor. In the here described approach of using a Sustainability CRM within mobility management the vendor is a municipal and the customer is the citizen. So we are coming to a Citizen Relationship Manage-
ment (CiRM) as described e.g. by Bonin and also Schellong (Bonin 2007; Schellong 2008) where we are transferring CRM principles and techniques from a Business-to-Customer (B2C) relation to an Administration-to-Customer (A2C) relation.

On a company level with a B2C relation further scenarios for this CRM approach based on different business models are possible. One scenario could be the use of the Sustainability CRM by a multimodal mobility service provider like Deutsche Bahn (DB). Here a Sustainability CRM can be used to get new customers or to identify new customer segments that switch from the use of the own combustion engine car to the by DB offered train or carsharing services. In this case a trade-off between profit-oriented and sustainability-oriented goals is possible, because the most sustainable service don’t have to be the most profitable service. Another scenario would be the offer of a pure information service for sustainable mobility that supports the customer in planning and executing his travels in a sustainable way. The revenue model could be similar to web 2.0 services like Facebook or Google. Typical customers would be persons who are already aware of sustainability, so called “Green consumers” (Grant 2007) that need support to choose the right offers fitting to their needs (Wagner vom Berg et al. 2012).

An architecture for a Sustainability CRM for mobility with its different components shows figure 1.

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![Architecture of a Sustainability CRM](image)

Figure 1
Architecture of a Sustainability CRM
However in this paper the focus lies on the incentive scheme, so the architecture is described very briefly. The architecture includes beneath traditional CRM components also software components that address mobility issues as well sustainability issues and orders them from a CRM point of view. The in the following described prototype for the implementation of the incentive scheme is integrated in this architecture. On the communicative level a web-based smartphone app is used as front end to the customer to provide travel planning and travel assistance services from the operational level. This services are very important to collect data about the customer moving behaviour and his preferences. The incentive system as described below is integrated in the smartphone app and plays especially a role in the travel assistance e.g. to support the tracking of data or to give information about bonus points. The sustainability calculator gives information about the sustainability of the different means of transport (e.g. CV, EV, bus) based on specific key figures that are needed by the incentive system. The data are collected in the operational CRM database and are analysed in the analytical components with the components data warehouse, data mining and report engine, e.g. to generate user-related reports. This repeating process of collecting data, analysing them, taking decisions and executing new activities is called the closed loop process.

5. Incentive Scheme for Sustainable mobility

5.1 Background and Classification

The here introduced incentive scheme can be classified as a tool for supporting the Mobility Marketing within a Sustainability CRM approach.

The aim of the incentive scheme can be divided into two sub goals: the creation of user-related incentives and information to convince users to use public transport and to confirm the behaviour of users already acting within the sustainable mobility context. The importance of these two sub goals becomes clear when considering the customer-related reasons of choosing a specific vehicle. According to that, a paucity of information regarding the two dimensions travel time and travel costs exists (Priewasser, 2003). According to the individual transport, these two dimensions are subjectively rated better than they really are. In this context the individual transport means the use of less sustainable vehicles like CV’s. Therefore, the alternatives to the individual transport are perceived worse. Several studies have already analysed the influence of the travel time on the customers’ satisfaction with regard to a specific vehicle. Thus, traffic participants quote the supply of information at disturbances and delays by public transport as the biggest factor for dissatisfaction (TNS, 2012).

Furthermore, the own acting within the traffic concerning the sustainability is subjectively rated often better than in fact (Wappelhorst, 2011). The creation and visualisation of user-specific information regarding these dimensions and other interesting facts concerning the personal mobility is able to change the subjective perception as a result of the own acting and may transfer the customers from the group of using individual transport to sustainable transport. Besides this, tools have to be created to bind customers and to increase the motivation of them to use public transport. This can be achieved by visualizing the advantages and by developing added values of an altered behaviour (Wappelhorst, 2011).

5.2 Target-group

To provide target-group-specific information, consulting and incentives, it is necessary to examine the underlying target-group.
According to that, the target-group of the incentive scheme can be divided into four different subgroups, every subgroup contains customers with different motivational structures. At first, there is the subgroup of users of the individual transport. For these users, incentives must be developed in order to transfer them in one of the three other subgroups or a combination of them. This means these users should be shifted from using individual transport to using sustainable means of transport. In concrete terms, the potential incentives are those, which increase the extrinsic motivation, like rewards in order to win these users for participation at the incentive scheme. Even a better informing about user-specific facts regarding the subjective mobility is possible to generate a better ecological thinking.

For the users of the other subgroups special incentives must be generated to bind them on the incentive scheme. These incentives can be in forms of rewards, but in greater degree a better informing about mobility-based and user-specific facts for increasing the intrinsic motivation. Objective facts have the ability to confirm these users in their behaviour, motivate them to improve their behaviour and consequently to bind them for using sustainable mobility and to participate on the incentive scheme. The goal is to establish a morally feeling of underlying an ecological norm or rule. It describes the sensitization of road users to the problems of the individual transport and the feeling of personal contribution to the reduction of traffic problems (Wappelhorst, 2011).

5.3 Theoretical Concept

5.3.1 Incentives

Based on the classification and the target-group, the incentive scheme covers three different groups of incentives. According to that, there are two groups offering the user primary incentives, which are directly connected to and established by the subjective customer-based mobility and one group offering the customer supporting incentives transferred from other domains, e.g. the Web 2.0, or as by-products from the other two groups.

At first the incentive scheme includes incentives for creation and visualization of customer-specific mobility facts and key figures. These incentives belong to the primary group of incentives. In concrete terms, the customer will be informed about mobility facts like the total distance, the travel time, the travel costs and the user-caused emissions of CO2. To create a sensible perception by the customer about his own mobility concerning the ecological sustainability, the limitation on the CO2-emission is legitimate, because the transport is regarded as third biggest perpetrator of CO2 and CO2 itself as mainly responsible for the climate change (VCD, 2007). Besides the visualization of absolute key figures, it is suggestive to visualize the relative change of the key figures as percentage change to show the customer the effects of his own adjusted behaviour for variable time periods. Furthermore, it is important to calculate a theoretical trend about the key figures. A visualization of a trend enables the customer the possibility to classify his actual behaviour and also gives an orientation.

The second group of incentives is formed by methods to generate and visualize advantages and added values of an altered customer-behaviour. This means the customer must be rewarded for his behaviour in relation to his effort. In concrete terms, this can be expounded twofold.

First, an absolute key figure evaluates the customer’s mobility. This key figure is able to make a clear statement about the customer’s mobility in the context of the sustainability. Based on this key figure, the customer is rewarded with the awarding of bonus points. These bonus points may be exchanged by the customer at specific partners of the incentive scheme in tangibles.

Second, the customer is rewarded directly related to a specific behaviour, so-called reward-competition. The reward-competition is able to manipulate the customer’s behaviour directly. For example, it will be possible to give out a reward to the user if he travels a predefined distance with a specific vehicle, e.g., to
increase the use of public transport, with the bus. This reward is not related to previously earned bonus points.

At third, the incentive scheme offers the customer supporting incentives. For example, it is possible to show ad hoc sustainable or more cost-effective alternatives for the current route to the customer. This is a side-product of the calculation of the key figure to evaluate the customer’s mobility.

Furthermore, incentives, mainly integrated in the Web 2.0, can be transferred for creating possible incentives. For example incentives to offer competition mechanisms to the customers are important to mention in this context. These mechanisms may effect in a long-term analysis the user’s performance with regard to other customers. By displaying the customer’s performance by comparison to others, the specific customer adjusts his own behaviour to achieve a better reputation inside the community. Even a following-mechanism, to offer the customer information about friends’ performances ad hoc and the integration of social networks, to improve the own reputation towards an ecological acting person inside the specific social network, is important to mention here.

An interesting concept, to offer the customer added values, is the so-called user-based messaging-system or “Mobility-Twitter”. The idea behind this keyword is to give the user the possibility to inform other users, like UGC, proactive and ad hoc about interesting facts concerning the traffic like congestions, accidents, warnings, peak-rates or bus-delays. The resulting incentives are diverse and addicted to the concrete implementation of the concept. To improve the existing paucity of information and the dissatisfaction with the public transport, the user-based messaging-system can be used in order to offer the user incentives to compensate these disadvantages and to improve the satisfaction with regard to the public transport. For example, the customer may inform other customers about the delay of the bus. The information arrives proactively and context-sensitively at other customers, who are located in the direct environment. This results in a lower standby time at the way station and in time savings. Many other use cases are thinkable. It is conceivable and possible to include official information- and planning-systems of public institutions in the user-based messaging-system, too. It is important to mention that the information-process is not initiated by the informed user, but rather by the incentive scheme itself. It is a proactive and context-sensitive information-process with so-called Push-Technologies. Therefore, the information channel is exactly conversely to conventionally systems.

5.3.2 Components

To offer the incentives, mentioned in 5.3.1 to the customer, the theoretical concept exists of several components. These components are shown in figure 2.

Thus, the theoretical concept provides a visualization-component as interface to the user. The basic components are represented by the data collection- and user administration-component. The data collection allocates mechanisms to record the actual mobility-behaviour of the user by GPS-tracking and to generate an individualised movement profile. It is conceivable to include external information systems, in case no GPS-tracking should be utilized. The user administration is required to allocate the data collected by the data collection-component to one specific user.

The analysis-component processes the movement profiles as a result of the data collection. This is where the profiles are evaluated with reference to the sustainability and where the key figures are calculated based on the key figures of the sustainability calculator. The evaluation can take place in third party systems or may occur within this component itself. Therefore, the analysis-component needs to offer open interfaces to interact with external analysis-systems.

The reward-component undertakes the task of handling the awarding with bonus points, based on the key figure as a result of the evaluation-component and the handling of reward-competitions. The aim of this component is to display the customer the individual advantages of the adjusted behaviour. To generate incentives, the recruitment of partners for the incentive scheme to offer rewards is mandatory. A reward
can be exchanged by a specific number of prior earned bonus points or by the successfully participation on a reward-competition and is technically allocated by the assignment of an individualized QR-code to the user.

The competition-component exists of four subcomponents. The social transparency includes methods to visualize the performance of a user to other users and therefore, to generate social competition. The user-based transparency refers to a transparent creation of the own performance to the customer itself. This leads out in a raising intrinsic motivation and in an adaption of his own-targeted performance standard. The publicity-component offers mechanisms to the user to post information to social networks like actual performances, user-based messages or the participation on a reward-competition. Postings into social networks may cause a better user-based reputation and has a viral-marketing-effect for the incentive scheme. The cooperation-component allows the users to join to user-groups. With the participation in groups, the hedonistic motivation may be raised. Furthermore, the following-mechanisms are included in the cooperation-component.

Last, the theoretical concept provides a reporting-component. This component offers the user-based messaging-system and a concept of integrating proactive and reactive exchange of information. For the proactive information exchange, a push-technology like the Apple Push Notification Service (APNS) or the Message Queue Telemetry Transport (MQTT)-Protocol, developed by IBM, could be used. The reactive information exchange should be implemented via web services. The focus by implementing the reporting-component must be set on the extensibility. The extensibility ensures, that several client-applications like native or web-based client-applications and third-party-systems can be developed and integrated.

![Figure 2](image)

**Figure 2**

Components of the theoretical concept

### 6. Prototype

The prototypical implementation considered here is called RISM (Reporting based Incentives for Sustainable Mobility). By using the prototypical implementation, the technical feasibility of the theoretical approach can be evaluated. Therefore, the concrete implementation exists of three components.
The first component is the backend-component, so-called RISM-Backend, which is java-based and the main component of the incentive scheme. It includes a data source to evaluate the users’ movement profile. This data source is a web service, so-called Jinengo-web-service. For this reason, the evaluation is not directly part of the incentive scheme itself. Jinengo is a multimodal planning-system for evaluating different combinations of vehicles for a given route with the integration of a CRM system (Wagner vom Berg et al. 2012). Based on the evaluation, the backend transfers the user’s performance into bonus points, which can be exchanged into specific rewards. To account the use of a reward by the user, partners may use QR-codes, which will be offered by integrating the Google-Chart-API. To interact with client-applications, the backend provides a JSON-based REST-web-service. This web-service can be used by client-applications for reactive communication via so-called POST- and GET-Requests. This means the communication process is initiated by the client-application. The proactive communication is sourced out to an own component, the so-called RISM-Push-Middleware that will be discussed later.

The second component is a visualization or so-called RISM-web-application, which acts as an interface to the user. For data collection the prototype uses the GPS-tracking. Required by the GPS-tracking, the development of an application for a mobile device is necessary because almost all of these devices offer mechanisms to record the actual coordinates of the user. To enable the use of the application to the largest possible number on different mobile devices, a web-based smartphone application is created. For this prototype, the JavaScript-based framework jQT is used.

Basically, the visualization provides the possibility to display the created incentives to the user. By this he can start the recording of his own movement profile. At the beginning of the recording, he may provide information to an end address of his route. In that case, the incentive scheme can suggest sustainable or cost effective alternatives to the chosen vehicle to the user. Basically, the user has to provide information about his chosen vehicle and the periodicity of his route. At the end of the recording, he may provide feedback-information about the route. This means, the user can evaluate his route relating to the quality criteria and has the possibility to provide further information via free text. Then the user-route or the movement profile is evaluated by the backend. After that, the visualization displays the user the earned bonus points. Basically, the integration of social networks takes place in the web-application because the programming-guidelines recommend this. At the moment, the social network Facebook is integrated via the Facebook-JavaScript-API. Based on the recorded movement profiles over the entire time, the user-based mobility-facts are calculated in the backend and displayed via the visualization to the user. Furthermore, the user has the possibility to exchange the offered rewards, to participate on a reward-competition and to look up his earned rewards. The user also has the possibility, in analogy to the traffic announcements in the radio, to post interesting facts regarding the traffic. The arriving of such a message is offered by the use of Push-Technologies and is managed by the RISM-Push-Middleware.

The third component is the so-called RISM-Push-Middleware. This component acts as interface between client-applications and the backend for proactive communication. Because the RISM-web-application is implemented as JavaScript-based web-application, there is the difficulty to provide proactive and just-in-time manipulation of the clients’ HTML. For the prototypical implementation, the MQTT-Protocol in combination with the Node.js-framework and the NowJS-Module is used.

7. Conclusion

In this paper we described in detail an incentive scheme for sustainable mobility and it’s prototypical implementation. The incentive scheme is already integrated in the concept of a Sustainability CRM for mobility as described shortly. The implementation of the described prototype in the complete system architecture (fig. 1) that includes analytical and operational CRM components and also the planning system is finished as far as possible.
Actually there are several running and planned projects where the here described concepts are highly relevant.

One is the “Schaufenster für Elektromobilität Niedersachsen”, a national joint-venture project of scientific and industrial partners funded by the German government to show solutions for integrating electric mobility in Germany. The Carl von Ossietzky University of Oldenburg is participating in the subproject “IKT Services” and leader of the work package “Customer-oriented mobility” that addresses the support of electric mobility in a multimodal concept under criteria of sustainability with the focus on customer needs.

Other projects are planned in the city of Oldenburg in the smart city context under participation of the company thepeaklab. and Carl von Ossietzky University of Oldenburg, e.g. for E-Bike sharing services.

Bibliography


