

# User-Centered Service Innovation for Commercial Vehicles: Plugging in the Handyman Market



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**Abstract** There is no vehicle segment where personalisation is as common, as for Light Commercial Vehicles. These vehicles are used for a large variety of tasks, supported by an ever-increasing number of new services. For Light Commercial Vehicles, one of the most interesting market segments from the perspective of service innovation and product personalisation is the handymen market. Handymen have a very strong relationship with their vehicle, highly specific mobility needs depending on their specialisation, and spend a lot of time personalising their vehicle.

This paper presents the Plugs concept. The Plugs concept is a new open-source approach to deliver personalised services for Commercial Vehicles to the handyman market. The concept was created based on user research and service innovation done by the TU Delft Design School in collaboration with Ford stakeholders from the Research and Innovation Center in Aachen. To deliver a broad variety of personalised hardware- and software-based services, called Plugs, to small handyman businesses in a cost-efficient way, Ford should build a strong open-source platform strategy around the core Ford Transit product, involving third-party developers and handyman lead users in the creation of these Plugs.

**Keywords** Service innovation · Light Commercial Vehicles · Handymen · Mass customisation · Open-source · Platform strategy · Plugs concept

## 1 Introduction

In one famous moment, Henry Ford said about the Ford model T, one of the first mass-produced consumer automobiles, that ‘any customer can have the car painted any colour that he wants so long as it is black’ [6]. As the automotive industry

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is challenged by trends like digitisation, access over ownership and environmental concerns [8, 13], this top-down approach of selling one car to all is no longer realistic, and the pressure to innovate is high. Instead, a focus on product tailoring and creating loyalty through service offerings and building long-term customer relationships is becoming increasingly important for automakers [13]. This means that at the same time, a switch from a focus on products to a focus on services or service innovation is necessary.

Automakers have started providing a broader variety of options that allow for the mass customisation of cars and vans. Mass customisation aims to deliver personalised products that answer real user needs, with the benefits of mass production for the provider of the goods or services in question [12].

In the automotive industry, mass customisation is still mainly achieved through assembly line production: a variety of product and service options are assembled around the core product that is manufactured on a moving production line, not too different from the original Ford model T production line. During this process, standard parts and subassemblies can be put together to make more ‘personalised’ offerings: common vehicle platforms and chassis are used, which can be chosen in a colour of preference and upfitted with certain automotive features or accessories, picked by the customer. Supply is created through upfront estimates of buyer preferences. Aftermarket services like maintenance contracts, in-car connectivity, car insurance and small adaptations to vehicles are provided through dealerships. And so, automakers can provide customers with more personalised vehicles.

There is no vehicle segment where personalisation is as important as for the Light Commercial Vehicles market. The Ford Transit range highlights this well, considering the Transit Custom alone comes in more than 5000 possible variations.

Light Commercial Vehicles are designed and constructed for the carriage of people and goods and have a maximum mass not exceeding 3.5 metric tons [5]. These vehicles are used by many different businesses and users for a large variety of tasks, in turn demanding an ever-increasing number of new product variations and services. Besides choice from a broad spectrum of automotive features, not only van exteriors but also complete van interiors are adapted through upfitting services to fit highly specific customer needs. Furthermore, a small range of special services is available like telematics, leases and maintenance. These services, however, are mainly focused on big fleets of vehicles, over smaller businesses. This means that the main beneficiaries of such services are also the fleet or business managers, over the end users of the vehicle. The Light Commercial Vehicle market, however, consists of many small market segments [1].

For Light Commercial Vehicles, one of the most interesting market segments from the perspective of service innovation and mass customisation is the handymen market. This is a user group that can be addressed through a limited set of marketing channels, whilst on the other hand, it has a very large variety in terms of specialisation and thus the needs and wishes for their van. Furthermore, research by the Freight Traffic Control of the city of London showed that more than 32% of all Light Commercial Vehicles in Britain in 2014 were accounted for by handymen businesses: small construction (plumbing, building, plastering and others) and

electrician companies [1]. As such, handymen form a very interesting and big user group for service innovation around Light Commercial Vehicles.

Furthermore, many handyman businesses lease or buy their vans from the secondhand market via dealerships or auctions [1]. As such, handymen and handyman businesses are a very interesting group to provide services to that enable customisation of the vehicle, even if they are not the first-time user or owner of said vehicle.

The Ford Motor Company has a lot of experience in the field of traditional product innovation. The year 2016 was a record year in number of inventions that were disclosed by Ford employees. However, with the transformation from an auto to a mobility company, Ford is looking into opportunities where not only products play an important role but also services [8]. Service innovation is less well known inside Ford. To this intent, Ford has recently started collaborating with the design school at the Delft University of Technology (the faculty of Industrial Design Engineering) on the topic of service innovation for the Light Commercial Vehicle market [10]. The aim of this university research project was to come up with user-centred opportunities for service innovation based on research with end users.

Below, one such service opportunity is presented, as a demonstration of what service innovation can add to the ever-increasing customised and personalised offerings of mobility companies like Ford.

## 2 From User Insights to Service Opportunities

As a first step in this demonstration, insights were collected on the user profiles of handymen [9]. This has been done through contextmapping. Contextmapping is a generative Delft design method in which contextual research is done with real users to gain tacit knowledge about the context and current use of a product [15]. The contextmapping with handymen included shadowing, interviewing and the development of personas and user journey maps [9]. The results of the research were then analysed to find out what is important for this user group when it comes to their van and their handyman business and to discover differences between handyman niches.

The contextmapping was done with three different types of handymen working in small businesses: plumbers, electricians and carpenters. Of each niche two handymen were followed in their daily work. Some were employed handymen, others an independent handyman that owned their own business. An example user journey of a typical electrician's day and his tasks can be seen in Fig. 1.

Based on this first study, several directions were identified for interesting service innovations for handymen. The contextmapping research done by Hnatiuk [9] showed that there are many opportunities for mass customisation services to support the lives and livelihoods of handymen. To give some insight into interesting opportunities, the most important research findings are now presented [9].





**Fig. 2** The different functions of a Handyman Commercial Vehicle (Source: Hnatiuk 2016 [9])

A handyman's van is not only a means to get from A to B; it is also a toolbox, office, lunchroom, stock room, business card and a source of professional pride and corporate identity (see Fig. 2). In short, handymen spend a lot of time in or in close proximity to their vans. Because of this handymen often tailor their vehicles to their needs and have a very strong relationship with their vehicle. Interiors are custom-made or chosen after a long period of scrutinising different options, to accommodate the different functions of the van throughout the day. Van exteriors are often adapted as well, for instance, with stickers, to display the handyman company information, or with roof racks to add more stock space. Therefore, supporting a flexible van set-up through mass customisation services that focus on tailoring and upfitting of existing vehicles is a key opportunity for automakers.

In addition, there are many opportunities for services that increase handymen business efficiency through connectivity and automation. Even though handymen are proud professionals that want to spend their time on their core job – building and repairing – they also want to stay in control of every aspect of their job and/or business. This means that throughout the day, they keep track of used materials, current inventory, working hours, driven kilometres and many other things themselves. This is often done by hand. At the end of the day, most

handymen end up ordering new materials and stock themselves and spend copious amounts of time doing more bureaucratic tasks and desk work, like making invoices and receipts, and logging working hours. Herein lie many opportunities for mass customisation services around the digital aspect of the handyman business: automated tracking and processing of business information through a connection with the vehicle. An example of this could be to automatically track and process the driven kilometres and support an easy connection between the collected vehicle data and the handyman back office. As every handyman business uses different software or systems for their management processes, a wide range of tools would need to be supported.

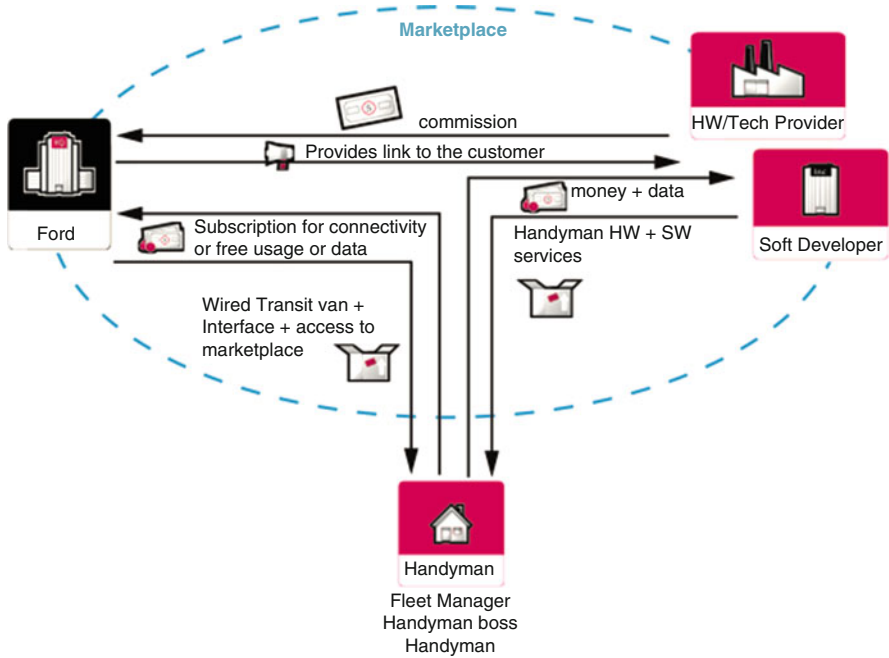
One of the main outcomes of the collaborative sessions was that there is an enormous potential for the aforementioned connected services that help to improve handyman business efficiency. All of these services, however, require a certain infrastructure and connection to the vehicle and/or to vehicle data. This led to the insight that there is a need for an infrastructure that enables services and smart hardware to be ‘plugged into’ the vehicle and for a new strategy to enable the mass customisation of Light Commercial Vehicle services – and so the Plugs concept was born.

Employees from Ford England and Ford Germany and professors and researchers from the TU Delft closely collaborated to further analyse and elaborate on the Plugs concept in several design and prototyping sessions, using different ideation and storyboarding techniques. The main tool used for ideation and storyboarding was the Scenes tool, designed by SAP [14]. Furthermore, literature research and studies of existing similar innovations in different domains were done to identify best practices, which will be discussed in the next section of this paper.

### **3 Mass Customisation for Commercial Vehicles: The Plugs Concept**

The Plugs concept consists of a special Commercial Vehicle design that provides an infrastructure inside the vehicle, to which both software and hardware can ‘connect’. This means that the infrastructure provides both a data network and a power network throughout the vehicle.

Third parties can then deliver singular software or hardware solutions to the handyman end user through the Plugs marketplace. A schematic overview of the value exchange between stakeholders can be seen in Fig. 3. The Plugs concept could thus be compared to what an app store is to a smartphone. Users can choose different add-ons, called Plugs, to personalise their Commercial Vehicle. Through a combination of smart hardware and software Plugs, live (vehicle) data can be used to automate, track or help with the aforementioned tasks and problems that the handyman runs into during the day around his van-based business.



**Fig. 3** An overview of the value exchange between involved stakeholders in the Plugs marketplace (Source: Spierings 2017 [16])

The Plugs concept is backed up by a platform strategy, in which Ford, the automaker, focusses on the core product, and other parties can provide smaller software- and hardware-based services, known as Plugs, around this core product through a development platform. The existence of many Plugs will lead to a higher value of the core product.

### 3.1 Involving Third Parties in the Plugs Concept

To successfully build Plugs vehicles, Ford would need to fulfil certain capabilities that are required when developing mass customisable products and/or services. This is to provide ‘the capability to manufacture a relatively high volume of options for a relatively large market (or collection of niche markets) that demands customisation, without tradeoffs in cost, delivery and quality’ [12]. Logically, then this creates the need to involve other parties, like technology start-ups and software developers, to make for more efficient production.

Together with Ford RIC stakeholders, three main benefits in involving third parties to create the Plugs concept were identified:

1. Cost and quality effectiveness: each partner/developer works on features in their area of expertise, leading to higher cost effectiveness in terms of R&D and supply chain, and a higher quality of the partial solutions that are offered as they have been created by domain experts.
2. Higher speed of innovation possible: many small solutions and connected features can become available with a shorter time to market, as many features can be developed at the same time by different parties who already have expert knowledge on a topic. This will also lead to a high level of variation in the features.
3. Democratisation of new Commercial Vehicle technologies: in the case of big automotive OEMs, low cost effectiveness and low economic viability of working on services for small user groups mean that services are usually created for big fleet clients or big generalisable user groups. By creating an open platform, connected solutions would be available for smaller Transit user groups and niche markets that would otherwise be overlooked. In the case of Ford, this democratisation also fits well with Ford's brand image of accessibility and affordability: making mobility available to all.

To work together with third parties, the only feasible approach would be to open up certain company boundaries, to enable the inflow of outside knowledge and contributions from other parties and domains, defined as open innovation [3]. The next section of this paper explores how to create a successful open innovation method around the Plugs concept to achieve high-quality, user-centred and economically viable Plugs services.

### ***3.2 Creating an Open Platform Around the Plugs Concept***

Three business scenarios were created to explore possible innovation models around the Plugs platform, with the aforementioned storyboarding tool Scenes:

1. A closed supplier relationship in which Ford outsources the creation of previously defined services to third parties
2. A cocreation partnership in which Ford works together with third parties to create innovative new services and
3. An online community-led open-source platform in which third parties are free to develop Plugs for Commercial Vehicle users

In sessions with Ford employees, the different storyboards were evaluated, and the third scenario, an open-source platform, was chosen for further development.

Given the potential value of the Plugs concept and the hesitance that resides around open innovation in the automotive sector, the big question then is: how can Ford set up a platform where third-party developers will start and continue to provide useful Plugs to handymen, whilst overcoming open innovation barriers and typical pitfalls in open-source projects?



A broad study of Ford OpenXC, the iOS app store and literature on open-source development lead to insights on the failure of Open-Source development platforms.

Ford has some experience with open-source projects. An interesting previous innovation is OpenXC. OpenXC is an open-source hardware and software platform that enables the extension of the use of vehicle data beyond common vehicle diagnostic purposes, as live vehicle data can be used as input for self-built apps [7]. To access this vehicle data, an OBD-II plug can be used that uses a software module to enable the extracting, reading and usage of live data from the vehicle [7]. Users of OpenXC can then incorporate vehicle data in their apps or products to provide extra functionality. Examples of vehicle data that are available through OpenXC include driving speed, engine information and brake information [7].

As it appeared through research with Ford stakeholders, OpenXC is not used that much by external communities or for commercial purposes. It is mainly used as an internal Ford research tool for new automotive features and in the external environment amongst a select group of automotive university researchers. Reasons for low adoption are the limited sets of vehicle data available, difficulties in getting to know the OpenXC platform and its possibilities online and the small range of cars and thus users that can be targeted with OpenXC.

Apple's approach to open-source service development is quite different. The iOS app store provides clear developer documentation online and heavily shapes the development process through strict guidelines for developer's apps and mandatory tools, hand-in formats and programming languages. However, this approach can also form a high barrier to entry for new developers due to the level of time needed to get started and the limited freedom developers have.

Literature research further underlined typical reasons for failure of open-source projects [4]. All research results have been summarised below.

Open-source platforms often fail due to the following reasons:

- Failure related to product security:
  - In the automotive industry, open standards and open software mean that the CAN bus, the control system of the car and/or certain vehicle data becomes available or accessible. This poses risks for the hacking of vehicles, something automakers want to avoid at all costs.
  - In open-source development, the lines of who built certain software or hardware are blurred, as it is built on creative common principles that any information can be adapted by any active participant of the community and returned to this community for the benefit of the end product [4]. Software or hardware solutions are thus often cocreated or coevolved, which can lead to IP issues and tangled ownership of contributions [4].
- Failure related to business strategy:
  - Many open-source projects fail because there is no clear revenue or business model behind the project. In commercial open innovation projects, it is highly important that all stakeholders gain from their contributions and work towards the same goal [4, 11].

- Marketing can also become a reason for failure in open-source environments as development thrives when there is a big and active community. Great open-source propositions can fail if the benefits of participating in the project are unclear, or it is difficult for potential developers to join, as research into OpenXC demonstrated [7]. Attracting users and developers to the open-source product or platform is very important for success [4].
- Failure related to a lack of participation:
  - Open-source projects can fail when there is no real user or developer need for the core product or service around which the project evolves [2, 4]. This is often the case with a lack of market or end-user understanding [2, 4].
  - A lack of a vibrant user and/or developer community is one of the biggest causes for failure in open-source projects, as the absence of a strong group of users makes it unattractive for developers to participate in the project and vice versa. This phenomenon is known as a network externality. Network externalities come to play in two-sided systems, where the value of the system increases or decreases with the amount of end users, on the one side, and services, products or developers on the other side [11].

### 3.3 *Overcoming Open-Source Challenges*

To be successful, the Plugs concept needs to overcome the abovementioned challenges.

*Overcoming Product Security Challenges* For Ford a certain level of secrecy and security can be maintained by using Application Programming Interfaces (APIs) to establish which vehicle functionalities are opened up to developers for the creation of applications and products. For third parties that want to contribute to the Plugs platform, clear guidelines and rules around intellectual property of Plugs and access to the vehicle will be needed. It will be more attractive for third parties to participate and contribute if they maintain the rights to their own Plug and get a broad level of access as not to block third-party creativity and allow for more innovative Plugs.

A way for Ford to create clear guidelines on the terms of collaboration could be through a membership contract, IP Policy and/or EULA (end-user license agreement), as is common in open-source software settings.

All Plugs should be quality-controlled by Ford in terms of vehicle security and user data privacy to make sure that security of solutions goes both ways, for the developer and the handyman end user.

*Overcoming Business Strategy Challenges* Plugs should provide valuable solutions to real user needs or problems, to create a vibrant community of handyman end users. Close collaboration between the different stakeholders during the development and implementation phase of the Plugs platform is important to establish a

strong benefit for each stakeholder involved. Different business and revenue models would also need to be explored.

Furthermore, strong marketing is needed to attract both developers and end users. This could be done in the form of initial Plugs showcases. From a user perspective, it is important to highlight the advantages of a Plugs Commercial Vehicle: a more efficient and pleasant handyman business. For developers it is important to provide correct and good APIs and documentation, to make it easy to get started with the development of Plugs by providing all necessary information and to link to the end-user group. To make sure developers and the handyman can connect well, a mediating layer of lead developers is needed on the development platform to aid in communication. These lead developers can also provide support to developers during the creation of Plugs.

*Overcoming Participation Challenges* Attracting initial Handyman users and third-party developers to the platform is the most important step for the implementation of the Plugs concept. Before launch a certain amount of ready and attractive Plugs should be available to attract handyman users. In turn there should be a strong incentive for third-party developers to join the Plugs platform, to create a vibrant community of developers. This can be done by showing the interest of the end-user group, underlining the vast amount of Transit users, making the creation of Plugs easy through clear documentation and APIs and offering clear monetisation options for the use of Plugs.

Through network externalities, the presence of a big developer group will lead to a higher interest of the end-user group and vice versa [11]. So, the Plugs platform will continuously increase in value once it has more developers, users and Plugs.

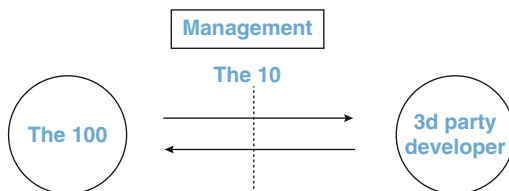
### ***3.4 Facilitating an Open-Source Development Process***

The proposed approach to create a successful open platform is to involve handymen and third-party developers in the complete development process of creating, testing and commercialising Plugs in a Ford-regulated process with clear guidelines.

In the first phase, the problems and challenges handymen are facing can be used as a starting point to attract developers and create showcase services to pre-populate the Plugs marketplace. With many Plugs add-ons available, it will be more attractive for handyman users to adopt the new Plugs vehicle. A lead user group of handymen, as well as third-party developers, can then be invited into a community to discuss and explore needs and challenges together. The lead user group, called the 100, consists of Ford Transit users that have been picked for their profile.

In a second phase, once ideas for apps and add-ons are to be prototyped, the handymen 100 community can be involved in (beta)testing prototypes and can provide (direct) feedback to third parties, which should be mediated by a group of lead developers that are also handyman domain experts, with previous experience

**Fig. 4** Overview of the collaboration model between stakeholders on the open-source Plugs development platform (Source: Spierings, 2017)



of building Plugs. This group of lead developers, called the 10, is to be scouted and employed by Ford.

In the third phase, the commercialisation phase, Plugs are offered to the Light Commercial Vehicle user community through the Plugs marketplace, and every handyman can use them to personalise his or her van.

Meanwhile, as the Plugs platform matures, it should become increasingly more open to the broader public: any interested user or developer should then be able to participate in the development of new Plugs for the Ford Transit. Finally this will lead to the collaboration model as shown in Fig. 4, where a Ford management team monitors the overall platform success and steers the platform strategy; where third-party developers create novel services, in collaboration with the 100 handyman lead users; and where the 10 lead developers, employed by Ford, moderate the connection between the handyman lead users and third-party developers and control the security and quality of new Plugs [2].

## 4 Conclusion

The best way forward to offer mass customisation services to the Commercial Vehicle market is to create an open platform on which multiple parties can come together to create services: end users, third-party software developers and start-ups and automotive OEMs. There is no other cost- and/or resource-effective way to offer a broad variety of personalised high-quality services to smaller businesses and user groups, like in the handyman market. However, for an automotive company like Ford, developing an open platform is controversial.

To be successful in offering useful Plugs, it is important to attract a large developer and user community that can easily link to each other to create novel services. This is most feasible through an open innovation platform.

Involvement and interest of the target group of handymen on the Plugs platform are expected to be the most important success factor, as this will attract third-party developers to contribute and develop services, create the basis for a viable business and revenue model and lead to Plugs services that provide value to the end user.

Ford can focus on the core product – the Ford Transit – and the vehicle’s special electrical set-up whilst applying a platform strategy. Third-party developers and end users themselves, who are domain experts, are then invited to develop features and value-added services for the Transit.

## 5 Discussion and Implications

To become a market leader after introduction of the Plugs platform, a future strategy could be to drive open innovation in the Commercial Vehicle market even further. However, some organisational barriers may make it hard to do so.

*Driving Open Innovation by Eliminating Customer Lock-In* One way to increase attractiveness for third-party developers and end users to join the Plugs platform could be to remove lock-in effects. In the automotive sector, vehicle standards are bound in secrecy and incompatibility. By opening up the vehicle system and providing an open standard, platform fragmentation between new models and/or brands could be eliminated. For users this would mean that they could use certain Plugs, even if they do not own a Ford Transit. For developers this would mean that their potential user group grows vastly, which would make it significantly more interesting to create car-specific Plugs or 'apps'. This strategy, however, would be highly controversial in the automotive sector.

*Challenges for Adoption of Open-Source Projects Within Ford* As the Plugs concept is built around an open platform, it is also important to overcome certain internal company challenges during implementation. It is advised to start a separate business unit for the Plugs platform, to maintain a certain distance from standard automotive innovation processes that can be highly monitored, arduous and slow. It will be important to maintain a strong link between separate business units to feed back valuable learnings on Commercial Vehicle usage to the Ford mother organisation.

Partially opening up the vehicle to third-party developers could lead to resistance from the Ford internal community or not-created-here syndrome. Furthermore, a new separate business unit could be received with great scepticism by internal stakeholders.

*Evaluating Platform Success* Another challenge is the perception of the platform's success: Ford should make sure the Plugs platform does not get evaluated in the same way as running projects or current car models. The separate Plugs business unit should perform as a start-up and should use new and different KPIs to measure the success of the Plugs platform. Evaluation should avoid quantitative metrics like direct and immediate profit made through the Plugs platform but focus rather on the creation of business value with the new open innovation approach.

For Ford one such example of created business value is that the Plugs platform would be an insightful way to learn more about its Commercial Vehicle users and their use of the vehicle and existing services. This knowledge could then be used to design better future Commercial Vehicles and mobility services, targeted at end users.

*Remaining in Control* A certain level of control over the actions of third-party developers, the suppliers of Plugs, would be mandatory to fit with Ford's strategy and vision.

Maintaining an in-vehicle Ford user experience towards users is important in the current automotive market. To make sure that happens, guidelines for potential user interactions and interfaces – still to be designed – could be used.

Besides APIs and contracts or agreements, proper moderation of the online community on the Plugs development platform is also necessary [2]. Lead developers, the 10, employed by Ford could also filter out irrelevant contributions, potentially steer the development of certain Plugs to make new innovations more valuable from a Ford perspective and even scout for popular services to professionalise them in future Ford Commercial Vehicles. However, these things should be done very carefully as not to scare away potential developers or cannibalise Ford's own business.

*Contribution of This Project and Further Development of the Concept* The Plugs platform would make a broad range of telematics services, automotive features and connected services available to and centred around the end users of Commercial Vehicles. Currently, connected services are targeted mainly at fleet or business managers and focussed on staying in control of operations and on monitoring driver's behaviour and their performance. However, contextmapping research with handymen has shown that there are many benefits for end users of Commercial Vehicles to be gained as well, through connected services.

As automotive companies are shifting from a product to a servitisation approach, the creation of long-lasting relationships with customers is increasingly important. Therefore, it is important to also shift away from an automotive sales and after-sales perspective to a perspective of providing value to users over the complete lifetime of their vehicle. The Plugs platform would help to provide this value to the end users of Commercial Vehicles by offering a standardised vehicle that can be upgraded with new quality automotive features and connected services at any moment.

For successful implementation of the Plugs platform, further development and a trial should be run on how to collaborate with third parties and how to set up the open platform in a way that is beneficial for all stakeholders involved. For a trial it would be interesting to involve start-ups with new technologies to gain insight into the necessary information and guidance needed to create successful Plugs and to involve handyman businesses to gain further insight into end-user needs.

After an initial trial and introduction for the handyman market, the Plugs platform could be expanded to different Commercial Vehicle niche markets and mobility domains. In the future personalisation options could then be provided for different van-based professions, ride-sharing services, autonomous vehicles or passenger cars.

With an increasing complexity in user needs, the need for open innovation, partnerships and open standards in the automotive sector is growing. Furthermore, automakers need to gain more experience in service innovation, through trial-and-error and switching to a user-centred development process. For Ford, the Plugs platform could be a first step in that direction.

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