# Product Digitalization in the Automotive Industry

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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# Introduction

Subscription services have become an integral part of our daily lives, and they are all around us. From streaming services like Netflix, Amazon Prime, and Spotify to clothing services like Stitchfix, subscription-based business models can come in various forms and are becoming increasingly popular. With this increased popularity, there are unexpected ways that subscription services have integrated into our lives. For example, imagine that after you buy a house, after taking a loan and making the down payment, you must pay a subscription fee to unlock certain areas of the house or even functions such as air conditioning. This hypothetical experience may be less than satisfactory for most individuals, but it is not too far from the truth. Yet, subscription services have somehow found their way into our cars, gating certain services and functions behind a perpetual paywall. This paper seeks to investigate such phenomena and explore the implications of it.

Offering services in the form of a subscription can bring a wide array of benefits to the user and the service provider. These services offer consumers the convenience of regular access to products and services at a predictable cost without worrying about managing individual purchases. For the service providers, providing their service as a subscription brings in a constant and predictable revenue stream. Furthermore, service providers do not have to worry about individual sales and can leverage the scale they provide.

The word “subscription” is often used interchangeably with the concept of software as a service (SaaS), but there are some fundamental differences between the two. Software as a Service refers to a method of offering software services to end-users through internet interfaces, instead of having the software installed directly on a computer. In contrast, subscription services

refer to the business model where individuals pay a recurring fee to use a service for a specific time (Hanika, 2015). Many services, such as Netflix and Spotify, are both software as a service and a subscription service. While some SaaS services, such as AWS Cloud Compute, are on a pay-as-you-go service model. For any of the subscription services offered through the web, such as streaming or textbooks, SaaS is the foundation that allows it to happen. Such is the case for the appearance of subscription services in cars. Advanced wireless technologies allow for functionalities in vehicles to be controlled through the web and enable manufacturers to connect with the car long after the sale. Thus, born the concept of "Connected Features" or "Features on Demand." For example, BMW has offered its heated seats and heated steering wheels as a subscription service (Charlton, 2020). In another example, Tesla has limited the range of its batteries for lower-end car models despite having the same battery model and capacity as its higher-end siblings (Fung, 2017). It is hard to gauge this application as an innovation that will change the automotive industry or an act of over-engineering to hop on the subscription bandwagon.

In this paper, I argue that automotive manufacturers are pursuing subscription services as an act of closure through a redefinition of the problem, justifying it as an act of innovation despite consumer desire for simplistic service. First, I will provide an overview of the literature on software as a service and review its benefits, developments, and applications in the automotive industry. Next, I will explore the implications of software as a service on our sense of ownership and digital extensions. Then I will analyze PR and marketing materials from automotive manufacturers, op-eds, and consumer surveys to analyze the discourse between these two groups. Through this analysis, I find that auto manufacturers believe that digitalizing the car is a necessary and innovative step for the industry, where many either have already indulged in

subscription services or have announced that they plan on adding such features. On the other hand, consumers believe this is an act of "nickel and diming" from the manufacturers and find it unreasonable to pay continuous payments after their initial purchase and mortgage. Finally, I will end with a discussion on how auto-manufactures have enacted closure on SaaS through a redefinition of the problem. I strongly urge them to take a step back to reconsider the application of SaaS and subscription services.

## Literature Review

For one-time purchase software programs, such as purchasing a game CD, once the user pays a one-time, upfront fee, they can access its functions as long as it resides on the computer. However, with the emergence of software as a service (SaaS), users can choose to obtain software capabilities as a service by paying a continuous fee for the duration that the service is needed (Kaur et al., 2014). In this model, users will no longer be responsible for managing the hardware or platform, resulting in many benefits including reduced operational overhead, eliminating the need for maintaining hardware, and lowering idle resources wasted due to overcapacity (Gong et al., 2010). Furthermore, with the service offered through the internet, the user is no longer confined to the physical space available and can access the service if they have a connection with the web. Finally, having the software managed by a specialized third party increases availability and security (Ajeh, 2014). One prime example demonstrating the benefit of SaaS is the services provided by cloud service providers, such as Amazon Web Services (AWS) and Azure. These cloud service providers rent out computing, storage, and networking powers through a pay-as-you-go service model. Each user can customize the service to their own needs, not having to worry about throttling when demand rises or paying for too many servers when demand shrinks. The SaaS providers also hire security specialists and set up redundant servers in

different geographical locations to make sure the data on the cloud is secure, reliable, and available (Microsoft, 2022). Features like this would have cost a fortune for each individual company to set up, but cloud service providers are able to capitalize on economies of scale to make it affordable, making it a win-win for both the user and the provider. All in all, employing SaaS reaps a plethora of advantages and has many applications in different industries.

Software as a service can go beyond pure software capabilities and venture into abstracting services that were once physical. Industries can abstract their service through software and provide it on a platform to a broader audience. The most prominent of such applications is in media subscription services, where users can pay a one-time fee per unit of time (month/year) in exchange for a library of content they can access for the desired duration. This form of service has proven to increase general social welfare and consumer surplus. On the supplier side, they can better manage the trade-off between price and quality (Randhawa & Kumar, 2008). Entertainment initially stored on physical medians, such as vinyl records, cassette tapes, and CDs, is now converted to digital 1s and 0s to be offered by the platform. Netflix, for example, allows users to enjoy thousands of movies and shows across different devices with a monthly payment. Users of Netflix do not have to worry about looking for individual DVDs, storing all the movies, or paying for something they do not like. They can simply log in to their account on a device with internet access to enjoy the service. This mode of service is much more convenient compared to the traditional method of going to a physical store and renting individual DVDs. Digitalized goods have changed products and services from what we can own and physically touch to something that we can access.

Further greying out the line between physical service and digital service is the appearance of SaaS in the Internet of Things (IoT) industry. In IoT as a service the physical device is in close

proximity to the end users, but its functionalities are abstracted and exposed as a service. This includes subscription services like the Ring doorbell, where the actual camera and electrical wiring of the doorbell are irrelevant to the consumer. They enjoy the service through the software on their phones. Like in SaaS, the end user does not need to be burdened with the knowledge of maintaining or setting up the service to use its functionalities (Mandal et al., 2019).

With SaaS infringing upon the physical space, the definition of ownership has been convoluted. Do the contents belong to the user or the provider? What consumers perceive as ownership in a subscription service is often not owned by them but licensed to them. Consumers may download an eBook on their Kindle or a movie from Netflix but do not own any aftersales rights to those content, such as sharing and resale. There have been cases where books have disappeared from consumers' libraries without warning (Perzanowski & Schultz, 2016).

Along with ownership, users' auxiliary rights, such as the right to repair and the right to continual usage, have been jeopardized. When we buy a physical book, we can expect to tape a page back together if it rips, and if we leave it in a garage for 20 years, we can expect it to be there still. However, engineering practices have prevented this concept. John Deere tractors have mechanical devices gated by software, so repairs cannot be done in-house by farmers and must be done by certified technicians authorized by John Deere. Phone companies only promise a few years of software updates and support for their device. iPhone's purchase agreement explicitly highlights that the iOS operating system is licensed to the user (Schultz, 2016). The digital world has changed our self-extension and the concept of ownership. In the subscription model, we have possession without ownership, which may influence our sense of self-extension and connections with the content we consume. In their paper, Belk challenges the necessity of ownership in this world of collaborative consumption, putting doubt on the concept that "we are what we own"

(Belk, 2013). It is imperative for us to keep in mind what has given up at the same time as we gain all these benefits of SaaS.

Finally, this paper draws largely on the social construction of technology (SCOT) framework described by Pinch and Bijker (1984). SCOT heavily emphasizes that technology does not exist in a vacuum; it suggests that technology and society are co-constructed. They argued that technological development is not a straightforward path; instead, "the developmental process of a technological artifact is described as an alteration of variation and selection" (Pinch & Bijker, 1984, p. 411). An essential concept in SCOT is relevant social groups, which refer to groups that share the same meaning in response to technology. This division into groups means more than just users and producers. Users can be further divided into those who want heated seats and those who do not. Other car manufacturers and regulators in the market may also respond to this technology differently. There are two stages to the methodology of SCOT. The first is to show the interpretative flexibility of technology, not only in the perception of it but also flexibility in its design. SaaS has demonstrated this flexibility as many industries have adopted it, and it can abstract different aspects of a product to provide a service. The second stage of SCOT is closure. I am particularly interested in closure by redefinition of the problem, where the meaning of the technological solution has been translated into another problem. In this case, car manufacturers have translated software as a service – the technology - to provide heated seats – the problem. This STS field and method is fit for analytical usage in investigating the difference between industries on the topic of SaaS services. I will use this framework to analyze how distinct relevant social groups find closure, or lack thereof, in applying this technology to automotive services. Additionally, I would like to explore the social implications of this move by industry leaders.

## Methods

To answer my research question, “How have auto manufacturers enacted closure by redefinition of the problem around software as a service model” I first gathered primary sources such as press releases and marketing materials from auto manufacturers that explain their reasoning for digitizing their products. Then, I will gather secondary sources from opinion editorials and news articles about these services. Due to the relatively new adaptation of SaaS in the auto industry, I will mainly be relying on these sources instead of academic papers. PR and marketing materials will give a firsthand account of how manufacturers find closure in providing functionalities in a SaaS model. These materials will explain auto manufacturers reasonings and motivations behind such decisions. Opinion editorials are an outlet for the public to express their opinions on topics; this will give insight into the public’s response to such offerings and their concerns about the technology. Finally, in my review of works of literature, I will use discourse analysis to examine the push-pull relationship surrounding technology. Particularly how relevant the offering of subscription services impacts social groups.

## Analysis

Pioneering automotive manufacturers, like BMW and Tesla, claims that a car connected through software subscription services will bring many benefits to its users. In an article relating to BMW’s “most comprehensive vehicle software upgrade to date,” BWM officially explains some of their reasoning for continual virtualization of service in their cars or “functions on demand,” as they called it. BMW’s main advertising points of functions on demand were “flexible offers, available immediately, simple to book and easy to use,” which shares many of the advantages of SaaS. They also claim additional benefits of this practice in after-market sales.

A second buyer can optimize spending by tuning these subscriptions and paying for only their desired features (Kapsaskis, 2020). Tesla, seen as the trailblazer in applying SaaS in cars, claims that their software updates are "designed to improve functionality, reliability and occasionally add new features to your car" (Veries, 2012). Even car companies not providing subscription services have announced their plans to expand into software-enabled services going into the 2020s. General Motors announces intent to explore connected features claiming that the feature will "Unlock[ing] opportunities from EVs, software-enabled services, and new businesses" (Warren, 2021). Audi has announced a collaboration with Mojio, a SaaS provider, to bring connected services to their cars (MacDonald, 2021). The automotive industry believes that digitalizing and increasingly connecting their car to the internet is right. They claim better economic savings and better performance from providing services through the web.

There could be many additional motives behind manufacturers pursuing software subscription services beyond innovation. One possible motivation is the trendiness of "subscription" services. Subscription services have proven to be a success story. Two of the most prominent figures in the subscription business are Netflix, valued at around $150 billion, and Spotify, valued at around $25 billion, which have succeeded in disrupting the original market ecosystem with the subscription approach (Yahoo Finance, n.d.). Additionally, according to Google Trends search results for the terms "Subscription" and "Software as a Service" have nearly quadrupled since 2004, as seen in Figure 1, indicating the rise in their popularity. Pioneering manufacturers may seek to borrow from such success by implementing subscription services in their cars. Following this trend could boost the public image as an innovator and pioneer and, in return, boost sales and revenues. Offering services as a subscription can be seen as an act of closure through a redefinition of the problem through the lens of SCOT. As publicly

traded companies, the main objective of these automotive companies is ensuring the profits of their shareholders. In an effort to make their products more appealing, resulting in increased units sold and profits, the auto manufacturers redefined the problem from "how do we offer better services" to "how can we be seen as innovators and boost brand image", and SaaS is their solution. Car manufacturers may find closure in offering subscription services, but the consumer side tells a different story.

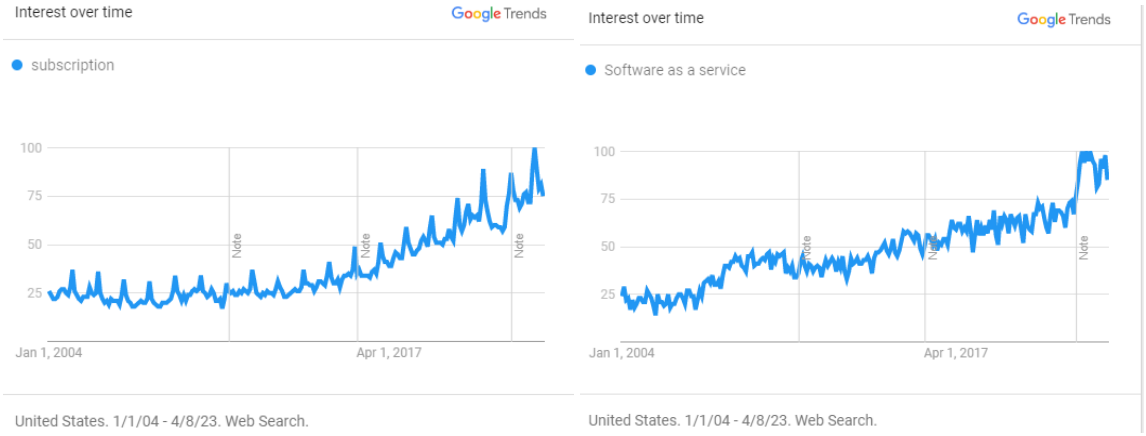


Figure 1. Search trends for "Subscription"(left) and "Software as a service"(Right). (Google Trends, n.d.)

Consumers are not satisfied with the need to pay a subscription fee for their cars. In a survey of 217 consumers done by Cox Automotive, 75% claim that they are not willing to pay for subscriptions in cars. Of the 25 percent of people willing to pay for subscriptions, creature comforts, and safety features were among the top features to be included in the cost of the car (Krebs, 2022). Response from news outlets shares a similar sentiment against such practices, particularly sparked by BMW offering its heated seats as $18 per month subscription. Major news outlets, such as *The Washington Post, The Wall Street Journal, CBS News, New York Post, Forbes,* have either responded negatively or shown people react negatively to such offerings (Bryant, 2022; Prang, 2022; Picchi, 2022; Wayt, 2022; Koetsier, 2022). Many believe that the

cost of the heated coils will already be factored into the car's initial price, even if they will never use it. Words like "microtransaction hell" and "nickel and diming" were used(Picchi, 2022; Westbrook, 2022). Consumers find paying for a service that was once a standard in their cars unreasonable. They do not believe the benefits of SaaS in this situation can justify paying a subscription fee; thus, they did not find closure in the offering of functionalities in the likes of heated seats as a connected service.

Despite the backlash on BMW's heated seats incident, some have argued for the economic soundness of offering connected services in the car. Frank Jung, an editor for ATZ Worldwide (a leading magazine in automotive development with 120 years of history), compares Tesla's music streaming subscription with Spotify, claiming that the Tesla package includes satellite maps and other accessories making it a better deal economically (Jung, 2022). Their argument fails to acknowledge the fact that integration with Spotify and functionalities, such as heated seats, was already the standard in the recent car. Why was there a backtrack to pay a subscription fee to use Spotify, which the consumer already had to pay a subscription fee? Furthermore, after a deep dive, there seems to be a lack of economic explanations from the auto manufacturers explaining whether the cost of the heated coils was included in the initial cost of the car. All in all, the consumers and manufacturers seem to disagree on the closure of offering subscription services in car features.

## Conclusion

In a world where digitalization seems like the general trend, we need to be aware of the process and, where it goes, who should be included in the conversation about the digitalization of goods. While SaaS does provide many benefits, it may only be suitable for some features. For

example, auto manufacturers claim that connected features will enhance their availability, functionality, and ease of use. However, only limited benefits apply to mundane features like heated seats. Heated seats are just metal coils with electricity running through them, sometimes with fine adjustments to how hot the coils can get. The coils' availability, functionality, and ease of use are not further improved by connecting them to the web; this only adds additional points of failure and complexity to the system. In this specific case of heated seats, it seems like a case of over-engineering, attracted by the trendiness of subscription services.

Furthermore, I want to implore the readers to think about extensions of such practices in other car features. How it might affect the livelihood of repair workers, and how it might affect the ethics behind these features. Along with the benefits of digitalization comes specialized or even gated repair knowledge. As seen in John Deere's case, physical things can be gated from repair by a simple chip, allowing manufacturers to dig a moat around their ecosystem. These technicians should also be included in the conversation about innovation in cars. Furthermore, if safety features, such as lane assist and electronic stability control systems, are offered as subscription features, some ethical issues are associated with it. We are effectively putting a price tag on the safety and life of the passengers. Who would be responsible for the accidents caused when those features are not turned on but are already available and ready to be used in the car? The government should be involved in this case. There has been a precedence of the government stepping in on car innovation. For example, backup cameras are now mandatory for all vehicles sold in the U.S. These discussions are outside the scope of this synthesis but are a possibility for future research.

I urge auto manufacturers to re-think their subscription services strategy to analyze their necessity and benefits before bringing them to the market. Furthermore, I hope this paper serves

as a reference for other industries contemplating adopting subscription services and the SaaS model. There is a fine line between innovation and clout-chasing. Digitalizing features can bring general welfare. For example, autonomous programs can be updated through the air for better performance and availability. Many innovative efforts that have been made to bring the SaaS model into different industries have not been in vain, but its utilization requires coordination between different relevant social groups.

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