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Installed Base in Service Innovation: The Case of Intelligent Speed Adaption

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ABSTRACT

While some argue that innovation is inhibited by installed base, this paper suggests that it is critical to service innovation. In particular, the installed base of devices and infrastructure is an important element for improved diffusion and higher acceptance of services. It brings forward a nuanced view of installed base and reports a case study of Swedish National Road Administration's strategy for increasing safety on the roads with intelligent speed adaptation (ISA) services. Over time, they changed the strategy in order to employ existing installed base available.

Keywords

Innovation services, installed base, diffusion and acceptance.

INTRODUCTION

This paper delves into different innovation efforts taken by the Swedish National Road Administration (SNRA) to decrease traffic accidents and increase safety on roads related to speeding. It has for a long period of time been known that speeding is one of the big causes of traffic accidents many times with a fatal outcome (Elvik 2005). Due to this there has been, and still is, focus on different solutions for eliminating speeding possibilities. Technological advancements and innovative development approaches have introduced new possibilities for different speed limitation and adaptation service solutions.

The case described is utilizing installed base with the objective to diffuse a service innovation in conjunction with an approach focusing on information and availability to get a high acceptance of the service. Building on a case study approach this paper examines the role of how utilization of installed base is a possibility for increasing acceptance and diffusion of an intelligent speed adaptation service. Installed base is a concept for describing an amount of units of a particular type of system actually in use. For example, mobile telephones can be considered as an installed base since they are highly diffused and used, 96% of the population in Sweden have and use mobile telephones (PTS 2008). Installed base is often described as having a negative influence on innovation and inertia effect on improvements and changes (Farrell and Saloner 1986; Herbig and Kramer 1993; Monteiro 1998). To my knowledge, there is limited research done on service innovation and its relation to installed base. However, this paper presents a case where installed base is utilized for a service innovation. Several initiatives by SNRA demonstrate problems with diffusion of a solution due to complex technologies with large investments included. One example is the adaptive accelerator pedal where extensive investments and installations need to be implemented by several stakeholders to reach full effect. Utilizing the installed base of mobile telephones is an attempt to overcome the problems and difficulties of large investments other initiatives have failed to do.

An installed base can be regarded as a stable platform not very keen on changes due to its size and form (Monteiro 1998). It can also be considered as a possibility for diffusing innovative services in a fast and efficient way. Service innovation is highly of interest today since our economy is increasingly dependent on it (Sheehan 2006). Along with the importance of further economical development due to new service demands and interest comes the opportunity to do further research within the area. Rai and Sambamurthy (2006), and Chesbrough and Sporer (2006) highlight the importance of further research into the area of service innovation. The innovation services literature bring up the importance of an "interdisciplinary approach required to understand how services should be conceived, designed, delivered, and supported"(Rai and Sambamurthy 2006). This paper is a response to these calls and an effort to draw attention to one important aspect within the complex realm of service innovation, namely the role of installed base.

The installed base and innovation literature sets the scene for this research and the aim is to examine the concept of installed base in relation to service innovation. The main contribution is to explore and discuss the possibilities installed base have on service innovation.

The reminder of this paper is structured as follows. Next section outlines the related literature where innovation research is briefly presented along with the literature handling installed base. Research methodology is presented in section three including data collection and four includes the description of the case. Section five is the discussion of the results and the paper is ends off with conclusions drawn from the case.

RELATED LITERATURE

Installed base

Installed base is a concept describing an amount of units of a particular type of system actually in use. It usually refers to a computing platform, however an installed base could be any existing platform utilized. Because installed base includes machines that may have been in use for many years, it is usually a higher figure than market share. The diffusion of mobile phones in 2008 in Sweden was 96% (PTS 2008). It can be regarded as an installed base that can be considered as an important part of the infrastructure in Sweden.

Previous research highlight the inertia installed base brings to development and improvement of information infrastructure (Herbig and Kramer 1993) or that innovation is inhibited by it (Farrell and Saloner 1986). In Monteiros article about the challenges that exist in scaling an information infrastructure (1998) he brings forward the conservative influence on diffusion installed base imply due to its massive rigidness. Installed base is an important factor that needs to be considered when developing information infrastructures which influences how and to what extent an information infrastructure can be improved and changed (Hanseth et al. 1996). The installed based acts like an actor that sets up requirements usable for some and acts like an inertia for others (Herbig and Kramer 1993). It can be considered as an adopted technology highly diffused. In this paper the utilization of installed base is discussed and not the option to change or improve the installed base itself.

Service innovation

An innovation can broadly be described as a process, knowledge or technology that adds something new (Rogers 1995). Lyytinen and Rose (2003) have defined innovation as "the creation and new organizational application of digital computer and communication technologies". One can categorize innovation in either incremental or radical innovation. Incremental innovation encloses a low degree of new knowledge, while radical innovation can be considered to contain a high degree of new knowledge (Dewar and Dutton 1986). Incremental innovations are additions to already existing product whereas a radical innovation is something completely new that open ups new possibilities for one or several stakeholders. Recent innovation literature highlight promises for non-traditional partners to participate in the innovation process in new ways and with new prerequisites (Chesbrough et al. 2006; Von Hippel 2007). Innovation networks including more than one stakeholder is highly relevant today as already noticed by Powell et al (1996). Historically has one organization developed and launched a product or service based on internal knowledge and resources. However, now services are taking new forms with digitization (Jonsson et al. 2007) and introduces new possibilities for a more distributed innovation process utilizing a heterogeneous base of knowledge and resources (Yoo et al. 2008). Along with these possibilities enters a new research possibility, service sciences or service management, highly of interest (Chesbrough and Spohrer 2006; Rai and Sambamurthy 2006). It is an interdisciplinary approach trying to understand how and why services are conceived, designed, delivered and supported (Rai and Sambamurthy 2006).

Four characteristics separate services from products, namely intangibility, heterogeneity, inseparability and perishability (Zeithaml et al. 1985). A product is an enabler of service delivery (Araujo and Spring 2006). Enablers can be a mobile phone while the service is the application on the telephone. Another example is that an airplane is the product and enabler of a flight, which is a service. Basole and Rouse (2008) describe different actors in a service value network; consumers, service providers, and different enablers. For a service to be realized different enablers help create, design, initiate and deploy the service. The service provider uses the enablers to develop a service, or bundle of services, and is the central actor in the service value network. For the service to have any value there must be an organization, enterprise, person or system utilizing it – a consumer.

Many organizations today focus on services instead of products due to the economical growth it offers (Sheehan 2006). A good example of an organizational transformation from product manufacturing to service provides is IBM. The majority of the company's revenues today comes from a service unit within the organization which did not exist prior the 1990s

(Chesbrough and Spohrer 2006). No longer is the technological artifact the main product but what services the artifact can present.

METHOD

Research setting

SNRA is a governmental organization responsible for the entire road transport system. Its objective is to create a safe, environmental sound and gender-equal road transportation system that enhances possibilities for regional development (Vägverket 2009). One of their main objectives is, often in conjunction with external partners, to start up, support and sponsor different R&D projects improving traffic situation in the road room. Research has shown that there are three main reasons for severe traffic accidents in the road room; drowsiness, drunkenness and speeding. Projects' aiming to reduce speeding is the one, of the three main reasons, with least acceptance and diffusion among users.

Data collection and analysis

This paper is based on a case study research (Eisenhardt 1989) where semi-structured interviews have been conducted during a period of 6 months. The respondents include people directly involved in the innovation process for the mobile service, but also people who have been involved in previous attempts to develop more or less successful solutions for intelligent speed adaptation services. All in all 12 interviews have been conducted in approximately one hour long sessions. The questions asked dealt with the history of different speed reducing services in general, and possibilities and obstacles for the service described in the paper in particular. Special focus has been on the utilization of installed base. All interviews were recorded and transcribed.

Documentation about speed limitation and adaptation services has been explored in conjunction with the interviews to get a better understanding of the solutions. Participatory observations have been conducted in seven project meetings and email correspondences have been observed for a period of one year. During the meetings has special attention been on discussions concerning diffusion of the solution and how attendants have interacted and discussed to come to a conclusion.

After completion of the interviews the process has continued with an elucidation of what technological advancements have had major impact on the different solutions and how these are connected to different kinds of installed base.

The different kinds of data collected established the foundation for exploring relevant literature for improving the understanding of the research setting and additional development of the interpretation of the material.

INTELLIGENT SPEED ADAPTATION SERVICES

There have been many solutions developed for reducing speed in the road room. In the following section two of these solutions will be presented, the active accelerator pedal and the mobile service. Both of them are sponsored by SNRA and one, the mobile service, utilizes the installed base of mobile telephones.

The active accelerator pedal

An active accelerator pedal is a service implemented in each car and let the driver know with tactile feedback when the driver is speeding. The feedback consists of a counterforce in the pedal when trying to increase the speed if above speed limit. External information from speed limit signs is sent to the vehicle which compares it with in-vehicle signals of how fast the car is driving. A condition for a solid solution is that all speed limit signs are equipped with transmitters sending out correct speed limit information. The solution evaluated were dependent on these signs, however, there are other ways of getting the information, for example from digital map data. The solution is an efficient way to the reduce speed and highly appreciated by users (Hjälmdahl et al. 2002; Várhelyi and Mäkinen 2001). The manager for an ISA project, running between 1998 and 2002 including over 5000 cars in four cities, describes the change of attitude towards speed reducing services in general:

> "Before we tested intelligent speed adaptation services in cars the acceptance of such a service was around 20% to 25%. But after the project ended one year later almost all users wanted to keep the service. … This project mainly showed that a demand from customers exists. Now we only have to find a way to get it into the car."

Today car manufacturers are not interested in implementing the active accelerator pedal in their cars for different reasons. They even did several attempts to suffocate projects focusing on speed reducing solutions. Car manufacturers don't want to force a solution onto their customers preventing them from driving as fast as they want. Another issue is that speed signs

equipped with transmitters are far from diffused and the digital map data still needs improvements to be fully correct and reliable. With the active accelerator solution also come concerns regarding responsibility. Car manufacturers don't want to be responsible for a solution that might cause unintentional speeding due to incorrect or lack of speed limit information. Nevertheless, a representative from a car manufacturer asserts that:

> "Even though the customer benefits are less for an ISA service than for an alcohol ignition interlock I see new possibilities for ISA when today's arguments for eco-driving is in focus."

Even though the active accelerator pedal showed positive results in regards to a smooth traffic flow, less speeding, increased awareness of speed limits and change of attitude towards an acceptance of the service could not be realized. Car manufacturers are not interested in investing money in a solution where the customer benefits are vague and the information infrastructure required for a complete solution is nonexistent. There is no employment of installed base in this solution.

The following section will describe and clarify the ongoing effort sponsored by the road administration which is a new innovation approach for an intelligent speed adaptation service utilizing installed base.

The mobile service

Since different efforts made by SNRA have failed for different reasons, yet another approach is taken. Issues with reaching a critical mass of users have been a problem along with being able to provide a solution applicable to all roads and situations. SNRA have noticed a higher interest in these kinds of solutions, especially from professional drivers who have realized there is money to earn, both in terms of less fuel consumption as well as wear and tear. Future solutions need to be flexible on many levels. As one project member in the ongoing project puts it:

> "Previous efforts have been too forceful and stiff towards the user. This service [under development] has more functions than only forcing the user to reduce the speed. It also includes a new business model and can be adjusted to fit each user."

The solution is not yet released but the below text describes a service application that can be used on all roads which is included and covered by digital maps. The project objective is to get a high diffusion and advance user acceptance of the service with utilization of the installed base of mobile telephones.

The innovation strategy

The road administration are aware of, and can clearly describe, the problems they have had with trying to find a solution that is applicable to all situations and can easily be diffused. Previous efforts were focusing on *where* the speeding is done, the roads, or with *what* it is done, the car. This effort is directed towards *who* is doing it, the driver. SNRA realized that to be able to get the wanted effect (less fatal accidents in the road room due to speeding) they had to try to reach a critical mass of users in an efficient way.

Table 1 The innovation network for developing the intelligent speed adaptation service

Organization	**Swedish National Road Administration**	**A**	**B**	**C**
Description of core business	The national authority has the overall responsibility for the entire road transport system. Tasks include co-operations with others to develop an efficient road transport system.	A is company with expertise in the area of road and transport information.	B develops mobile services such as mobile GPS navigation and fleet management.	C has expertise competences in safety and man-machine-transport interaction and is devoted to applied research and development.
Provides to the service **(type of actor in project)**	NVDB (National Road database) (an enabler)	Refined map data databases (an enabler)	The ISA application along with the navigation application (the service provider)	Graphical user interface evaluation and preparation of user surveys focusing on diffusion and

				acceptance (an enabler)
Provides to the project	Experience and knowledge regarding ISA services	Knowledge of how to merge and refine digital map data as well as project lead.	Application development	Experience and knowledge within the area of ISA and customer acceptance and diffusion

Mobile telephones are an installed base today introducing new possibilities for services in and outside the car. SNRA realized the potential and contacted people with knowledge and experience in developing and selling service applications for in-car use. The company specializes in developing navigation systems for mobile phones, in this paper named organization B. Not only was an application provider necessary but also expertise in collecting, refining and merging map data, organization A. Since SNRA wanted to measure the acceptance and diffusion another organization were invited to take care of and develop methods for evaluation. This organization, C, is also an expert in interaction design and have experience from the active accelerator pedal solution.

SNRA is not only sponsoring the project but also delivers information via the National Road Database (NVDB) to the solution. NVDB has information about most roads in Sweden, including both static and dynamic speed limit information. Organization A is the company in the project who imports NVDB to their databases and refines and structures the data. Organization B is the developer of the actual application which uses the information from the databases supplied by organization A. Organization C are experts in interaction design as well as doing research within the area of user acceptance and diffusion in regards to ISA services. As mentioned has organization C also been involved in evaluating and developing the user interface to optimize usability.

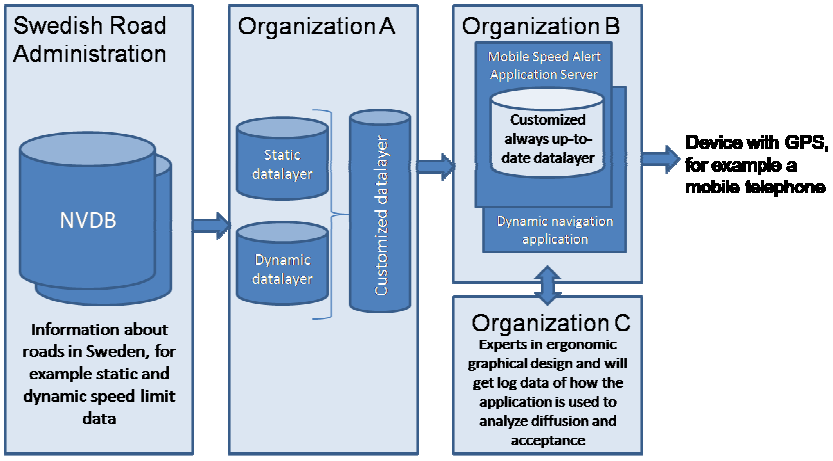

Figure 1 A simplistic overview of components included in the solution

Each stakeholder has different agendas and purposes of being part of the project. The goal for SNRA is to have a service highly diffused, accepted and used which decrease critical incidents on roads due to speeding. Organization A sees an opportunity to further refine mapdata and increase the company portfolio of digital mapdata services. Organization B wants more services to be included in their navigation application which offers new value to their customers and organization C are interested to be a part of yet another project focusing on speed adaptation and limiting solutions and do research on it. The different components included in the solution are owned and controlled by each stakeholder. They all have to cooperate and share information during the innovation process of the service.

The service utilizing installed base

Figure 1 show the many components from different stakeholders included in this service application. Different kinds of information about roads are collected in databases which are refined and thereafter used in the application. Information is collected from several digital data sources withholding map information. Figure 1 only shows the databases provided by the

organizations innovating the service. General map data is provided by global organizations specializing on digital map data for a wide range of personal and in-car navigation systems and mobile and Internet map applications. Other organizations that enable the service are the Global System for Mobile communications (GSM) and different mobile phone operators.

The solution is an application intended for the installed base of java-friendly mobile telephones equipped with GPS (Global Positioning System). However, it is possible to use other devices with GPS for the application. As mentioned in previous section, the intention is also to provide the service directly to cars and further develop the solution for a better integration in the car. A product manager from organization B unveils his awareness of improvements for the service implied by integration in the car:

> "One major flaw with the service presented in a mobile telephone is the small display and lousy sound. If it could be more integrated in the car the service could use the big displays available in cars along with existing loudspeakers."

The application uses data from databases in conjunction with the navigation application. Today is the navigation application the platform where the service application is added on. Future scenarios can incorporate the possibility for a standalone intelligent speed adaptation service.

GPS signals are necessary for positioning. Together with database information and GPS signals can the car not only be positioned but also speed estimation can be conducted. Current speed limit is presented in the window of the mobile telephone and if the driver is speeding will graphical changes occur on the mobile telephone along with a beeping sound.

This solution is only advisory to the driver. The driver has to activate the application on the mobile telephone to use it. It is easy to ignore the application when driving; however, it informs the driver both of speed limit on current road and actual speed of the car in real time. When the driving session is completed can the driver take part of different kinds of information based on the recent driving session, for example how many percent the driver have been speeding on the driving session and how the fuel consumption has been effected by the speeding. The fuel consumption feature is only a general estimation since different cars have different consumptions. Other functions that are not yet implemented are connected to green driving which means that the user can get information about emission and how the driving session effects the environment.

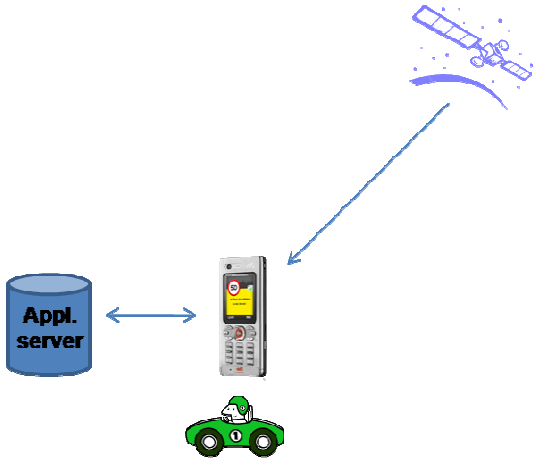

Figure 2 A simple overview of service components; the application server with map data, a mobile telephone and GPS satellite.

This solution needs information from NVDB which is supplied by the SNRA. It is therefore impossible to use the application in other countries with no equivalent NVDB solution. However, since the navigation application, where the speed service is included, is available in many other countries but Sweden is the possibility for further diffusion high as long as data exist regarding speed limit signs along roads.

The application can be adjusted and changed after release to customer. The application has several settings which the user can change to his, or her, own preference. For example, the user can choose when the application should warn regarding speeding. There is a 5km/h interval starting from –5km/h to +30 km/h. This means that the user can choose to get a warning when the speed has reached 5km/h less than speed limit or up to 30km/h more than speed limit. There are also settings

regarding feedback, default is audio and visual information, but the user can choose either audio or visual. One can also choose to turn the speed limit warning completely off and only use the navigation application.

DISCUSSION

This paper sets out to explore and discuss the role of installed base in service innovation. Addressing the call for further research on service innovation (Chesbrough and Spohrer 2006; Rai and Sambamurthy 2006), the case describes the innovation process for an ISA service. The aim of the project was to innovate a service with its main objective to get a higher diffusion of an ISA service compared to the previous solutions. SNRA realized the potential in utilizing an installed base of mobile telephones to diffuse the service. Research done on installed base brings up an inertia effect on changes and inhibition of innovation (Farrell and Saloner 1986; Herbig and Kramer 1993). This research demonstrates a more nuanced view of installed base when exploring the possibilities of utilizing it for innovative services.

The aim to get a higher diffusion with utilization of the installed base of mobile telephones shows the innovation potential installed base establishes. The service can be used by mobile telephone owners on all roads in all situations for all vehicles as long as the other enablers (Basole and Rouse 2008) are available. The telephone has to have GPS and a diverse set of digital map data that is covering all applicable roads. Other enablers are the GSM net and different telephone operators and last but not least; the user have to make the active choice of ordering the navigation application where the ISA service is included. The other enablers (Basole and Rouse 2008) of the system can also be considered as installed bases, such as the GPS included and the navigation application. The diffusion is dependent on all these different kinds of installed bases.

The active accelerator pedal did not have an installed base in the same sense as the mobile service solution. Investments were necessary to be made in each car where the pedal was to be implemented. Car manufacturers were not interested to do such investments. For the mobile service solution no investments were needed in the installed base of mobile telephones, it already exists.

96% of the population is Sweden invest in, and use, mobile telephones (PTS 2008). Nonetheless is this equivalent with diffusion of a service, for example the ISA service. As mentioned, the installed base of mobile telephones are the product enabling the service (Araujo and Spring 2006) but other installed bases are necessary to complete the service. These different levels of enablers, the installed bases of GPS's, GSM net, telephone operators and navigation application, have not been considered by SNRA.

Nevertheless, it could be assumed that this service hold a promise for diffusion and acceptance in new ways due to its form and behavior compared to previous solutions. This service is flexible in new ways and due to its digital components can the service be adjusted and improved throughout its lifecycle which allow for a sense and respond process not previously possible. The solution can provide new values even though it is released and in use. This makes the solution flexible.

However, since the solution is not yet released will future research show if the goals are reached, if the solution reaches higher acceptance and increased diffusion and if this together will result in less fatal accidents on roads caused by speeding.

CONCLUSION

This paper has explored and discussed installed base and the possibilities and challenges of utilizing it for service innovations. It highlights that installed base does not necessarily only mean reduction of innovation possibilities and inertia but can present a promise for new service innovations which can influence both diffusion and higher acceptance. However, there seems to be nuances of installed base that needs be further explored in relation to service innovation. The relationship between installed base and the flexibility facilitated by a service is an appealing area of interest.

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