Value of Cellular Technology to Vehicles: A Cost-based Approach

By Davood Hasanzadeh[1]

1. Introduction

Cellular connectivity is transforming the automotive industry in ways in ways once thought impossible. This year, an estimated 403 million connected vehicles will reach our roads, a number expected to rise to 645 million by 2030.[2] These smart vehicles do more than just drive: they communicate with their surroundings, improving safety, efficiency, and convenience. By exchanging information about speed, direction, and location, connected cars help to improve traffic and prevent accidents. Similarly, features enabled by fast and reliable connectivity are now part of modern cars. Some examples are advanced navigation systems, music streaming, parking assistance, hands-free calls, remote repair and diagnostics, and safety systems.[3]

These advanced capabilities are directly attributable to cellular standards, like 4G and 5G. 5G, like previous cellular standard generations, creates entirely new possibilities for mobility. For instance, 5G enhances real-time traffic updates, improves navigation accuracy, and offers more advanced driver-assistance systems, including complex safety features required for autonomous driving. Moreover, 5G positioning accuracy is one hundred times greater than its predecessor.[4] Such accuracy is vital for safe lane keeping, automated parking, and vehicle-to-everything (V2X) communication. Additionally, 5G provides ultra-low latency, with data travelling across networks nearly instantaneously. This permits car manufacturers to monitor vehicle health in almost real time and, if an issue arises, contact the driver to arrange maintenance proactively.

These crucial features for car communication, entertainment, safety, and maintenance are all made possible by standardisation. By enabling global functionality, cellular standards ensure seamless information exchange between devices, regardless of their origin or manufacturer.[5] Standardisation also enables interoperability and compatibility, ensuring that connected cars can function efficiently across different networks.[6]

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[1] Davood Hasanzadeh is an economist. The findings and conclusions presented in the study are based on the data collected and analyzed during the course of the research. While every effort has been made to ensure the accuracy and validity of the information, limitations or potential biases may remain. The views expressed herein are solely those of the author and do not necessarily reflect the opinions or policies of any affiliated institutions or organizations.

[2] Placek, Martin, 'Projected Number of Autonomous Cars Worldwide' (Statista, 3 May 2021) https://www.statista.com/statistics/1230664/projected-number-autonomous-cars-worldwide/

[3] Sureh, Gotham.R, 'Connected Cars: Testing the Vehicles of the Future' (Eviden, 18 January 2024) https://eviden.com/insights/blogs/connected-cars-the-vehicles-of-the-future/ ; Automotive Technology, 'Connected Car Technology: The Future of Automotive Connectivity' (12 October 2023) https://www.automotive-technology.com/articles/connected-car-technology-the-future-of-automotive-connectivity

[4] Ericsson, '5G - the 5G Switch Made Easy' (Ericsson, 2 October 2019) <https://www.ericsson.com/en/5g>.

[5] Bradshaw Jamie, 'Telecommunication Standards and Protocols | Zeus Cloud' (2023) https://www.zeuscloud.co.uk/blog/telecommunication-standards-and-protocols

[6] 4iP Council, 'What Are IoT and Cellular Standards?' (4iP Council, 2024) https://www.4ipcouncil.com/iot-standards/what-are-iot-and-cellular-standards

To encourage wide dissemination of the standard, members commonly commit to making their patents essential to the standards available for licensing on Fair, Reasonable, and Non-Discriminatory (FRAND) terms and conditions.[7] One way to obtain a licence for essential patents is through a patent pool, such as Avanci.[8]

Avanci is the leading patent pool for licensing SEPs in the automotive sector. Its 5G licence covers a portfolio of SEPs from 72 licensors, and includes not only 5G, but also 4G, 3G, 2G, and Cellular Vehicle-to-Everything (C-V2X) technology. Licensees can access this licence through a one-time payment of 32 USD (approximately 30 EUR) per vehicle.[9] By providing a *one-stop-shop* platform, Avanci enables implementers to license thousands of patents from multiple owners through a single agreement. [10] This simplifies the licensing process and offers cost predictability, with fees remaining stable over the term of the agreement. To date, 30 automotive companies have taken a licence through Avanci. Despite its clear success, some companies have expressed concerns that the royalty rates may exceed what is considered FRAND. [11]

To assess whether these concerns are justified, it is first necessary to determine what constitutes FRAND. In other words, what is the economic value that SEPs covered by the Avanci licence bring to vehicles? FRAND licensing assessments are inherently complex. Further, as in many business transactions, key information exchanged during negotiations remains confidential. Therefore, this paper focuses exclusively on publicly available data related to the value consumers place on connected cars. This data is intended to serve as one of the factors that can inform the broader assessment of FRAND.

Section 2 explains the role of SEPs and FRAND in standardisation. It also highlights how patent pools offer an efficient way to license essential technologies in the automotive sector. Section 3 outlines the methodology and key concepts such as 'cost-benefit analysis'. By comparing overall subscription revenue to one-time licensing costs, the data illustrates the value captured when connectivity is integrated into automotive products. The findings, as discussed in Section 4, will showcase the positive impact of connectivity services through the substantial revenue generated from automotive connectivity subscriptions. Finally, Section 5 concludes with an analysis and discussion on the role of FRAND and the current balanced patent system in maintaining a functional ecosystem.

[7]Méniére, Yann. Fair, Reasonable and Non-Discriminatory (FRAND) Licensing Terms: Research Analysis of a Controversial Concept (EUR 27333, Publications Office of the European Union 2015) JRC96258, p. 3.

[8] www.avanci.com

[9] Avanci, 'Avanci 5G Vehicle - Avanci' (Avanci, 11 November 2024) https://www.avanci.com/vehicle/5gvehicle/ . AS of December of March 28, 2025, $32 is equivalent to €30.4, using an exchange rate of 1 USD = 0.95 EUR.

[10] *Ibid.*

[11] European Commission, *Impact Assessment: Annex to the Proposal for a Regulation of the European Parliament and of the Council on Standard Essential Patents* (SWD/2023/124 final, 2023) https://single-market-economy.ec.europa.eu/document/download/a009816a-3b24-46c8-9c3c-fd8bd89a1380_en?filename=SWD_2023_124_1_EN_impact_assessment_part1_v4.pdf p.11

2. Cellular Standards, SEPs, and FRAND

2.1 SEPs and FRAND Framework

Cellular standards play a vital role in the development of new technologies like connected cars.[12] These standards combine multiple technologies, which are often protected by Standard Essential Patents (SEPs).[13] SEPs are patents that protect inventions that are indispensable to the implementation of a standard, like 5G.[14]

When a company intends to implement a standard into their product, they must obtain access to all relevant SEPs. Access can be provided by either signing a licence with the SEP owner or indirectly.[15] A licence is an agreement between the party using the patented technology (the licensee) and the party that owns the rights conferred by the patent/s (the licensor). [16] It often requires the licensee to pay royalty rates to the SEP owner.[17]

FRAND allows SEP implementers to gain access to standardised technologies at reasonable rates, fostering quick dissemination of technology throughout the market.

At the same time, reasonable royalty rates are key to the success of standardisation. Major contributors invest heavily in R&D to develop cutting-edge technologies that become part of the standard.[18] Recognising and fairly compensating this effort is crucial. A reasonable return enables continued reinvestment in R&D, a virtuous cycle of innovation that benefits SEP owners, implementers, and society as a whole.[19]

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[12] Wang, Olivia. 'What Are Standards? Why Are They Important? - IEEE SA' (IEEE Standards Association, 11 January 2021), https://standards.ieee.org/beyond-standards/what-are-standards-why-are-they-important/.
[13] WIPO, Standard Essential Patents (2024), https://www.wipo.int/web/patents/topics/sep.
[14] *Ibid.*
[15] Vary, Richard. The case for the defence: Access for all v. license to all, April 2020, at https://www.twobirds.com/~/media/pdfs/practice-areas/ip/the-case-for-the-defence.pdf?la=en&hash=A5A88D21EF55BE81B47C5FB16774785FBBD64B12; Juan Martinez. FRAND as Access to All versus License to All. GRUR Int. 201v9, 633, July 2019 & Journal of Intellectual Property Law & Practice, Volume 14, Issue 8, August 2019, Pages 642–651, https://doi.org/10.1093/jiplp/jpz075.
[16] In some cases, both parties own patents. This may lead to a cross-licence, where each side grants rights to the other, with the party owning the weaker portfolio providing compensation.
[17] Licensing terms can also impose certain limitations on the licensee, including on the field of use, scope, and duration of the agreement. UK Intellectual Property Office, 'Standard Essential Patent Licensing' (GOV.UK, 21 July 2024), https://www.gov.uk/guidance/standard-essential-patent-licensing#types-of-sep-licensing.
[18] For example, in 2022, Huawei, Ericsson, and Nokia collectively spent $32.5 billion on R&D globally. Ruoff, A. James, 'Here Are the Telecoms Spending the Most – and Least – on R&D' (Fierce Network, 18 April 2023) https://www.fierce-network.com/5g/here-are-telecoms-spending-most-and-least-rd. Effraimidis, Georgios and Gupta, Kirti, 5G standards and the stark divide between innovators and implementers, IAM, 8. June 2022, https://www.iam-media.com/article/5g-standards-and-the-stark-divide-between-innovators-and-implementers and https://www.4ipcouncil.com/research/5g-standards-and-stark-divide-between-innovators-and-implementers. In 2023 alone, Ericsson invested 50.66 billion SEK (around 4.3 billion EUR), in R&D, Alsop, Thomas. 'Ericsson R&D Expenses. 2011-2022' (Statista, 14 May 2024) https://www.statista.com/statistics/566320/ericsson-research-and-development-expenses-worldwide/.
[19] 4iP Council, 'FRAND – The Cycle of Innovation' (4iP Council) https://www.4ipcouncil.com/iot-standards/frand-cycle-of-innovation.

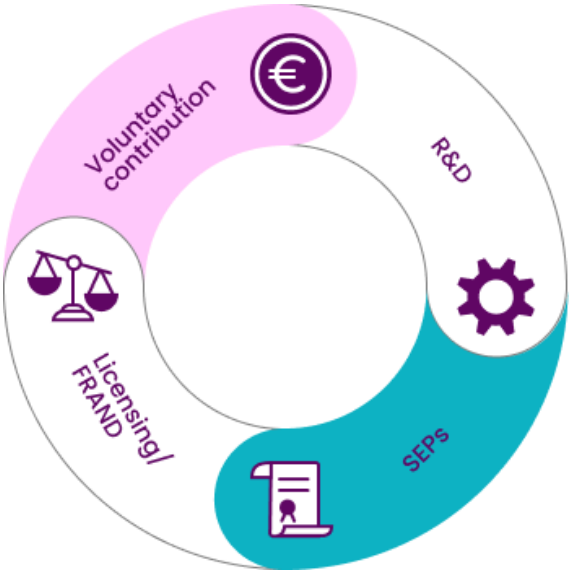


Figure 1: Cycle of Innovation, 4iP Council
https://www.4ipcouncil.com/iot-standards/frand-cycle-of-innovation

2.2 SEP Licensing

FRAND reflects the economic value that the patented technology brings to the end product—in this case, the connected car.[20] Typically, FRAND terms are determined through bilateral negotiations between the SEP owner and the implementer.[21] However, when multiple patent owners are involved, as is often the case with cellular standards, licensing can become complex and time-consuming. In such situations, structured alternatives like licensing platforms offer significant advantages.

Patent pools are one such solution. They bring together SEPs from multiple patent owners and license them as a single package. This model is particularly well-suited to industries like automotive, where numerous interdependent technologies must work seamlessly together.[22] By offering access to a broad portfolio of patents through one standardised agreement, pools can reduce transaction costs, minimise legal uncertainty, and improve transparency.

Avanci reduces administrative burden and protects licensees from infringement claims by offering a single agreement with a fixed per-vehicle fee. It supports manufacturers with cost certainty and simplifies access to essential technologies as vehicles become increasingly connected. Patent pools like Avanci are recognised by regulators for improving licensing efficiency and reducing litigation risk when aligned with FRAND principles.[23] In short, Avanci

[20] *Nokia v Daimler*, Regional Court (Landgericht) of Mannheim, 18 August 2020 - Case No. 2 O 34/19, paras. 171-172. Claudia Tapia, Chapter 8 'Internet of Things and licensing: SEPs and FRAND determination' in A Modern Guide to Patents, Elgar Modern Guides, June 2025, 221.

[21] Herranz, Luis and Tapia, Claudia. Good and Bad Practices in FRAND Licence Negotiation (chapter) in Resolving IP Disputes, Zeiler/Zojer (eds), pp. 49 -68, 2018, p. 53.

[22] World Intellectual Property Organization (WIPO), 'PATENT POOLS and ANTITRUST – a COMPARATIVE ANALYSIS' (2014) https://www.wipo.int/documents/743993/747687/patent_pools_report.pdf/8690993c-639b-d12d-eb8f-fff1125cf13f?version=1.2&t=1671199878003 , p. 3.

[23] Brito, Julia and Contreras, Héctor Axel. 'Patent Pools: A Practical Perspective – Part I' (2021) 56(4) les Nouvelles – Journal of the Licensing Executives Society https://ssrn.com/abstract=3946590

enables efficient access to SEPs while promoting legal certainty and supporting innovation in the automotive sector.

3. Research and Methodology

3.1. Cost Benefit Analysis

This study utilises a cost-benefit analysis (CBA) to illustrate the value of cellular connectivity to automotives. A CBA is a tool used to evaluate the negatives and positives associated with a project or decision.[24] By assigning monetary values to both costs and benefits, it enables comparisons between different options, facilitating informed decision-making.

A CBA considers both tangible and intangible elements, including direct costs, indirect costs, and opportunity costs. Direct costs are those incurred as a result of a decision. In the present study, this refers to the licensing fees for the Avanci 5G patent pool, priced at $32 USD (€30.4) per vehicle. On the other hand, indirect costs reflect the potential loss of competitive advantage if a company avoids investing in innovation.[25] Opportunity costs and indirect costs are acknowledged but remain outside the scope of this study.

Similarly, revenue growth, customer satisfaction, and competitive advantage in the market are examples of potential gains that are considered when deciding to invest in an idea or not. In this study, direct financial gains pertain to revenue from subscription-based connectivity services that car-makers sell to consumers.

3.2. Methodology

This study uses a survey with closed questions, conducted through in-person interviews with dealership representatives from eight premium car brands. Namely, these brands were Audi, BMW, Mercedes-Benz, Tesla, Volvo, Jaguar, Volkswagen, and Mini. These direct interactions provided valuable insights into the pricing, structure, and duration of offered connectivity packages. To ensure consistency in the analysis, the data was collected in a single location: Munich, Germany from November 2024 to January 2025.

This study does not consider the requirements or restrictions some companies impose before subscription to connectivity packages. Neither does it include car models or manufacturing years, as no correlation is being sought. It also excludes additional connectivity features available for subscription, such as map updates or remote-control services, and the revenue they generate.

Notably, some companies like BMW apply dynamic pricing to their subscription packages, leading to price differences between vehicles and regions. Future studies can expand on this research by exploring pricing variations across regions, and the correlation between vehicles, models, and manufacturing years.

[24] Robinson, Ray. 'Cost-Benefit Analysis.' (1993) 307 BMJ 924.

[25] Hayes, Adam. 'Cost-Benefit Analysis: How It's Used, Pros and Cons' (Investopedia, 25 July 2024), https://www.investopedia.com/terms/c/cost-benefitanalysis.asp.

3.3. Presentation of Results

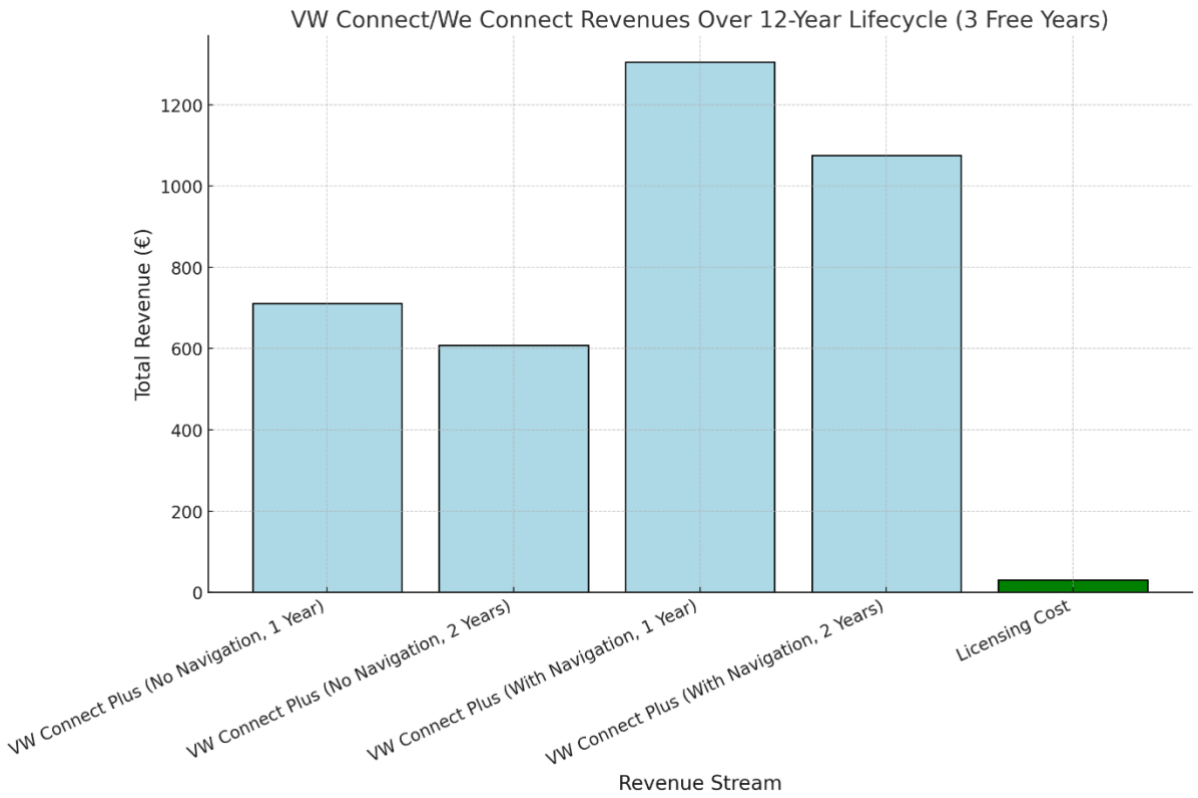
The next section presents the data collected from the questionnaire, followed by a brief discussion on the duration of each package and additional features available.

A bar chart is used to highlight total revenues from connectivity services over the average vehicle lifecycle. Since passenger cars in Europe have an average lifespan of 12 years,[26] this study adopts this period as the duration for revenue generation from connectivity subscriptions.

The chart uses distinct colours to differentiate revenue sources. Green represents the one-time Avanci 5G licensing fee, while blue signifies recurring subscription revenues, emphasising their ongoing nature throughout the paid period. Moreover, each section contains a chart illustrating the distinction between the one-off licensing cost and the recurring income from subscription services per vehicle.

4. Results

4.1. Volkswagen



Package	Annual Fee € For Customers	Paid Period/ Year	Free period/ Year	Licensing Fee € (one-time)	Aggregate Revenue €
VW Connect Plus	78.90	9	3	30	710

[26] ACEA, 'Average Age of the EU Vehicle Fleet, by Country' (ACEA - European Automobile Manufacturers' Association, 2 May 2023) https://www.acea.auto/figure/average-age-of-eu-vehicle-fleet-by-country/

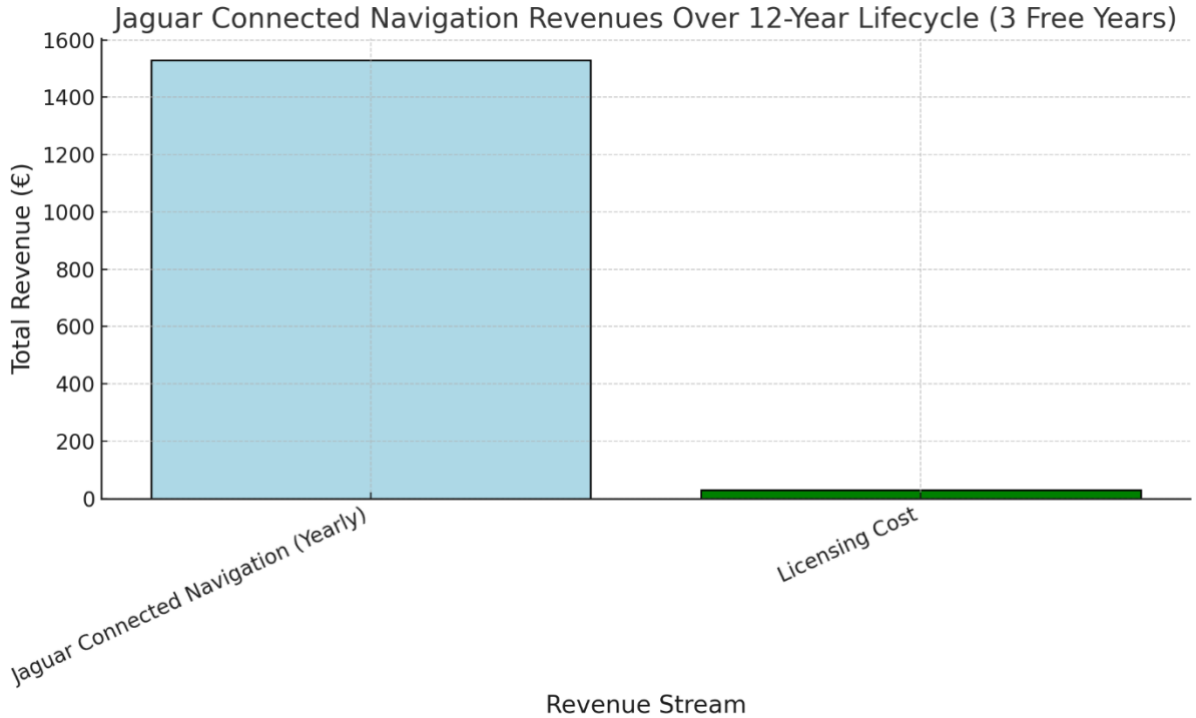
(1 Year No Navigation)					
VW Connect Plus (1 year With Navigation)	145	9	3	30	1 305
VW Connect Plus (2 Year No Navigation)	135	9	3	30	607
VW Connect Plus (2 Year with Navigation)	239	9	3	30	1 070

Volkswagen offers free connectivity for the first three years. After this period, it is assumed that customers will pay for one of the connectivity services for the remaining nine years. Revenue is calculated exclusively on the paid subscription period. This approach captures the recurring revenues generated during the subscription phase while acknowledging the complimentary nature of the initial offering.

Since Volkswagen offers both one- and two-year subscription plans, revenue for the two-year packages is calculated as four two-year packages plus one additional two-year package, divided in (239/2 = 119.5 & 135/2 = 67.5). The cost includes a one-time Avanci 5G licence payment of approximately €30. Meanwhile, the revenue streams include recurring fees from the connectivity packages accrued during the nine paid years.

As regards the included features, VW Connect Plus (No Navigation) and VW Connect Plus (with Navigation) provide parking positions, music streaming, and Wi-Fi hotspot. The key difference is the inclusion of online navigation and traffic information in the package with navigation.

4.2. Jaguar



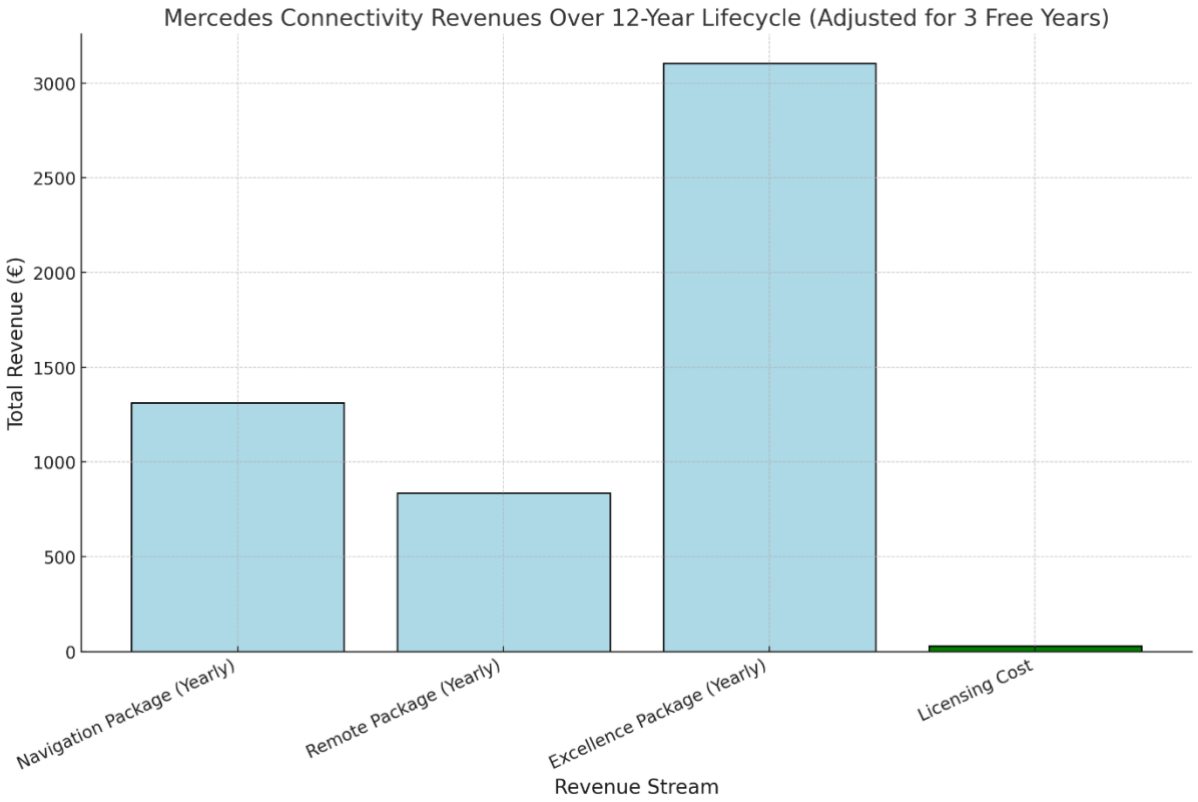
Package	Annual Fee € For Customers	Paid Period/ Year	Free period/ Year	Licensing Fee € (one-time)	Aggregate Revenue €

Jaguar Connected Navigation	170	9	3	30	1 530

Like VW, Jaguar also offers its Connected Navigation package for free during the first three years. Following this, customers have the possibility to renew the package for an annual fee of €170. Assuming customers opt to retain connectivity for the remaining nine years of the vehicle's lifecycle, Jaguar would accrue an aggregated revenue of €1530 per vehicle.

Jaguar's connectivity package includes the following services among others: a remote app for vehicle control, Secure Tracker for vehicle monitoring, Emergency SOS, and breakdown assistance, connected navigation with real-time updates, Apple CarPlay, and Android Auto integration.

4.3. Mercedes Benz

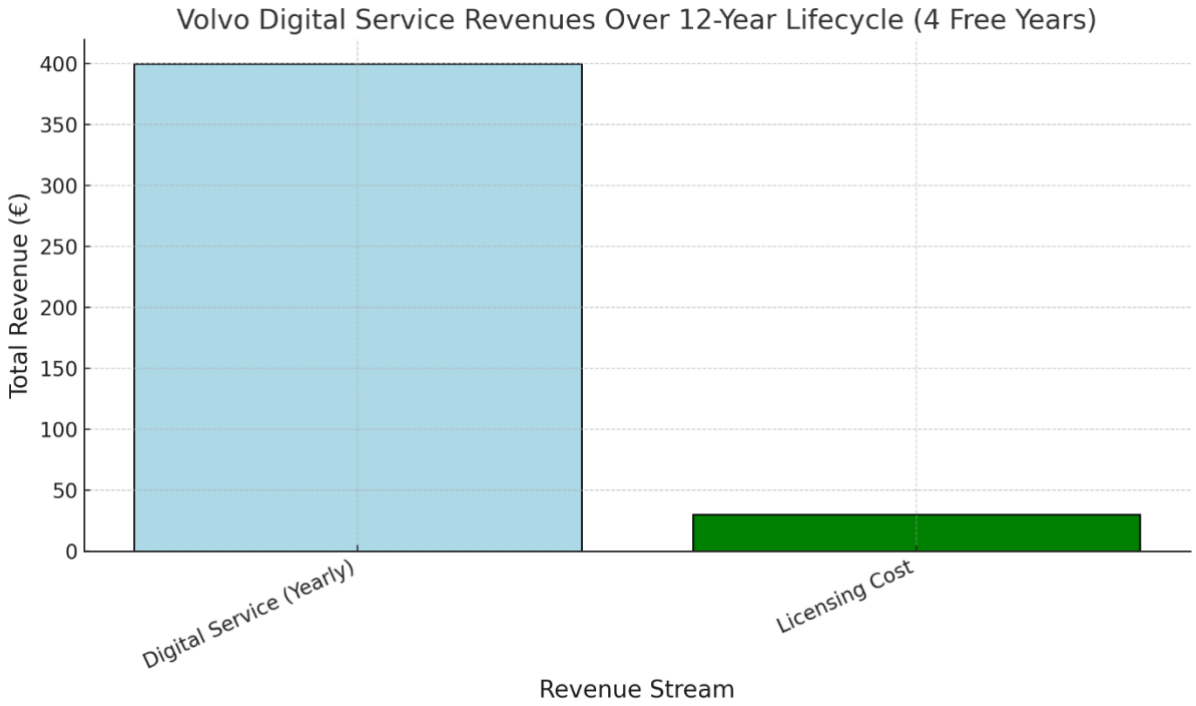


Package	Annual Fee € For Customers	Paid Period/ Year	Free period/ Year	Licensing Fee € (one-time)	Aggregate Revenue €
Remote	93	9	3	30	837
Navigation	146	9	3	30	1 314
Excellence	345	9	3	30	3 105

Mercedes-Benz offers a portfolio of three different connectivity packages which are available for annual subscription once the initial three-year free period has ended. The 'Remote' package is the cheapest package offered by Mercedes and includes remote vehicle control (locking/unlocking, climate control), vehicle location and tracking, service appointment scheduling, and parking assistance. The 'Navigation' package includes real-time traffic data,

door-to-door navigation, online map updates, weather, and parking information. The most expensive package is the 'Excellence' package. This package provides all remote and navigation features, in addition to advanced security features (vehicle location tracking, theft alerts), enhanced navigation services, remote control of windows and sunroof.

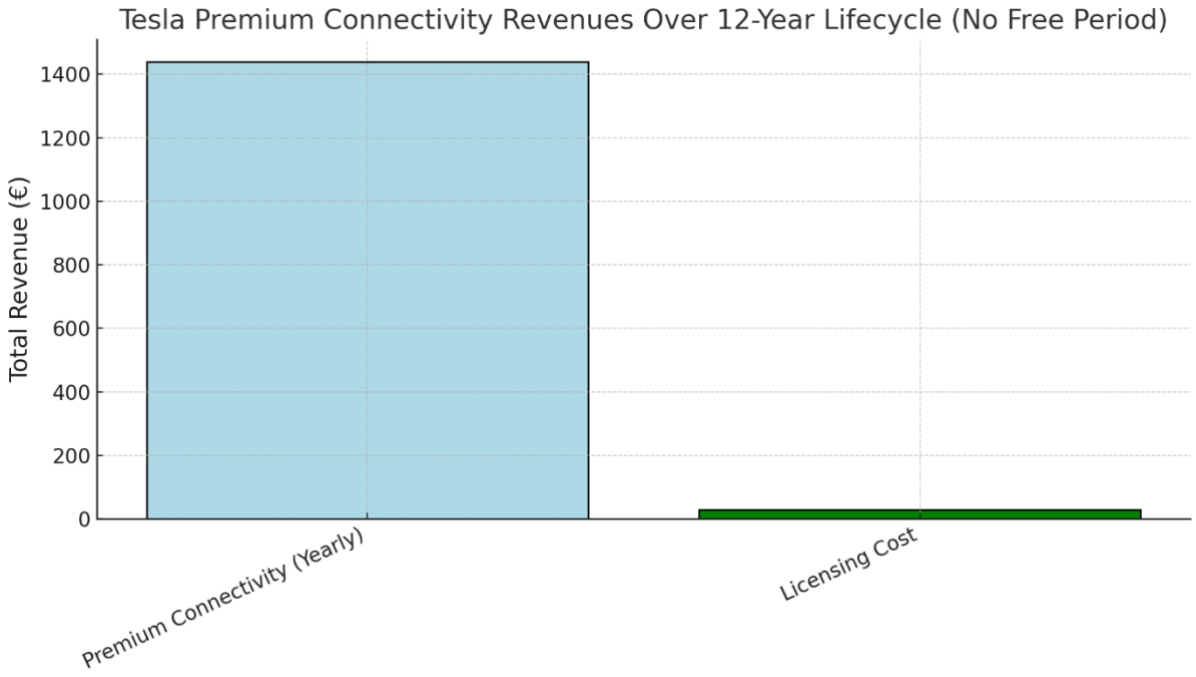
4.4. Volvo



Package	Annual Fee € For Customers	Paid Period/ Year	Free period/ Year	Licensing Fee € (one-time)	Aggregate Revenue €
Volvo Digital Service	50	8	4	30	400

Volvo offers free connectivity for the first four years of a vehicle's lifecycle. After this period, further use of its 'Digital Service' packages requires an annual subscription for a fee of €50. Offered features consist of data for navigation, voice assistant, and app usage (e.g., music streaming), connectivity for maps, apps, and voice assistant.

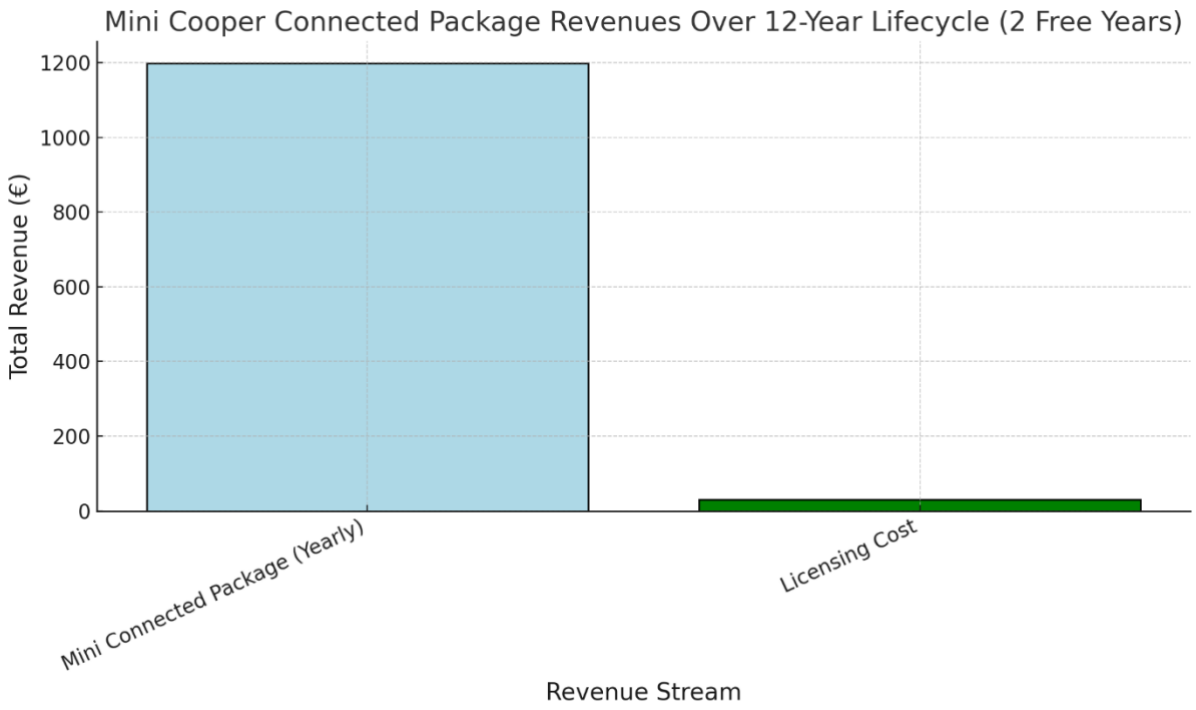
4.5. Tesla



Package	Annual Fee € For Customers	Paid Period/ Year	Free period/ Year	Licensing Fee € (one-time)	Aggregated Revenue €
Tesla Premium Connectivity	119.88	12	0	30	1 435

Tesla offers two different connectivity packages to its customers. The focus of this study is the Premium Connectivity package which is priced at €9.99/month, equivalent to €119.88 annually. Some included features are real-time traffic and satellite maps, music streaming (Spotify, Pandora, etc.), video streaming (Netflix, YouTube), karaoke, Internet browser, and mobile hotspot.

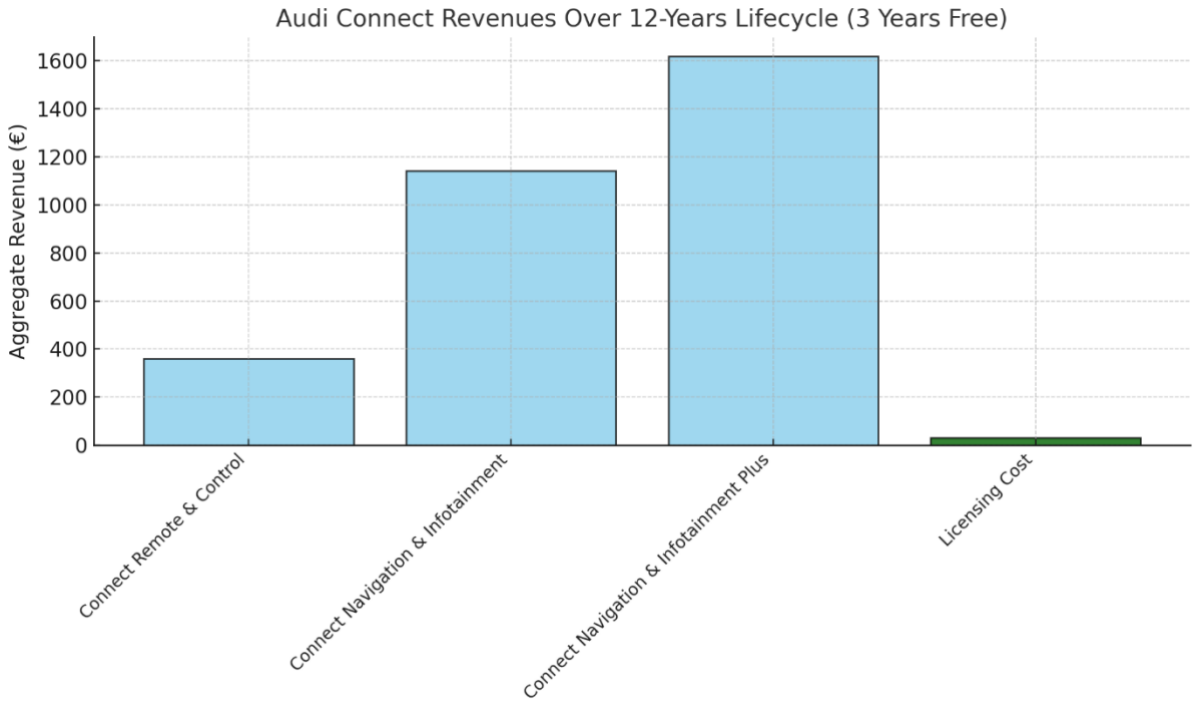
4.6. Mini



Package	Annual Fee € For Customers	Paid Period/ Year	Free period/ Year	Licensing Fee € (one-time)	Aggregate Revenue €
Mini Connected	119.80	10	2	30	1 197

Mini offers its 'Mini Connected' package free of charge for the first two years. Following this, it is available on a subscription for 9.98€/month. This equates to an annual price of €119.80. Features include 3D map display, data volume, remote features, entertainment, and navigation.

4.7. Audi

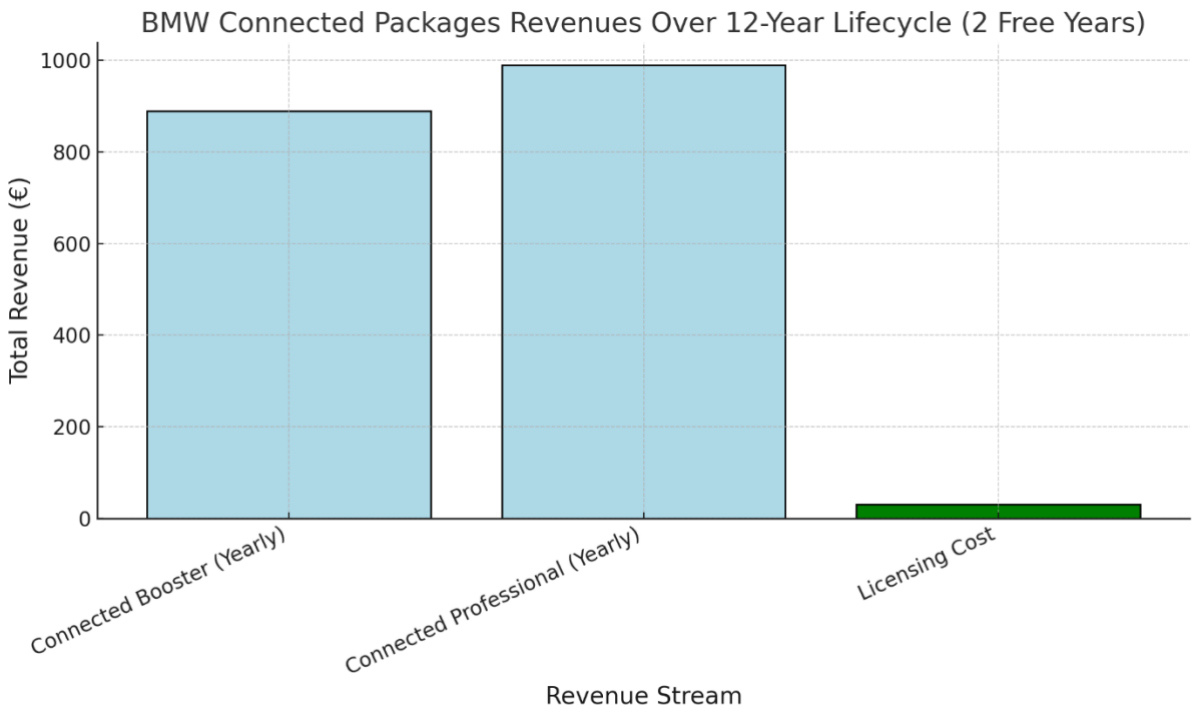


Package	Annual Fee € For Customers	Paid Period / Year	Free period / Year	Licensing Fee € (one-time)	Aggregate Revenue €
Connect Remote & Control	40	9	3	30	360
Connect Navigation & Infotainment	127	9	3	30	1 143
Connect Navigation & Infotainment Plus	180	9	3	30	1 620

Audi offers four different packages for vehicle network connectivity, three of which were shared for this paper. While features vary between each package, all are offered free for the first three years of ownership. After this period, customers can continue the service through a monthly or yearly subscription.

The Connect Remote & Control package includes remote vehicle access, vehicle location, theft alarm notification, and climate control. The Connect Navigation & Infotainment package includes additional features such as: online navigation with real-time traffic, music streaming (Spotify, Amazon Music), voice assistant, weather, and news updates. Finally, the Connect Navigation & Infotainment Plus package offers all features included in the Connect Navigation Infotainment package and offers additional features. A few of these are Amazon Alexa, 3D city map, map navigation, online voice, and traffic light information.

4.8. BMW



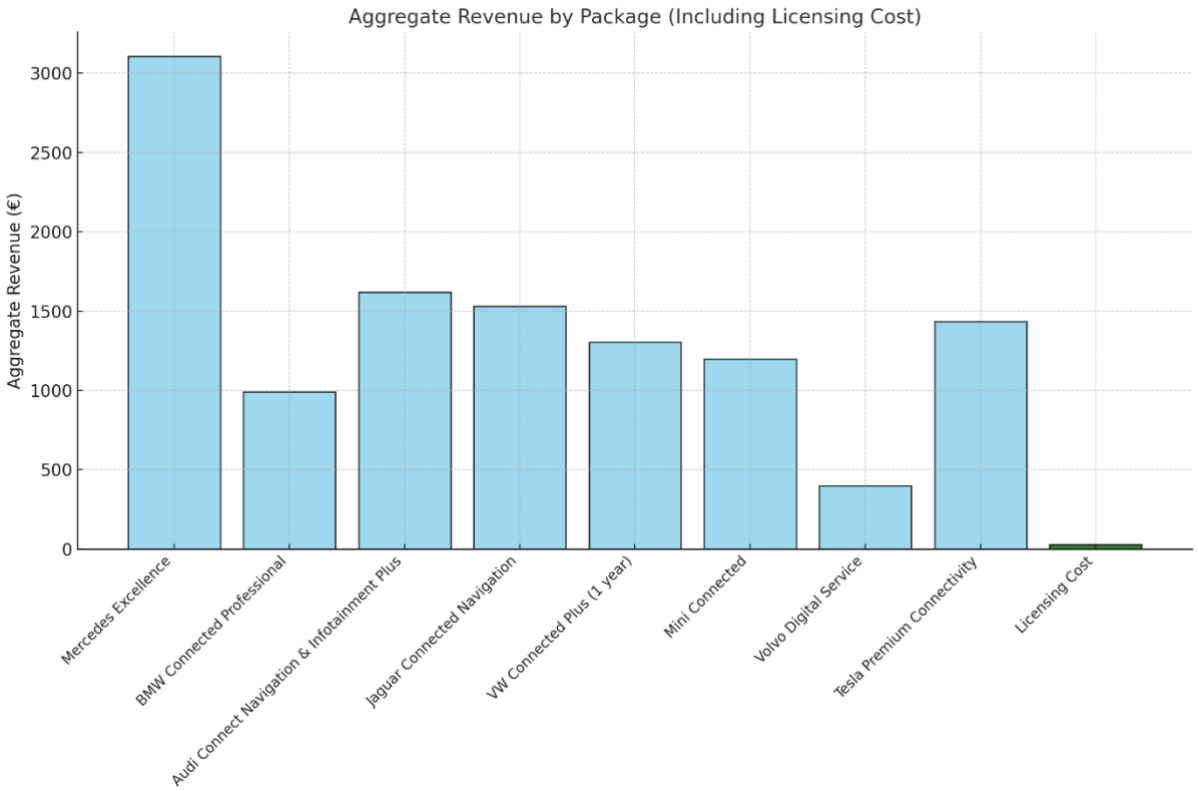
Package	Annual Fee € For Customers	Paid Period/ Year	Free period/ Year	Licensing Fee € (one-time)	Aggregate Revenue €
Connected Professional	99	10	2	30	990
Connected Booster	89	10	2	30	801

Bayerische Motoren Werke (BMW) offers various connectivity packages, with prices varying by car model and region. Free network connectivity is offered only during the first two years of car ownership. This study focuses on two packages, which include the features listed below:

- **Connected Professional**: remote vehicle control, real-time traffic updates, BMW Online (route info via built-in SIM), remote 3D view, and connected music (Spotify).

- **Connected Booster**: advanced navigation, parking assistance, remote vehicle control, and Apple CarPlay/Android Auto integration.

4.9. Summary of the results



Package	Annual Fee € For Customers	Paid Period/ Year	Free period/ Year	Licensing Fee € (one-time)	Aggregated Revenue €
Mercedes Excellence	345	9	3	30	3 105
BMW Connected Professional	99	10	2	30	990
Audi Connect Navigation & Infotainment plus	180	9	3	30	1 620
Jaguar Connected Navigation	170	10	2	30	1 530
VW Connected Plus (1 year)	145	9	3	30	1 305
Mini Connected	119.80	10	2	30	1 197
Volvo Digital Service	50	8	4	30	400
Tesla Premium Connectivity	119.88	12	0	30	1 435

The bar chart above is a comparative summary of the previous graphs of each car maker included in this study. For the brands with more than one offering, the most premium package has been selected. The chart also considers the free period of each package during the 12 years of a vehicle's lifecycle. Finally, the predicted revenue for all the brands in this study has been presented in comparison with the licensing cost of connectivity technology. The bar representing this cost can be found on the right side of the chart.

5. Analysis and Discussion

5.1. Strategic Value of Connectivity in the Automotive Industry

Beyond offering connected car services through subscription-based packages, the eight companies in the study are well-established premium brands in the automotive industry. Accordingly, the study provides a broad perspective on how automotive companies effectively use connectivity to create and capture value for themselves and their customers.

What the data in this study reveals is a clear financial opportunity and advantage for automotive manufacturers. As shown above, the one-time licensing fee of approximately €30 per vehicle accounts for merely a small proportion of the revenue generated through automotive connectivity services. As examples, even the least expensive package in this study, offered by Volvo, generates almost twelve times more revenue than the cost of the licensing fee over the vehicle's life. In Mercedes-Benz's Excellence package, the one-time licensing fee accounts for just 9% of the first annual subscription fee. Considering the revenue generated from connectivity services, the ease of licensing and cost-effectiveness provided by patent pools presents an enormous advantage for SEP implementers.

Assuming a customer subscribes to a connectivity package, it is likely that even a one-year subscription is more than enough to cover the expenses associated with connectivity in most cases, including the network licensing fee.

As the data shows, profitability can be considered a certainty, provided customers continue to renew their connectivity subscriptions. The latter is to be expected since the consumers are increasingly demanding it. The global connected car market is projected to grow from $115.8 billion in 2023 to $501.8 billion by 2033.[27] On a broader scale, with the growing number of connected car sales, car manufacturers might be able to reduce costs. Variations in features included within different packages indicate the existence of different customer segments with diverse needs, desires, and expectations.

To further emphasise the value of cellular connectivity to cars, every company included in this study offers free connectivity for a limited time upon the purchase of a new vehicle. This can be seen as a strategic move by manufacturers to demonstrate the value of connectivity and convince customers of its benefits. From the data, one can infer that a vehicle can, far before its lifecycle ends, generate enough revenue to make it worthwhile for companies to afford this strategy.

5.2. Value Creation and Capture

This study highlights the critical role of SEP owners in the value chain, positioning them as the primary value creators. This is achieved through a functional ecosystem, where SEP owners innovate and collaborate to ensure the development of new technologies for incorporation in cellular standards. Industries such as the automotive sector then capture the value of these technologies through the implementation of connectivity into their products. Through this

[27] The CAGR is expected to be 16.5%. Allied Market Research, Connected Car Market Insights, 2033, January 2025 <https://www.alliedmarketresearch.com/connected-car-market> accessed 28 March 2025.

system, connectivity creates new possibilities for different sectors to innovate and deliver new services to their customers and create new revenue streams.

Particularly, this study shows how automotive manufacturers use connectivity to capture significant value, primarily in terms of revenue from subscriptions. Customers increasingly demand real-time navigation, remote-control features, or real-time traffic information, all of which rely on connectivity.[28] This technology is the result of years of trials and significant investments in R&D by SEP owners.

Moreover, the future of connected cars is not limited to the current state of the industry. As the value of connectivity is increasingly realised, new types of connected cars are being developed. In the near future, more advanced connected vehicles with enhanced features are expected to enter the market, driven by continuous progress in connectivity.[29]

Given this, reasonable compensation for R&D efforts by SEP owners is necessary to ensure continued development of these cutting-edge technologies. The FRAND framework ensures that such investment can remain possible whilst also providing car manufacturers access to the latest connectivity technologies. A robust FRAND framework fosters a predictable licensing environment, reducing transactional costs and ensuring the functionality of the SEP ecosystem. With this virtuous cycle, manufacturers can focus on utilising the technology to exploit new business opportunities rather than seeking cost reductions. In other words, connectivity acts as a driver for value capture and innovation.

5.3 Conclusion

In accordance with this study's objective, the findings affirm the positive financial impact of connectivity services in the automotive industry. The revenue generated by connectivity packages far exceed the one-time licensing fees offered by patent pools. It demonstrates that connectivity is not only a cost-effective investment but also a substantial source of value capture for manufacturers. Even the least expensive connectivity offerings generate multiple times the cost of licensing, while premium packages achieve profit well above this threshold.

In summary, this study demonstrates how connectivity serves as both driver of value creation for SEP owners and a mechanism for value capture for car manufactures. The findings also underscore the importance of maintaining a FRAND-compliant licensing environment to ensure the sustainability and functionality of a SEP ecosystem. As customer demand for connectivity in vehicles continues to grow, the alignment of connectivity standards innovation, FRAND-compliant licensing, and the development of new connectivity features can bring continuing and long-term success.

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[28] Navigation Data Standard, Hello customer! What consumers want from their in-vehicle systems 23. July 2024, <https://nds-association.org/connected-cars-navigations-user-expectations-dataconcept/>; Verified Market Reports, Consumer Connected Cars Market Insights, February 2025, <https://www.verifiedmarketreports.com/product/consumer-connected-cars-market/>
S&P Global Mobility: What Connected Car Services are Consumers Willing to Pay For?, July 19, 2023, <https://press.spglobal.com/2023-07-19-S-P-Global-Mobility-What-Connected-Car-Services-are-Consumers-Willing-to-Pay-For>

[29] Sunil Arya, The Value of Standardized Technology to Connected Cars, GRURInt., 69(4), 2020, 365–379, 4, April 2020, <https://academic.oup.com/grurint/article-abstract/69/4/365/5820182>