Pandemic, Scarcity and Supply Chain Decisions: Impact On Changes In Business to Consumer Car Purchase Behaviour In Finland and the UK

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Abstract

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This constructive research explores the impacts of the COVID-19 pandemic on the car industry supply chain and its' end users. Specifically, it focuses on how the lack of parts caused by the pandemic have changed consumers' behaviour and perceptions when purchasing cars within Finland and the UK. This research identifies the key aspects which caused the car industry to struggle during the pandemic and then related those struggles back to the consumer.

The scope of this thesis concentrated on car private owners purchasing vehicles within Finland and the UK. This was implemented over 2 research phases. Phase 1 was undertaken with the use of articles, books and media to identify a chronological order in which events took place for the car industry during the COVID-19 pandemic. This order took both external and internal factors into consideration, primarily in and around Europe. Phase 2 of the research brought the focus onto the customers within the UK and Finland, with the use of a questionnaire which targeted their behaviours prior to, during and after the pandemic.

The results of this thesis identified the critical actions and mistakes of the car industry during the pandemic. Just in Time inventory management was found to be a major contributor to the downfall of the industry. The results also examined the consumers' reactions to these mistakes with their purchasing habits. Crucial changes in consumers' habits were a slow but significant change of preference towards completely online purchasing platforms, and the recognition that they would have to spend more as a result of the pandemic.

Keywords

Car industry, pandemic, scarcity, purchasing, Just in Time, Black Box consumer behaviour model

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1 Introduction

This is a research type of bachelors thesis for the Degree Programme in International business in the major specialisation of Supply Chain Management in Haaga-Helia University of Applied Sciences. In this chapter the background of the report will be explained, giving the reasoning behind the research. Then it will move on to provide readers with the research question and the investigative questions which will be formatted in a table overlay matrix with information on where to find each investigative question throughout the report. The introduction will then go on to cover the demarkation, benefits, risks and key concepts.

1.1 Background

During December 2019 COVID-19, a very infectious virus which causes severe respiratory difficulties in humans, was identified in Wuhan, China (Centers for Disease Control and Prevention 2021). This virus quickly spread throughout the entire world creating a global pandemic and in turn causing a dramatic effect on global supply chains (BBC Future 2021). The car manufacturing industry had significant trouble getting enough semiconductor chips and rubber for their cars, which in turn meant that the cars cannot operate and therefore be sold (Fernandez 2021). This research focussed on how consumer behaviour changed in relation to buying cars in the UK and Finland, as a result of the increase in prices and the lack of supply.

1.2 Research Question

The aim of this thesis was to improve knowledge of how consumer behaviour has potentially changed or evolved in correlation with the shortage of parts during the COVID-19 era. This can be used by businesses for better understanding of customers within the Finnish and UK markets, during this age of volatile economies.

The international aspect of the Haaga-Helia degree program was covered within this thesis due to the fact that there are two countries of interest within this topic (Finland and the UK).

The research question (RQ) of this thesis was:
How has B2C consumer behaviour in Finland and the UK changed within the car buying industry, as a result of a lack of parts caused by the pandemic?

The research question was divided into investigative questions (IQs) as follows:
1) What has been the cause of the shortage of parts?
2) Which parts are in short supply in the car manufacturing industry?

3) What was the consumer behaviour like before the pandemic?
4) What has changed in consumer behaviour since the pandemic started?
5) What are the consumers' hopes for the future of the car industry?

Each investigative question will now be listed along with theoretical framework components, research methods and results chapters for each investigative question.

- IQ 1 – The theory framework for this IQ will be based on scarcity, opportunity cost, back ordering, pandemic transportation, pandemic logistics issues and car industry just in time manufacturing. The research methods will be from articles, books and websites. IQ 1 will be answered in the results chapter 4.1
- IQ 2 – The theory framework for this IQ will be based on semi-conductor chip use in cars and rubber use in cars. The research methods will be articles, books and websites. IQ 2 will be answered in results chapter 4.2
- IQ 3 & 4 – The theoretical framework for these IQs will be based on Black Box consumer behaviour model. The research methods undertaken will be qualitative a questionnaire to be completed by car owners within Finland and the UK. The results chapter for IQ 3 and IQ 4 will be 4.3 and 4.4 respectively.
- IQ 5 – The theoretical framework for this IQ will be based on resilient supply chains, Black Box consumer behaviour model and electric vehicle car ownership (with associated incoming laws)

Table 1. Overlay matrix

Investigative question	Theoretical Framework*	Research Methods **	Results (chapter)
IQ 1. What has been the cause of the shortage of parts?	Scarcity, opportunity cost, back ordering, pandemic transportation and logistics issues, car industry just in time manufacturing	Articles, books and websites	4.1
IQ 2. Which parts are in short supply in the car manufacturing industry?	Semi conductor chip use in cars, rubber use in cars,	Articles, books and websites	4.2
IQ 3. What was the consumer behaviour in car purchasing like before the pandemic?	Black Box consumer behaviour model	Qualitative & quantitative questionaire completed by car owners in Finland & UK	4.3
IQ 4. What has changed in consumer behaviour in car purchasing since the pandemic started?	Black Box consumer behaviour model	Qualitative & quantitative questionaire completed by car owners in Finland & UK	4.4
IQ 5. What are the consumers' hopes for the future of the car industry?	Resilient supply chains, Black Box consumer behaviour model, electric vehicle car ownership (and associated incoming laws)	Qualitative questionaire completed by car owners	4.5

1.3 Demarcation

The main focus of this research were the recent challenges in the car manufacturing industry and how that has affected consumer behaviour. Between IQ 3,4 and 5 an evaluation was undertaken on what consumers used to expect, what challenges they currently face and what expectations and hopes they might carry into the future.

The demographic for the research concentrated on car owners within Finland and the UK. These countries were selected because of their relatively close average wages according to OECD 2020, which should give them similar purchasing power. They are also both located in Europe and even though the UK is no longer part of the EU, both still have similar laws and rules regarding car ownership so the choices available are definitely comparable.

The other demarcation was that this thesis focussed on the time periods surrounding the pandemic (before, during, after) to draw conclusions of the effect the lack of parts supply has had on consumer behaviour.

1.4 Benefits

Benefits should come to the consumers who participate in the survey process, as this should drive them to think about what they truly want from their car purchasing experience and gain insight in that area. Since they were questioned about their behaviours in a way that they had to meaningfully think of the rational (or irrational) reasoning behind their decisions, it may open new perspectives for them in the future.

Personally, the author benefitted because this is a particular topic of interest. The author also believed it was excellent as a learning opportunity, to gain critical insight into consumers' purchasing decisions as they usually make up the end of the supply chain. It allowed the author to consider how the end user might view and be affected by any decisions that are made in one's future career, and hopefully assist the author in making the correct decisions with the customer in mind. Often in a supply chain the professionals involved are very isolated from the consumers because they are not on the "front line", as a result the author believes that this would allow a unique perspective compared to other supply chain professionals.

1.5 Risks and Risk Management

There were not considerable risks involved within this project. The survey respondents, being Finnish or British car owners, were relatively easy to track down and attain responses from. All of these surveys were sent out and received online, meaning there was very little travel time and risk involved in the collection process.

One risk of this research was if all or most of the respondents gave very short answers which would have made the data unusable and would not have allowed for any conclusions to be drawn. The other risk, which the author found during a budgeting QRM course, was a considerable number of the respondents not replying. To mitigate the risk, a much larger number of responses during the questionnaire part of the research than the amount that was actually needed.

1.6 Key Concepts

Scarcity is when there are too few resources available compared to the demand for them. This creates an opportunity cost of not being able to use them in another way. (Wetzstein 2013, 3.)

Opportunity cost is “the cost of increasing the consumption of one commodity measured by the resulting decrease in consumption of another commodity” (Wetzstein 2013, 73).

Black Box consumer behaviour model “focuses on the consumer as a thinker and problem solver who responds to a range of external and internal factors when deciding whether or not to buy” (Lumen 2021).

Resilient supply chains are supply chains which “have the ability to resist or even avoid the impact of a supply chain disruption – and the ability to recover from a disruption” (SAP Insights 2021).

Just in time was developed by Toyota during the 1950s. It is a method of eliminating waste and excess stock storage by only meeting the requirements for production and nothing more (Moody 2021.)

2 Logistics problems impacting the scarcity of car parts – effects on consumer behaviour

During this research there were four main themes when it comes to researching about the pandemic and the lack of parts caused by it within the car industry. This is split into “sub-theory frameworks” which were a part of each of the main 4 theory framework topics. These are shown in both the list below and also in figure 2.

2.1 Car industry

The two main focus points for studying the car industry in the theory framework was their reliance on just in time manufacturing and the effects of factory shutdowns on the rest of a supply chain. It also featured resilient supply chains.

2.1.1 Just in time manufacturing

According to Roser (21 June 2016), in time manufacturing was originated by Kiichiro Toyoda, the founder of the Toyota Motor Company. When he missed a train, he started to think about similar situations for material. He thought that material being late is bad for causing stoppages and delays while at the same time material arriving early causes increased inventory. Thus, the only correct time would be just in time, which was first spoken about within Toyota around 1936.

Many years later, Just In Time actually became a working methodology at Toyota. According to Obara & Wilburn (2012, 57) it was established after years of continuous improvement within the production processes. They aimed to manufacture the vehicles ordered by their customers in a fast and efficient manner, driving down the delivery time.

It has since been assimilated by virtually all high-volume manufacturers within the car industry, and has been accepted as the best way to operate for decades. The only notable manufacturer who has deviated from this methodology is the creator of it, Toyota. This was due to the 2011 Fukushima earthquake negatively impacting Toyota’s production previously. It was during this time that they realised the lack of resilience that Just in Time manufacturing imposes on the industries that adopt it (McEachran September 2021).

2.1.1.1 Goals of Just in Time manufacturing

Just in Time manufacturing has key goals that a company strives to achieve with its implementation.

The first goal would be the identification and response to consumer needs. It focuses the organisation on what are the demands from the customers and what is in turn required from their production. This allows them to produce products that the consumers want and make sure the organisation is viable (Cheng & Podolsky 1993, 9).

The second goal of Just in Time manufacturing is to aim for the optimal quality / cost relationship. Quality cannot be achieved if it does not pay off for the organisation because it is no longer viable. An organisation must attempt to develop a manufacturing process that has zero defects. If the organisation can achieve this then they can make certain functions redundant such as inspection, rework and the production of defective products (Cheng & Podolsky 1993, 9).

The third goal of Just in Time manufacturing is to eliminate unnecessary waste that do not add value to the product (Cheng & Podolsky 1993, 9). Using Toyota as an example, this goal is the basis of the entire Toyota production system and Just in Time is one of two methods they use to support this (Ono 1978, 4).

The fourth goal is to aim to develop trusted relationships with the suppliers. It is also necessary to have relationships with as few suppliers as possible in order to create a more efficient company with regards to inventory and materials, punctuality of deliveries and knowledge that the necessary materials will be available when needed (Cheng & Podolsky 1993, 9).

Designing the plant for maximum efficiency and ease of manufacturing is the fifth goal. This is aimed specifically as the machinery and labour that are directly used for the manufacturing process (Cheng & Podolsky 1993, 10). A key part of maximising the efficiency of a factory is the reduction of safety stocks in order to not only facilitate that part of the factory for actual operations (or to move to a smaller factory), but also to tie in with the elimination of waste from goal 3.

The final goal of Just in Time is to adopt the Japanese working methods of aiming for continuous improvement even where high standards are already in place. This ensures that the organisation remains competitive as they cannot rest on their laurels and fall behind other companies who are pushing forward (Cheng & Podolsky 1993, 10).

2.1.1.2 Disadvantages of Just in Time manufacturing

Just in Time manufacturing can bring many advantages, but it also has many limitations.

The culture tied to Just in Time manufacturing is intrinsically linked to Japanese culture. The problem is that not every culture replicates Japanese working culture. In many companies this will mean that if Just in Time is implemented, it will require widespread changes in attitudes and worker philosophy to become successful (Cheng & Podolsky 1996, 12).

The issue of culture is important when talking about the lack of autonomy associated with JIT. The loss of autonomy has been attributed to the short cycle times (the time between recurring activities) of manufacturing using JIT. Buffers such as slack or idle time are reduced when using JIT methodology and gives workers less time to perform “vertical tasks” such as team meetings and other administrative functions. This in turn forces workers to adapt to changes in demand without taking their needs or limitations into consideration. Furthermore, the loss of autonomy may be a possible result of the reduction of buffer inventories. The flexibility they once enjoyed as a result of the buffer inventories has now been reduced or abolished (Cheng & Podolsky 1996, 12).

Finally, given that one of JIT manufacturing’s goals is to design the plant for maximum efficiency, a natural part of that involves the reduction or abolition of safety stocks. These stocks usually act as a buffer for companies who inaccurately predict demand forecasts. The elimination of these means that a company must be completely sure that their forecasts are close to 100% accurate. Without this level of accuracy there will be large delays in production output while the company waits for extra inventory to fill the gaps (Cheng & Podolsky 1996, 12).

2.1.2 Resilient supply chains

During the course of the past 10-15 years both suppliers and customers have been engaging in acquisitions, mergers and consolidation. This has meant that while previously a large manufacturer might have thousands of suppliers, the numbers of suppliers have dwindled down to dozens or hundreds of larger suppliers. This has resulted in simplified tenders, improved procurement cycles and simpler contract management (Hiles & Fry 2016, 16).
Complex global supply chains are susceptible to disruption through environmental, geopolitical, economical and technological reasons. Environmental will include natural disasters and pandemics such as COVID that can affect production or delivery of a product. The COVID 19 pandemic also triggered the other three means of disruption for the car industry on a global scale. Geopolitically, the pandemic brought trade barriers and customs difficulties. Economically, there was a sudden loss of production by many suppliers to the car industry throughout much of the world. Finally, technologically there were mass transportations failures (Hiles & Fry 2016, 17).

There are a number of ways for companies to combat these colossal supply chain issues and create a truly resilient supply chain which will be looked at in the following sub-sections:

2.1.2.1 Creating a resilient supply chain - Optimise production with supply chain planning

Companies must optimise production with supply chain planning. Supply chain planning provides companies with a greater understanding of supply and demand requirements while simultaneously harmonising production. With this foresight, companies can anticipate issues and limit disruptions to their supply chain (SAP 2021).

When car manufacturers receive an order, they already need to have already anticipated and planned for enough of a supply of parts, labour and other resources in order to deliver on the order when it arrives. This means that they have to make decisions about what parts to procure and which products to produce prior to actually knowing their true demand. This is difficult because they have to plan their usage based on future demand, available production capacity and sources of supply using uncertain and conflicting information. This is a difficult balancing act which usually involves compromises such as inventory targets versus customer service levels (Feigin 2011, 4).

Supply chain planning is made up of 3 interlinked processes: demand planning, sales and operations planning (S&OP) and finally inventory and supply planning. These processes flow sequentially each with different objectives and key outputs as shown in Figure 1 (Feigin 2011, 7).

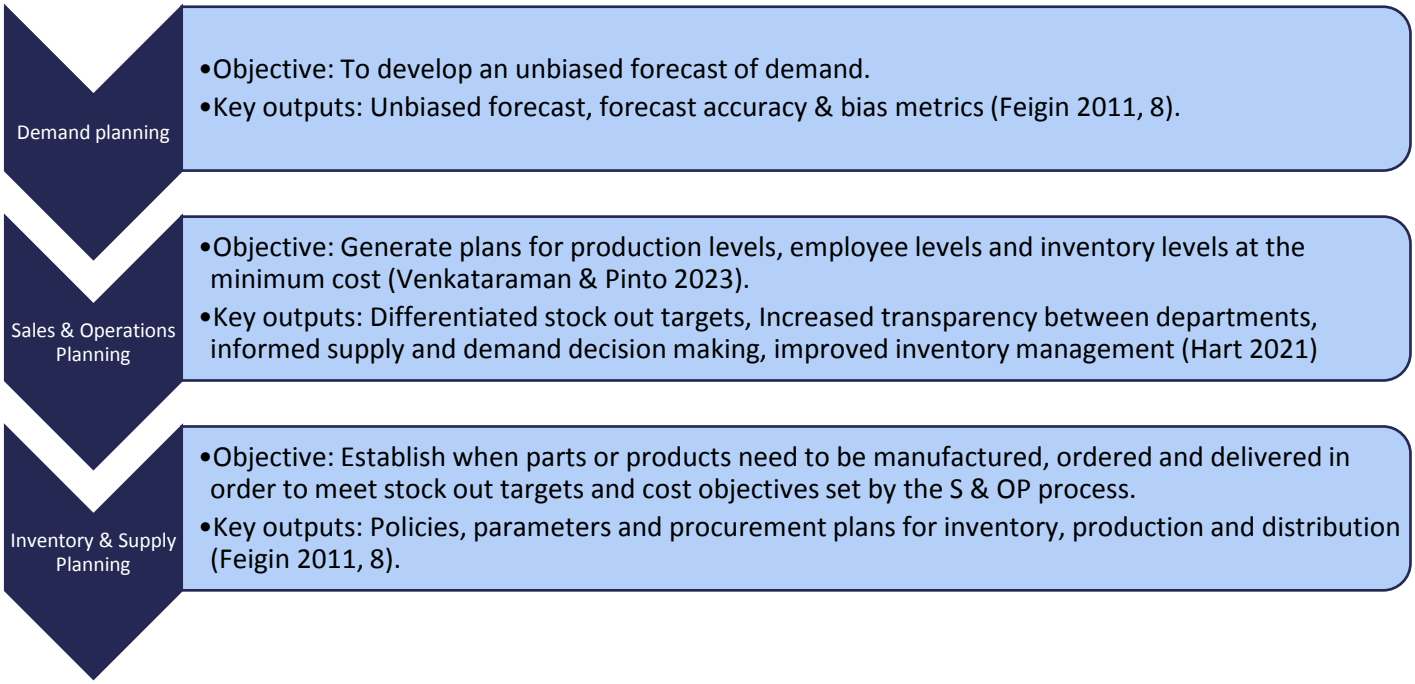

Figure 1. Supply chain planning

2.1.2.2 Creating a resilient supply chain – Understanding and leveraging data

All large car manufacturers now have access to incomprehensible amounts of data. This data can come in a variety of formats including machine readable datasets, videos, sound recordings or text. All these formats can be merged and manipulated into providing significant analytics data. However, stakeholders in the automotive industry have frequently misunderstood the benefits and methods of leveraging this data, and thus have limited its applications and potential across the industry, until very recently. Utilising supply chain data, companies can understand which parts of their supply chain are at risk. This allows manufacturers to proactively neutralise any issues before they actually materialise (Deloitte 2015, 1).

Advanced supply chain analytics signifies an alteration in the usual strategy for car manufacturers of reactive management models. Automakers now have the ability to perceive any shifts in the industry as it happens around them. Car manufacturers can analyse progressively larger datasets using established analytical and mathematical techniques. Using powerful big data tools to merge different data sources with the aim of delivering actionable insights has now become more widespread in the industry (Deloitte 2015, 8).

Advanced analytics give the automotive industry the advantage of moving away from historical point in time snapshots, towards real time data. This real time data increases a company's ability to analyse and provide visibility to stakeholders, both within an organisation and across their supply chain. As the amount of data elements and records increase, the utilisation of these advanced analytics are also expected to simultaneously surge across the industry. The focus on internal cross-functional sharing of data is expected to transfer towards a greater coordination with partners across a company's supply chain network. This will result in a more transparent, broader supply chain which is better connected and quick to react to fact-based analysis. Crucially, this analysis will allow alternative responses to be simulated before they are selected, meaning a company can pick a best-case scenario with significantly more evidence behind their decision than they currently can (Deloitte 2015, 8).

2.1.2.3 Creating a resilient supply chain – Diversifying suppliers and manufacturing partners

In the past the car industry was a stable business with reliable and predictable uprises in demand. As the amount of passenger cars sold in Europe annually has increased it has resulted in an intensified demand for OEM parts and components. This phenomenon has also been enriched by

the overall fleet on Europe's roads continually growing, and thus requiring increasingly large aftermarket support for spare parts (Schlosser, Hoppe & Sarftel 2021). Ultimately this has led to car manufacturers being able to identify predictable demand patterns and easily work with supply chain partners to meet that demand.

Modern technological trends such as the move towards new powertrain technologies and the push toward electric vehicles have disrupted the traditional supply chain relationships in the car industry (Schlosser, Hoppe & Sarftel 2021). These traditional relationships have revolved around a car manufacturer having a minimal number of partners and suppliers to reduce operational and logistical complexity. Unfortunately for manufacturers, this strategy relies on social, environmental and political stability, which has not been commonplace in the last few years. Unexpected disruptions in one region has the potential to hinder or stop an entire network of operations. This has led to changes in strategic thinking. While having multiple supply locations was previously seen as an inefficiency, it must now be viewed as another cost of doing business (SAP Insights 2023).

2.1.2.4 Creating a resilient supply chain – Implementing capacity and inventory buffers

Profitability within a supply chain has been traditionally dependent on the minimisation of surplus stock and keeping inventories as lean as possible. Supply chain managers have usually gambled with disruptions by keeping low amounts of inventory buffers, to keep costs down. The pandemic brought to life the real cost of the gamble when it backfires. A move that manufacturers are now recommended to make is to move from their traditional "Just in Time" to a "Just in Case" model. This means they need to restructure their supply chains and manufacturing operations toward a model where resilience is favoured over absolute efficiency (SAP Insights 2023).

Just in case inventory management means that a manufacturer keeps a large standing inventory to reduce the risk of stockouts (GEP 2023). This can allow a company to offset labour shortages, delivery delays and resource scarcity. The key purpose of just in case management is to shield the customer from disruption out of their control and gives them the ability to access the goods and resources when they need it most (Verhoeven 2023).

The pivotal aspect of transitioning to this just in case operation stems from traceability along the supply chain (Verhoeven 2023). This is the capability of being able to track a product from its' source, all the way to the customer (ChainPoint 2023). It allows a company to better predict demand, provide real-time updates and to deliver goods consistently (Verhoeven 2023).

2.1.3 The effect of factory shutdowns on a supply chain

When a supply chain contains a factory, it is usually a viral piece of infrastructure to that supply chain. A factory shutdown has the power to negatively impact a supply chain in both directions resulting in the complete cessation of that supply chain as shown in figure 2.

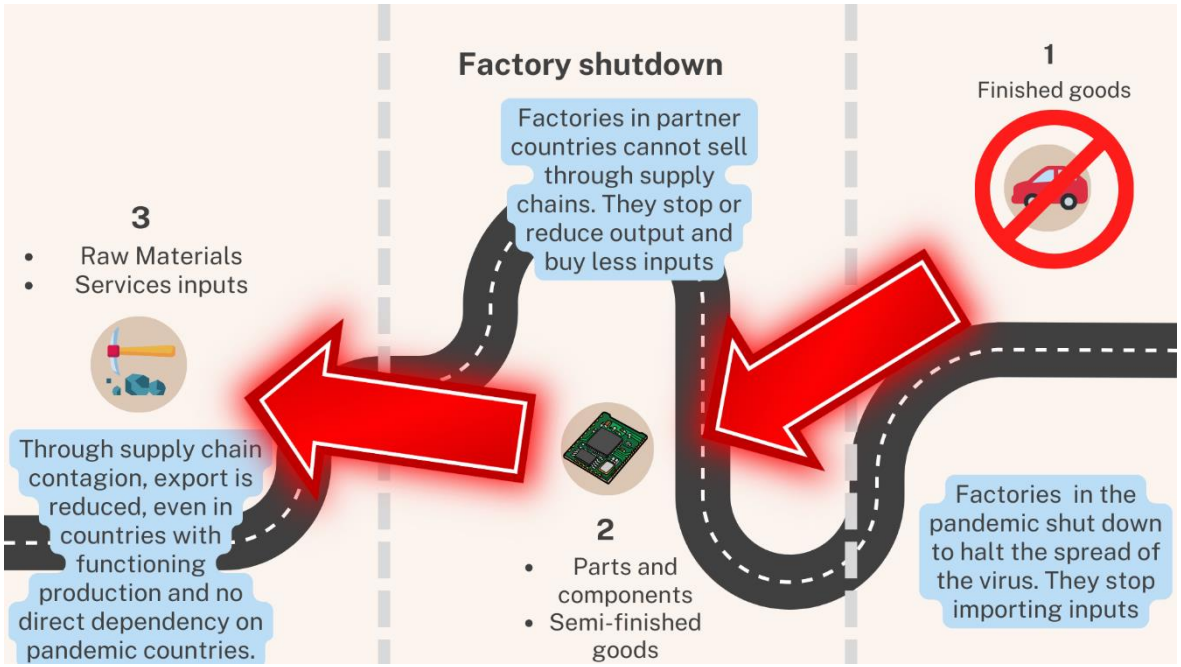

Figure 2. The effects of a factory shutdown during the pandemic (International Trade Centre 2020)

Not all factory shutdowns are equal. Factory shutdowns across the EU (including the UK) will have the strongest negative impacts on supply chain exports for other countries. The reason for this is because the EU is the largest importer of manufacturing inputs as well as being the largest market for three of the world's five geographic regions and being highly integrated into global value chains (International Trade Centre 2020).

To exacerbate the problem for the car industry, the top 5 industries affected by supply chain disruption are machinery, "plastics & rubber", chemicals, electronics and "motor vehicles and parts". To create a car, the motor industry relies on all these industries to deliver the finished product. Finally, there is also no quick fix to the problem as immediately finding alternative specialised suppliers would be expensive and a potentially risky method of resolving the problem (International Trade Centre 2020).

2.2 Transportation logistics

This part of the theory framework concentrated on the effect of border closures and driver shortages on supply chains.

2.2.1 Border closures

During the COVID 19 pandemic almost all OECD countries as well as emerging market economies established restrictions on the movement of people to control the spread of the virus. These included quarantine requirements, visa restrictions, flight suspensions and crucially, border closures. Internationally, more rigorous restrictions were implemented when compared to domestic travel (OECD 2021).

These border closures often have unintentional influences on trade bottlenecks. This is because many border closures likewise apply to maritime, road and rail transport workers (WTO 2021). According to Eisenstein (2018) 37% of imported parts used on U.S made vehicles are imported from Mexico. This also includes critical pieces such as wiring harnesses that are used on 70% of all vehicles manufactured within the U.S. It was estimated that were the border to close between the U.S and Mexico, the disruption would halt the work of over 1 million employees in U.S auto assembly and parts plants. That is the effect of merely one country's border closure on the single largest economy in the world. The pandemic was the first time in history where every destination worldwide had imposed border restrictions, including the full closure of borders in many countries (WTO 2021).

2.2.2 Driver shortage

Throughout COVID many countries worldwide suffered with a shortage of lorry drivers. Research published in 2022 indicates that there are currently 380,000 drivers needed throughout Europe alone. The long-standing reasons for this have been attributed to a lack of women in the industry, an ageing population within the industry and difficult working conditions (Przybyla 2023). More recent stated reasons have been the global pandemic, and Brexit for employees working inside the UK (REC 2022).

The results of this have been paralysing for the automotive industry. Renault have thousands of cars stuck at the car manufacturer's plant in Sochaux in 2022. Renault was then forced to park the cars on a local airfield while they were in a queue to be transported (Chaplin 2023). The problem is further exacerbated with cars that are shipped to the UK, that sit in ports with transport unavailable. The consequence of this has been that the dealership has no information to give to the customer

because the dealerships are not given any estimations or knowledge of arrival times (Baggott 2022).

2.3 Parts scarcity

The parts scarcity theory framework aimed to establish the use and importance of semi-conductor chips and rubber within modern vehicles. It also examined the opportunity cost involved with these parts on behalf of the companies producing them, lending to the reason why car manufacturers struggled to obtain parts.

2.3.1 The significance of semi-conductors in car manufacturing

The first car was built by Karl Benz in 1885 (Mercedes-Benz 2023). For the next 70 years cars would be mostly mechanical with the gradual addition of very simple electronics over time. However, in the late 1960s the first chips were introduced to cars to manage functions such as fuel injection and transmission shifting (Swinhoe 2018). Today cars rely on chips for a vast amount of their operations to the extent that they cannot run without them (Electronics-sourcing 2022). Even the failure of one chip in the car has the potential to render the entire car undriveable. For example. If a chip fails in the fuel injection system, then fuel will not be delivered to the engine and the car cannot make any power. It is estimated that between 1000 (Electronics-sourcing 2022) and 3000 (Shih 2022) chips can be used in a conventional petrol or diesel powered car, with twice as much in an electric car (Electronics-sourcing 2022).

2.3.1.1 Advantages of semiconductor chips over mechanical alternatives

There were significant incentives for the automotive industry to consistently pursue the ever-increasing utilisation of chips, over mechanical alternatives. Their popularity originates from the 1973 oil crisis. Using sensors to monitor different variables such as temperature, throttle position and mass air flow car manufacturers were able to significantly improve the fuel economy and emissions in their vehicles. The chips were able to carry out immediate calculations to optimise engine performance. These features would have been impossible with their mechanical counterparts. Modern cars also have the ability to be modified with over the air updates similar to a mobile phone. This means that certain problems can be fixed for a fraction of the cost, compared to a manufacturer performing mass recalls as they had to in the past (Shih 2022).

2.3.1.2 Quality of automotive chips to other tech industry chips

Automotive chips are unique in certain aspects relative to the majority of chips produced for other applications. Car manufacturers require that they have an operating lifetime of 15 years while simultaneously having a failure rate of zero parts per billion. They also necessitate that replacement parts are available for at least 30 years. When comparing this against a phone which has failure rates measured in parts per million and reaches obsolescence after 5 years, this is extraordinary. Finally, they also require the chips to operate over a wide range of temperature extremes at the same time as being exposed to significant amounts of shocks and vibrations. Many modern cars are produced as worldwide cars which means that the same chips may be used in Finnish winters as well as Saudi Arabian summers. On top of these prerequisites, the chips must also meet ISO 26262. which defines how failures are handled as well as undergo extensive testing and qualification before the manufacturer will authorise their production. This period can take a manufacturer as long as 3-5 years for the design, test and validation stage prior to entering a consumer vehicle (Shih 2022).

2.3.1.3 Other key differences in automotive chips compared to other chips

Chips are measured in nm (nanometres) which is equivalent to 0.000000001 metres. Nm is used to measure the size of the transistors that make up a processor. The tech industry is consistently pushing to make their chips have smaller nm transistors. Having smaller transistors gives advantages of the chip requiring less power, less cooling, less distance between each transistor and a higher transistor density. The first two features are advantageous for economical power use, while the last two features are great for the computing power benefit (Arslan 2022).

A considerable proportion of automotive microcontrollers use 90nm technology (Shih 2022). To put this into perspective, the standard length of transistors used by the tech industry today is 10nm with the very latest research able to create 5nm and 7nm chips (Gopani 2022). While the shortages during the pandemic have led automotive companies to pursue smaller chips, the industry specific development times and necessary quality adherence means that these chips will not be in production for up to 5 years (Shih 2022).

2.3.1.4 Opportunity cost of producing semi-conductor chips for the automotive industry

The older style of 90nm chips, which are manufactured for the automotive industry, make chip manufacturers less money than the more advanced chips, created for the tech industry. As demand for the chips is beyond the capacity that the chip manufacturers can provide, they are in a position to either manufacture the most profitable type of chips possible, or to manufacture chips

which garner them less profit (Cole 2022). This is a direct example of opportunity cost, whereby choice A which involves making the chips for the automotive industry has an opportunity cost compared to choice B of making the chips for the tech industry and producing more profit (Corcoran 2023).

2.3.2 The significance of rubber within the automotive industry

Tyres are not the most glamorous part of a car, but they are crucial to the operation and usability of a car.

The production of car tyres is complex and involves getting the correct mix of ingredients to produce a tyre. From these materials, natural rubber usually makes up around 19% of the composition of the tyre. Rubber is the ideal material for car tyres and very few other materials come close to giving the ideal range of properties that rubber provides. Rubber is firm but also offers enough flexibility to fulfil the range of conditions that it must undergo throughout its' life cycle as a car tyre (Oponeo 2020).

Traditionally, all rubber would come from hevea trees. These trees require a hot, damp climate to grow so they are usually found in countries such as Brazil and India. Today, less than half of rubber used to produce car tyres is natural. Many companies have opted to develop synthetic rubber making use of a variety of materials. These synthetic materials provide better properties for the tyre giving it superior heat resistance and better longevity (Oponeo 2020). However, even with this push towards increasing use of synthetic tyres, the tyre industry still accounts for around 70% of the worldwide production of natural rubber (BTMA 2023).

2.4 Consumer behaviour

This theory focussed solely on Black Box consumer model. This looks at many different internal and external factors surrounding consumer behaviour when making a purchase (Lumen 2021).

2.4.1 Black Box consumer behaviour model

Consumer behavior models are an attempt to rationalise the logic behind buyer behaviour in a way that covers all buyers. There have been many different models throughout time such as the economic man theory, which assumes people act selfishly as consumers and always try to maximise the benefits they derive from the process of buying goods. This has since been branded

an over-simplification of consumer behaviour and does not encompass all consumer choices (Lumen 2023).

The Black Box consumer behaviour model identifies the consumer as a rational thinker who responds to a large variety of external and internal factors (shown in Figure 3 below) when making a purchasing decision (Lumen 2023).

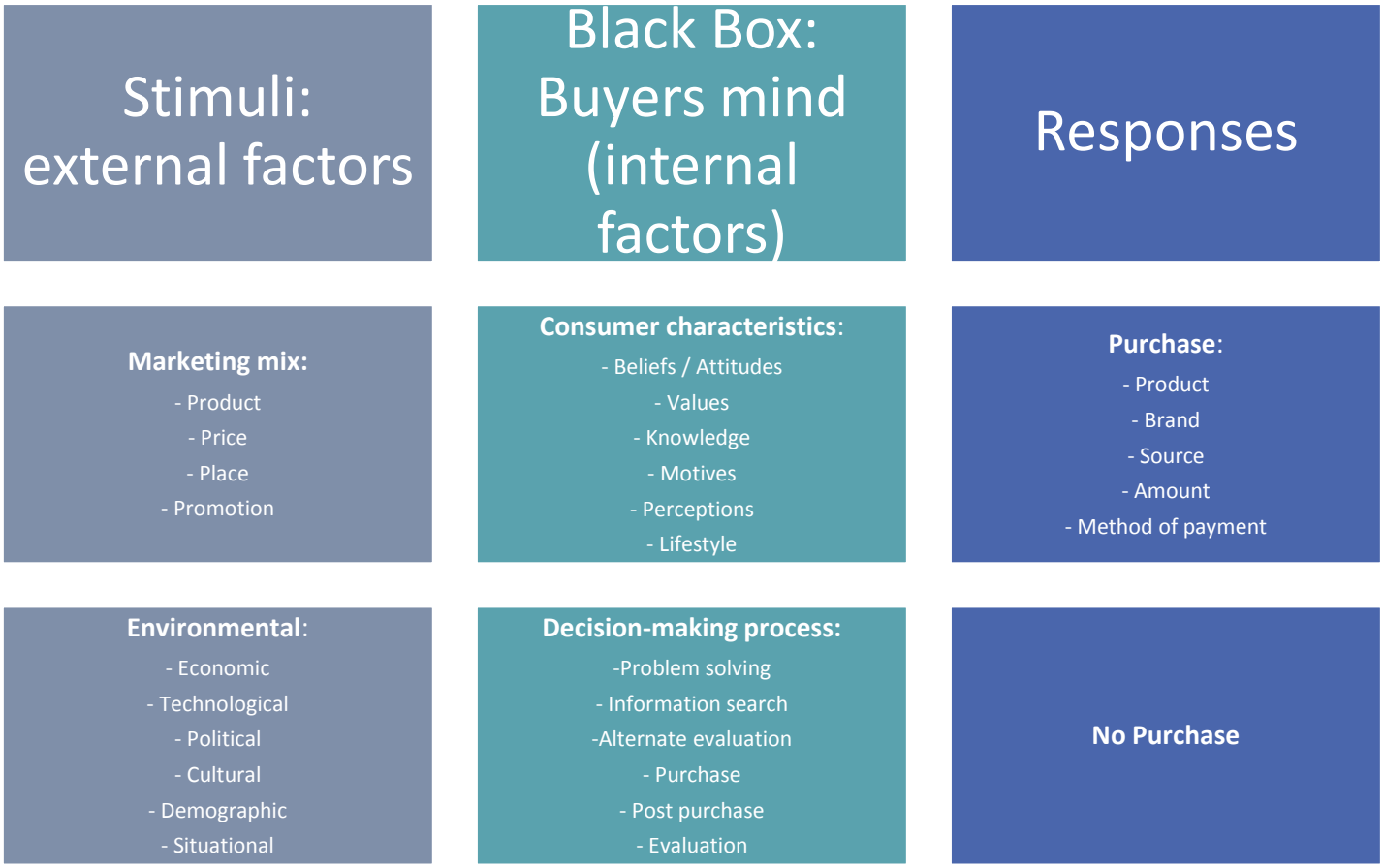

Figure 3. Black Box Consumer Behaviour Model (Lumen 2023)

In this model the marketing mix is represented by the “4 P’s” of marketing stimuli planned and created by companies. The envionmental stimuli is provided by the economic, political and cultural circumstances of a society. When combined, these two stimuli represent the external factors of a purchasing decision (Lumen 2023).

The internal factors are known as the Black Box. These include an array of factors that exist internally within a consumer’s mind and characteristics of the consumer such as lifestyle. This combined with the decision making process forms the internal Black Box that are relevent to the consumer (Lumen 2023).

Finally, the consumer can either make a decision to purchase or not to purchase. The decision to purchase also comes with multiple factors of its own such as method of payment. For example, if two dealers are selling the same car at the same price under the same warranty conditions. Dealer A only offers PCP finance and the Dealer B offers HP and PCP, some consumers may find it preferable to go with Dealer B, due to their preferred method of payment being provided.

2.5 Theory framework model

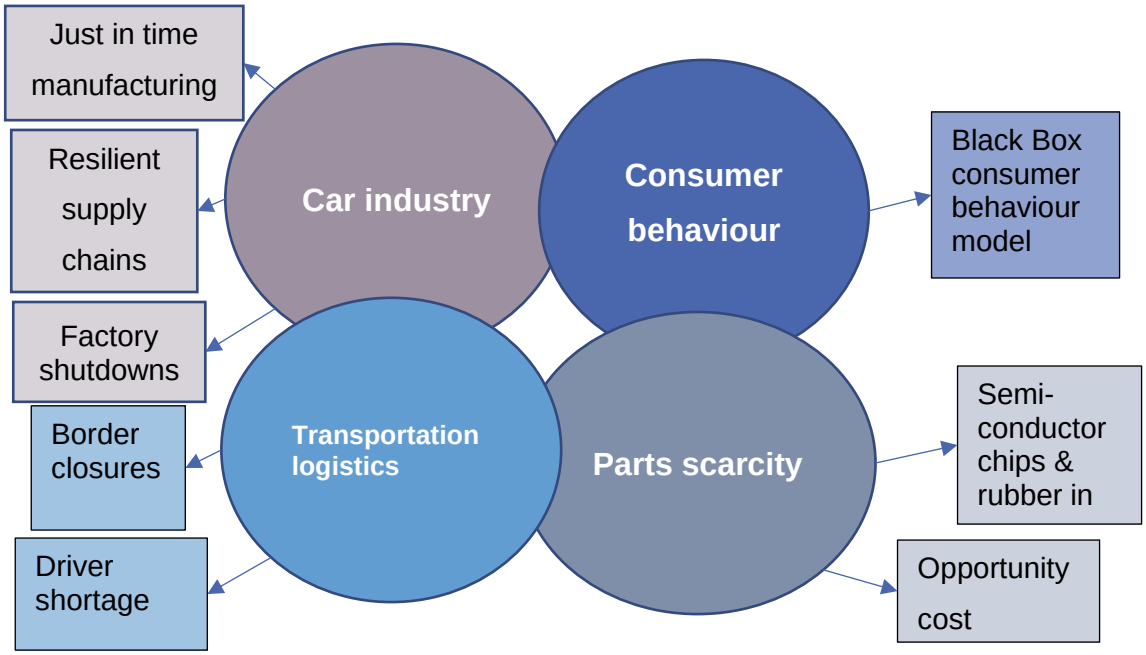

Figure 4. Theoretical framework

3 Research Methods

3.1 Phase 1

Phase 1 of this research was seeking answers to IQ1 and IQ2. To accomplish this, the author required data and information from books, journals and articles. This data was used to build the author's knowledge and understanding of the key concepts and phenomena of the topic. Using this knowledge was the key to starting phase 2 of the research.

3.2 Methods of phase 1 & 2

The methods of both phase 1 and phase 2 was a mixed data analysis (qualitative and quantitative) method. According to Bazeley (2015), mixed methods are using a combination of different types of data, different types of data sources or different kinds of analysis in order to develop an outcome which is integrative so that they are interdependent on each other while serving a common purpose. He also mentions that using these methods together achieves more than they would as separate methods and produces an outcome that would be difficult to do with the other method. The author believed this helped to achieve the goals that were set out in each IQ. The reason being is that the purchase of vehicles (from a consumer perspective) is not only dependant on qualitative thinking but also by the raw numbers involved. To not include them would only be telling half the story and thus, not analysing the situation appropriately.

3.3 Phase 2

Phase 2 of this research covers IQ3, IQ4 and IQ5. This stage of the research targeted car owners in Finland and the UK. The data collection method during this stage was done using a questionnaire. The author aimed to acquire a sample size of between 40-50 respondents. These respondents were made up entirely of car owners who live either in the UK or Finland. The author hoped to get an equal ratio of both Finnish and British respondents. Whilst 50/50 is an ideal ratio, 60/40 would also carry enough weight in responses from both countries. Initially direct contacts were pursued as the first respondents, with further options pursued as and when necessary.

The questionnaire was kept open for around 3 days and got 53 responses. This was slightly more than the top end of the goal which was set prior to the survey going live. While attempts were made to keep the ratio of Finnish and British answers similar by asking more or less people from each country, after the survey was released, it was very difficult to control. After the first day there was a significant amount more Finnish respondents than British respondents. By trying to rectify this and pursue more British people in day 2, the British respondents outweighed the Finnish

respondents. The end ratio of answers was 56.6% of British people, compared to 43.4% of Finnish people. Whilst this is not the ideal of 50/50, it is still within the 60/40 ratio which was determined to carry a significant weight of response from both countries, and so it was suitable for the results.

3.3.1 The questionnaire

As demonstrated in appendix 2, the questionnaire sent to car owners (please use the zoom function to scale up the text). It was formatted like this for the thesis, but the actual questionnaire was on Google Forms. The questionnaire was answered by all respondents over two days, between the 20/04/2023 and the 22/04/2023.

3.3.2 The questionnaire structure and reasoning

This questionnaire was designed to encompass IQ3, IQ4 and IQ5 in the form of questions asked to car owners in Finland and the UK. The Black Box consumer behaviour model was also kept in mind during these question sets as this is what the consumers' behaviour would be evaluated against. It was therefore structured accordingly with the initial questions revolving around the respondent as a person.

After this, the questions moved on to both pre-pandemic and during the pandemic era. These eras were clearly defined for the respondents to remove ambiguity from the questions. These questions were also kept very similar between each "era", in order to be able to draw comparisons and useful information from them.

The final segment of the questionnaire featured consumers' hopes for the future of the car industry. With the combination of all of 3 segments in the questionnaire, it gave the research significant clarity when approaching the topic from a chronological viewpoint. The types of questions were mixed, with open ended, closed and multiple choice questions being used to gauge respondents feelings towards questions. The initial question meant people had to define if they resided in Finland or the UK. As this research only targets those two countries, then this question meant that any potential respondent outside of those two countries could not answer, ensuring only the correct respondents replied. It was also extremely useful during the comparison phase of the survey because it meant that not only could comparisons be drawn between the countries, but each respondents' currency would also become obvious in questions about income or purchasing costs for example.

3.4 Research methods overview

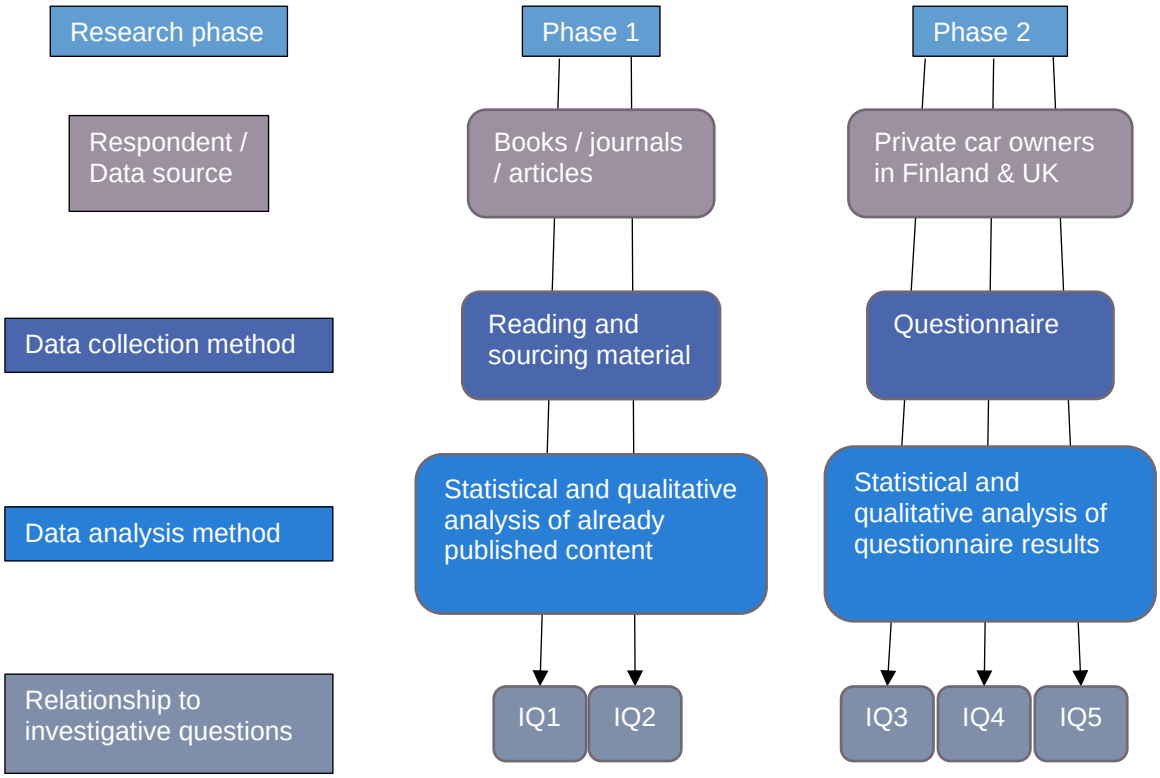

Figure 5. Research design

4 Data and results

During this chapter of the thesis, 4.1 and 4.2 will detail a timeline of the critical aspects of the pandemic and their effects on the car industry and the industry's supply chain.

Segments 4.3, 4.4 and 4.5 will focus on information collected from a survey of British and Finnish car owners. The author has constructed a question set for car owners from these two countries to give insight into their behaviour before, during and their desires for the industry after the pandemic.

4.1 The collapse of the car industry during the pandemic

The pandemic was an unexpected event which triggered internal responses from the car industry as well as external responses from political and geographic decision makers. These internal and external responses interacted in a unique way which has not been seen before on a global scale. The result of the unique interactions ultimately resulted in entire well established supply chains being disrupted and critical parts becoming unavailable for automotive manufacturers. As this happened in a chronological order, this part of the thesis will be designed in a similar fashion to demonstrate the logic of supply chain failure during that stage of the pandemic. For political decision making, this thesis will focus mostly on the EU and the UK as an inclusion of worldwide political response would fall outside the scope of this thesis.

4.1.1 The initial political reaction to the pandemic

Within Europe the initial stage of the pandemic was handled in an inefficient manner. This was down to the living members on the continent having no prior experience of a pandemic and also the unique way which European democracy is handled as a union while also remaining separate. The EU states are too integrated to handle a crisis of this magnitude alone but also not integrated enough to collectively tackle a health crisis. The freedom of movement ideal is one of the key aspects of the EU, which means that the countries were not well adjusted to implementing travel restrictions during the pandemic. This led to significant disruptions while also simultaneously failing to control the spread of the pandemic (Lehne 2021).

Despite some initial resistance to border closures, the entirety of the EU (Schengen Visa 2021) as well as the UK (Gov.UK 2022) closed their borders in an attempt to combat the spread of COVID-19. Both the EU and the UK also initiated lockdowns which meant that the population no longer had the right to roam freely within their own country as well as businesses being restricted on certain operational activities such as opening hours (Parkinson 2020).

4.1.2 How lockdowns and border closures affected the dealerships during the pandemic

For car dealerships, lockdowns mostly negatively impacted their sales output while border closures affected their ability to stock new cars and deliver on new car sales. This is because both the border closures and lockdowns happened in either very close time frames or simultaneously for most countries. The results of these two political decisions combined to create a larger effect on the automotive industry.

4.1.2.1 Lockdowns destroy demand for dealerships

From the consumers' perspective, after lockdown rules were initiated, there were significant implications on their ability to move freely throughout their own country and certain business types being more impacted than others. For example, in the UK only essential retailers were allowed to continue normal business operations. As a result of legislation imposed during that time, car dealerships were not considered an essential function and were therefore closed until further notice. During this time period, year on year new vehicle sales within the UK fell by 97.3% (Buckley 2020)

Later in 2020, within the UK car dealerships were allowed to sell cars in a click and collect method, which is usually associated with smaller purchases such as electronic goods or food shopping. While test drives were possible with this method, it was not a service which was widely offered by dealerships during the pandemic (Evans 2021). The risk here for the customer was that they would have to place down large sums of money or sign a large finance agreement on a car which they had never actually driven. During a study of British consumers, it was revealed that around 27% of drivers would buy a car online without a test drive (Netimperative 2019). While that is a significant number, in this instance it also excluded the remaining 73% of the market from purchasing a vehicle during the lockdowns.

4.1.2.2 Border closures create supply issues for dealerships

Border closures impacting the supply of new cars into countries dealers have turned to the used car market to flesh out their forecourts. However, this has in turn led to a strong demand for used cars amongst dealerships putting a strain on the amount of available stock left within the market. In this field, traditionally physical sourcing has been a strong method of acquisitions when it comes to sourcing stock. However, dealers have now had to adjust to the realities of the situation and instead use multi-channel sourcing. Digital only auctions and sourcing stock directly from consumers has become more popularised during the pandemic in order to keep sufficient stock levels (Davies 2021).

4.1.2.3 Large decline in used car sales during 2020

While the market did recover to an extent, the year ended with new car sales within the UK falling by 29.4% throughout 2020 when compared with 2019. When put into raw figures this equated to a total of 1.6 million cars sold during 2020 compared to 2.3 million in 2019, which is an enormous loss for the industry (Pollard 2021). In Finland, a similar trait was seen with passenger cars dropping from 114,199 units in 2019 to 96,415 units sold in 2020, resulting in a 16% drop in sales (Car sales base 2020). Globally, new car sales were also negatively impacted by the pandemic dropping from 65.5 million units in 2019 to 56 million units in 2020 (Car sales statistics 2021). This negative effect from the sales end of the supply chain was then pushed further up to the car manufacturers production lines.

4.1.3 The domino effect of a lack of sales on the production line

Car manufacturers production lines were impacted from a multitude of directions. From the sales end, the border closures and lockdowns were causing a massive decrease in sales. These same issues were then impacting the factories themselves, who were under the same rules and were also not considered as a necessary function by most countries. Simply put, without sales the manufacturers had no revenue income, so they reacted quickly and cut their production and purchase orders to maintain their just in time model. They did not want a build-up of stock or wasted labour, as this went against the key principles of the model as outlined earlier within this thesis. For all of the manufacturers, this turned out to be a grave mistake (Isidore 2021).

As a result of their just in time methodology, automakers shut down plants across the world to meet the sudden lack of demand they were receiving. This meant completely dissolving their manufacturing capabilities and parts supply, rather than keep operating to the extent that the laws of each country allowed them to during the pandemic. The manufacturers had too much confidence that their forecasts were correct and that they still operated in the efficient format that had worked so well for them for so long (Sugiura & Tanaka 2021).

Their key error was that their forecasts were completely wrong. Car sales bounced back much faster and in greater quantities than they expected, and manufacturers were unable to answer the increased demand (Isidore 2021). The actual numbers of sold units globally only increased from 56 million in 2020 to 58 million in 2021 (Best selling cars 2022). Had the manufacturers been able to meet their demand, this increase would have been significantly higher. It is estimated that the cost

in sales to automakers globally was 7.7 million units. Put into financial terms, this has cost the industry $210 billion (approximately €188 billion) in lost sales (Isidore 2021).

4.2 The effects of factory shutdowns further up the supply chain

Unfortunately for manufacturers, the factory shutdowns had considerable adverse effects on their supply chain and certain parts became very difficult for the manufacturers to source. In particular, those parts were rubber for tyres (Anderson 2021) and a more extreme shortage of semi-conductor chips (Sugiura & Tanaka 2021). As evidenced in section 2.3 of this thesis, these two items are absolutely critical to the functionality of cars.

4.2.1 A lack of rubber

The shortage of rubber was caused by many issues and then made worse by the factory shutdowns. The pandemic itself caused an upsurge in the demand for rubber for items such as rubber gloves and packaging tape (Anderson 2021). COVID also resulted in the migrant workers not being able to travel to “tap” the trees to obtain the rubber from them (Swain 2021). The supply of rubber was also disrupted by harsh weather conditions within the leading countries which produce rubber. As previously mentioned, these countries containing the hevea trees are usually hot, damp climates which are usually more susceptible to drought and floods. Finally, rubber trees were also suffering from leaf disease, making them unusable for commercial purposes (Anderson 2021).

As a result of these shortages rubber was purchased in excessive quantities because manufacturers wanted to stockpile rubber due to future availability being unclear (Anderson 2021). The supply of rubber dropped to the extent that it can no longer keep up with demand. Due to the low prices that farmers received for rubber, they have very little incentive to plant extra trees to make up for the shortfall. Even if new trees are planted however, it can take 7 years for trees to become sufficiently mature to be tapped for rubber. While the industry managed to navigate this shortage by using their buying power to buy in bulk, it will require significant attention in the future to prevent a global crisis (Coruba 2022).

4.2.2 Scarcity of semi-conductor chips

The factory shutdowns had considerable ramifications for automakers globally when it came to the scarcity of semi-conductor chips. As evidenced in section 2.3, these chips are radically different from the standard semi-conductor chips used elsewhere in the tech industry. They are also a critical part of the infrastructure of modern vehicles, allowing them to function. When the car

manufacturers shut down their factories and cancelled orders from the chip manufacturers, it left the chip manufacturers with gaps in their manufacturing capacity. To eliminate this problem, they merely started production of chips for the rest of the tech industry. These chips were significantly more advanced and therefore more profitable than the relatively simple but high wearing semi-conductor chips that the automotive industry uses (Cole 2022).

As a result of this, when automotive manufacturers wanted to start production again, they found that the suppliers they relied on for semi-conductor chips had no capacity. The semi-conductor chip manufacturers would be left with a choice of opportunity cost. Would they restart production of the less profitable, hard wearing specification phenomenon chips for the car industry, or would they keep manufacturing the more advanced and more profitable chips for the tech industry? As a business choice, it was a very simple choice for them to keep supplying the tech industry for a higher profit margin (Cole 2022).

The chip shortage was one of the key fundamentals that led to the lack of sales evidenced in section 4.1.3. The median semi-conductor chip inventory for automakers fell from around 40 days in 2019 to just 5 days in 2021. Therefore, if any disruption hit the supply chain for only 1 week or more, the entire factory would potentially be shut down (Cole 2022). In the US, this meant that freshly manufactured vehicles in the quantity of 10,000s were sitting still in car parks waiting for chips prior to them being shipped to dealerships (Lareu 2021).

Solutions have been put forward to resolve the chip shortage for car manufacturers. These involve more domestic production of semi-conductor chips, closer to the manufacturers themselves. However, due to the specialised nature of semi-conductor chip plants, they have to be purpose built from the ground up and can take years to complete. A large scale facility is also estimated to cost around $10 billion (approximately €9 billion) (Cole 2022). Furthermore, as mentioned in segment 2.3.1, the chips undergo years of quality and control testing before they are authorised to be used in a car. Both of these elements combined means that there is no quick fix to resolve the situation.

4.3 Research into consumer behaviour

In this chapter the information collected from the questionnaire will be analysed and evaluated. The pre and post pandemic question sets will be directly compared with one another and the results will also be evaluated against the Black Box consumer behaviour model.

4.3.1 The types of respondents who answered the questionnaire

As previously mentioned, this thesis only targets car owners within Finland or the UK. Those were the only options given on the survey and so 100% of respondents were either from Finland or the UK. The total count when the survey was completed was 23 Finnish residents and 30 British residents.

The first segment of the questionnaire also targeted people's income. They were given a variety of choices increasing in £/€ 10,000 steps, up to a total of £/€ 100,000+. The average income of Finnish respondents was €50,000, while the average income of British respondents was £40,000. Once the British respondents' income was converted into Euros, it equated to €44,820 (as of 22/04/2023). This meant that the Finnish respondents had around a 12% income advantage over the British respondents. Given this slight difference, we may expect a slight difference in results, but they should be mostly comparable.

According to (Take-Profit.org 2023) the average wage for Finland is €45,684 per year. Meanwhile, the average wage for the UK is £32,760 according to (ONS 2023). This translates into €36,708 euros when converted from pounds (as of 22/04/2023). This meant that Finnish and British respondents were 22% and 9% above average wages overall respectively.

When comparing these statistics against the Black Box consumer behaviour model, these respondents likely have fairly good purchasing power relative to the average person in their countries. This will invariably have effects on the consumer characteristics segment of the Black Box. According to (Gregoire 2018) psychologists who study the impact of wealth on human behaviour have discovered that money can powerfully influence human behaviour in ways that they are often unaware of. It is likely to have an impact on their lifestyle, perceptions, beliefs and attitudes.

4.3.2 Respondents behaviour before and during the pandemic

The two middle parts of the questionnaire aimed to look for any changes in behaviour or attitudes between the "pre-pandemic era" and the "pandemic era".

4.3.2.1 Time between purchasing cars

Prior to the pandemic, respondents purchased a car every 4.7 years per car purchase, on average. From these "pre-pandemic" results, 8 results were invalid as the respondents gave inconclusive answers which have not been included in the calculations below.

In the questionnaire, they were asked how often they have purchased a used car during the pandemic. While many people had purchased a used car once, lots of people had not purchased a used car bringing the figures down to 0.7 average purchases since the start of the pandemic. In order to compare that figure to the pre-pandemic era, the number of days that had elapsed since 01/12/2019 was calculated to be 1238 days (the date at which the questionnaire determined the pandemic started). 1238 days was then divided by 365 to give a pandemic era stretching 3.4 years. Following this, the number of years was divided by the number of times respondents purchased a new car on average since the pandemic. The result was 4.6 years per car purchase.

Comparing an average of 4.7 years per car purchase “pre-pandemic” to 4.6 years per car purchase during the pandemic, the result is extraordinarily similar. This data shows that at least in Finland and the UK, consumers have not held off purchasing new cars at all. Considering the effect that the Black Box consumer behaviour model claims consumers should be under, their buying patterns had very little consistency with the increased car prices, nor the economic, technological or situational stimuli of the Black Box behaviour model.

4.3.2.2 Most important factors within a car

The respondents were asked to identify the most important factors they looked for prior to the pandemic, when purchasing a car. While they were provided pre-filled in options, the respondents also had a field where they could write their own factors in. This field was provided because a person’s priorities during a purchase can potentially be very different to most other peoples’ priorities dependi phenomenon phenomenon ng on all of the factors displayed within the Black Box consumer behaviour model.

Figure 6 (below) exhibits the results from this question. The most important priority for consumers when purchasing a vehicle is price, with 85% of respondents selecting this as an important factor. This coordinates with the external factors’ stimuli within the Black box model, as price and promotion can both fall under this category. However, although residual value is a significant part of the price that a consumer pays on a car throughout the time that they own it, it is not a significant factor for most people when making a purchasing decision, with only 8% of consumers considering this during the purchasing process.

Instead, consumers focus on the upfront costs when operating the vehicle post purchase, with both reliability (72%) and fuel efficiency (60%) being significant factors during the purchasing process. With regards to both of these car features, consumers would need to consider many of the aspects

from the decision making process in the Black Box. They would need to actively search and compare cars against one another in order to reach a conclusion, requiring problem solving, information searching, alternate evaluations, and post purchase evaluations. These factors also require a small level of technological understanding, because fuel efficiency and reliability do not always go hand in hand. To make their vehicles more fuel efficient, manufacturers often use complex unproven technologies which can compromise the reliability of the car at the same time.

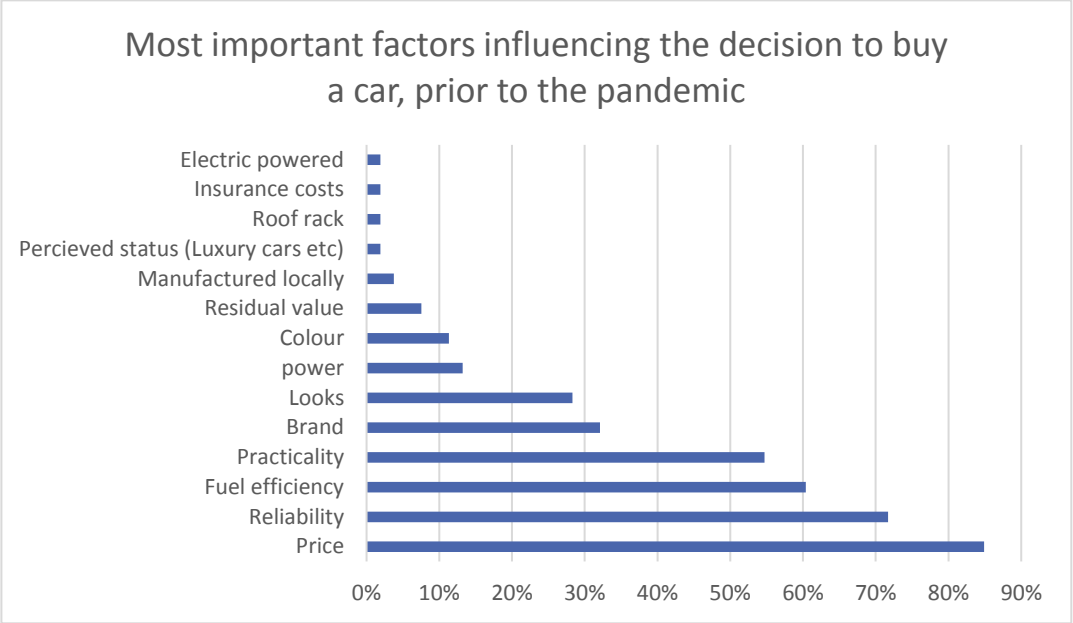

Figure 6. Most important factors influencing the decision to buy a car, prior to the pandemic.

For the pandemic era, consumers were asked if the pandemic had influenced their priorities when buying a car. Out of 53 respondents, 39 said that the pandemic had not influenced their priorities when purchasing a vehicle. If the respondents answered that the pandemic had altered their priorities, they were asked to follow up by answering how. This question was left open ended as there were too many potential reasons for the author to list. The main themes in the answers were that people now prioritise cars which are cheaper to run, both in fuel cost and stronger reliability to avoid paying extra maintenance.

Other themes included spending less money on cars altogether as a result of not having to travel to work anymore. This has been caused by the “work from home” requirement that started during the beginning of the pandemic. It has changed the previous assumptions that people have to work from offices, by transforming working practices into a hybrid of office and home working. This often resulted in peoples’ existing cars lasting longer as a result of less wear and tear from a daily commute, or being sold altogether as some of the respondents have done. These behaviours all correspond to the environmental stimuli of the Black Box model. They are responding to the

pandemic's alteration of economic, technological, political, cultural and situational changes to their circumstances.

4.3.2.3 Which platforms the respondents used to purchase cars prior to and during the pandemic

This section will be used to analyse what platforms respondents prefer to use to purchase their vehicle prior to and during the pandemic. They were given 3 choices of dealerships, private purchases and online purchases. While they were required to select at least 1 choice, they could also select 2 or 3 choices if they wanted to.

As figure 7 demonstrates, the most preferred choice of purchasing a car is overwhelmingly a dealership. Both Finland and the UK have significant consumer protection laws in place for dealership purchases, meaning there is a considerable amount of safety if something goes wrong after the purchase. Privately, those laws do not exist in either country and any attempt to rectify issues on a bad car from an unwilling private seller would have to go through a court of law and could become prohibitively expensive (Finnish Competition and Consumer Authority 2023; Evans 2023). This behaviour shows that consumers frequently factor in the post purchase experience. Even though private sales are considerably less expensive, consumers preferred to be safe in the knowledge that if something goes wrong after purchase, they won't be responsible to rectify the issues.

During the pandemic consumers preference for using dealerships as their preferred method of purchasing a car has dropped slightly, although it is still by far the most favoured method. Private sales have almost dropped by half, going from 43% to 23%. It's easy to understand why private sales have fallen, when factoring in the lack of consumer rights mentioned above in both Finland and the UK, along with the financially uncertain times that the pandemic has brought with it.

The only method that has gained favour during the pandemic is online sales, moving from 17% prior to the pandemic, to 26% during the pandemic. This is a significant jump, with over a quarter of all respondents now showing willingness to use this purchasing model. This result is also very similar to the 27% quoted earlier, in section 4.1.2.1 of this thesis. Similarly to working from home during the pandemic, car purchases are slowly moving into completely online platforms with the consumer only having sight of the car when it arrives at their house after purchase. This model also allows for the consumer to have more freedom of choice in the decision-making process. They now have access to an almost endless number of cars compared to dealerships or private platforms, which usually limit consumers to what is within a nearby area. At the same time, they

can also search for more information and evaluate cars in their own time, rather than be pressured by any dealers or private sellers.

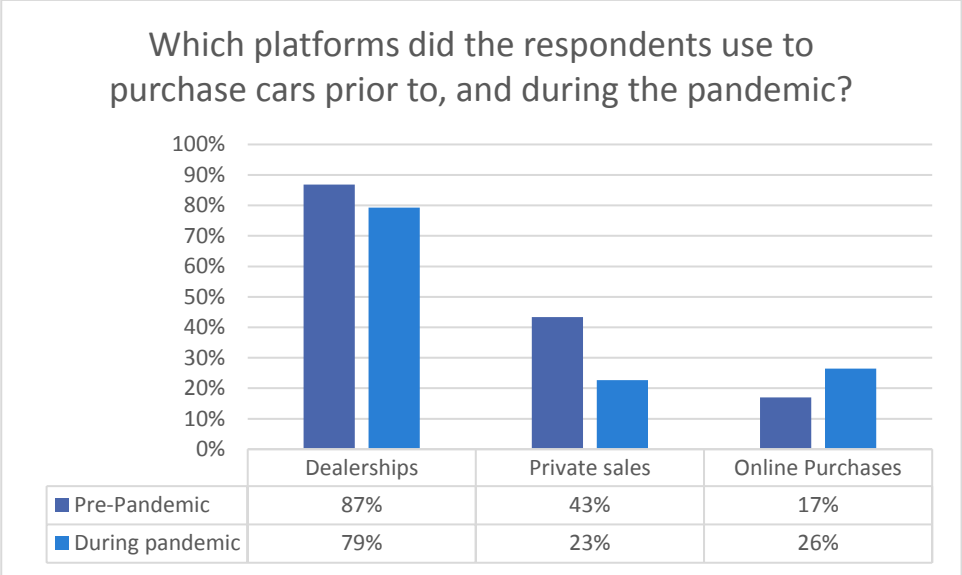

Figure 7. What platforms did the respondents use to purchase cars prior to, and during the pandemic?

4.3.2.4 Length of time spent deciding on and purchasing a vehicle

For this segment the respondents were asked the question “From the initial idea of purchasing a car through to the point of purchase, how long did it usually take?”. This would confirm if the pandemic had made the consumers hesitant, or quicker, or if their thinking time including the purchase had stayed the same.

This data is visualised by the dark blue line representing the time prior to the pandemic and the lighter blue line representing the time during the pandemic. Using the trend line, it is evident that consumers have become faster in making their purchasing decisions since the pandemic has begun. However, this change is not particularly large, with the trend line standing at less than a 5% variance at its’ peak.

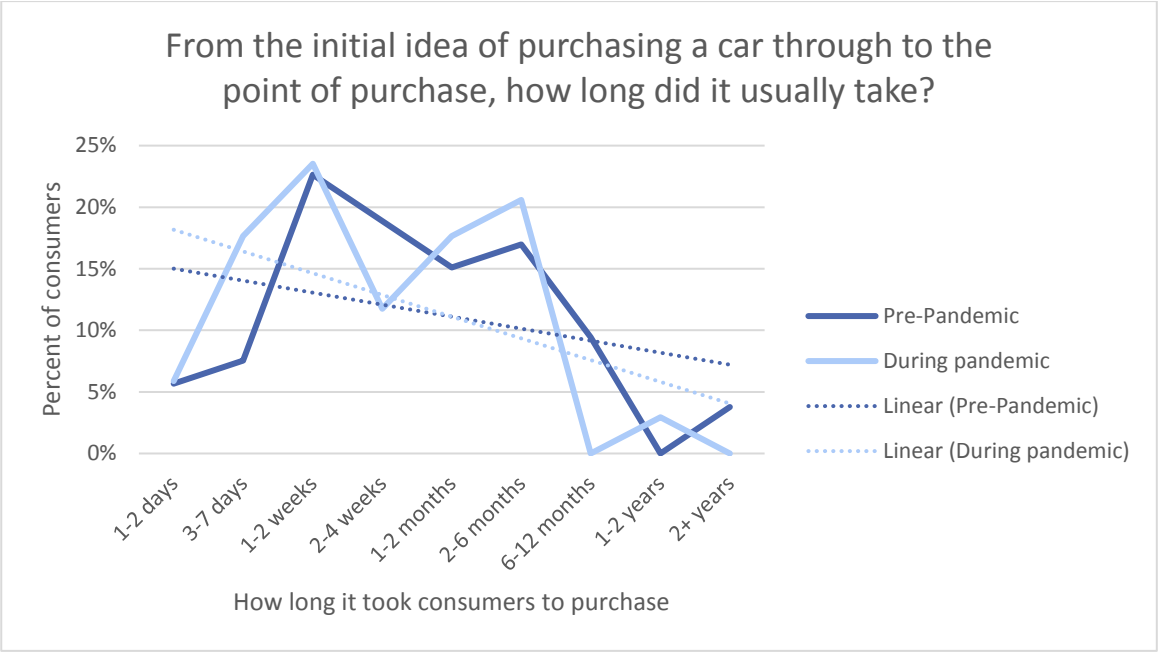

Figure 8. Line chart showing the difference in purchasing time from consumers

4.3.2.5 Buying new or used

This section was to determine if the pandemic had any effect on purchasing behaviour when it came to buying new or used. The results were astoundingly close, with used being highly preferred over buying new. There was a tiny variance from one respondent who swapped from buying both new and used, to only new cars. There was no other movement in the respondent's behaviour.

Table 2. Results of buying new or used pre-pandemic and during the pandemic

Pre-Pandemic		
Status	**Quantity**	**Percent**
New	6	11%
Used	39	74%
New + Used	8	15%

During pandemic		
Status	**Quantity**	**Percent**
New	7	13%
Used	39	74%
New + Used	7	13%

4.3.2.6 Car purchasing values pre-pandemic vs pandemic

During this segment, respondents were asked initially how much they spent on average on cars between the periods of November 2009 and November 2019 (10 years prior to the pandemic). Then they were asked on average how much they spent on cars or expected to spend on cars during the pandemic. To keep this fair, Finland and the UK have been split in the results since they have different currencies.

Table 4 demonstrates that in each country there were increases in average spend during the pandemic period. It is noteworthy is that both countries have increased by very similar amounts in percentage across the same periods. Rather than the consumer wanting to spend more (on a more expensive product), the larger vehicle prices are likely a combined result of the pent-up vehicle demand in section 4.1, and the semi-conductor chip shortage from section 4.2 of this thesis.

Table 3. Average spend on vehicles pre-pandemic and during the pandemic

Country and time period	Spend on cars	
Finnish average spend pre-pandemic	€	11,861.11
Finnish average spend pandemic	€	16,072.73
Change (increase)		36%
British average spend pre-pandemic	£	9,722.22
British average spend pandemic	£	13,578.33
Change (increase)		40%

4.3.2.7 How do people fund their car purchases

Consumers were asked how they funded their car purchases. The options were either finance, cash or using a mix of both across multiple car purchases.

As shown in table 5, prior to the pandemic, cash was by far the most favourable way of funding car purchases, being used by 55% of people exclusively, as well as being used while mixed in with finance for other people.

During the pandemic, these methods of payment changed rapidly. Now, cash is only slightly more used than finance with finance being exclusively used 45% of the time. The reasons for this are likely to be that the 36-40% increase in car prices from the previous sub-chapter, leading to consumers being unable to afford to buy their vehicles outright anymore. This is a rational purchasing decision which is a normal response from consumers using the Black Box model. If the price changes and the consumer still decides to buy, then the method of payment may differ to cover any shortfall the consumer may have.

Table 4. Methods of funding for car buyers pre-pandemic and pandemic

Pre- Pandemic		
Method of funding the vehicle	**Quantity of consumers**	**Percentage of consumers**
Finance:	15	28%
Cash:	29	55%
Finance some cars and cash for others:	9	17%

Pandemic		
Method of funding the vehicle	**Quantity of consumers**	**Percentage of consumers**
Finance:	24	45%
Cash:	25	47%
Finance some cars and cash for others:	4	8%

4.3.2.8 Pandemic's influence on consumers' decision to purchase a car

The consumers were asked if the pandemic would influence their decision to buy, or not to buy a car. As figure 9 exhibits, consumers were largely unaffected in their decision whether or not to buy a car based on the pandemic. This answer is significant because of all the affects that the pandemic wreaked on the car industry, and yet almost 85% of people remain unaffected when they come to the idea of purchasing a car.

For the people who decided to purchase a car because of the pandemic, their decision mostly revolved around a lifestyle or practical choice as a result of the pandemic. For example, one respondent moved house further away from a city with public transport, because of work from home. Another consumer purchased a travel van in order to explore while they were restricted from going aboard. Only one of the respondents purchased a more economical vehicle precisely because of the soaring fuel costs.

For the consumers who decided not to purchase a car as a result of the pandemic, their results all concentrated on the idea of working from home, reducing their wear and tear on their existing car, or completely removing the need for a car altogether.

Almost all respondents who made a decision to act as a direct result of the pandemic made a lifestyle choice rather than anything to do with the rising costs or lack of parts. Consumers seemed largely indifferent to both of these changes made during the pandemic and accepted them as the new reality without making any changes.

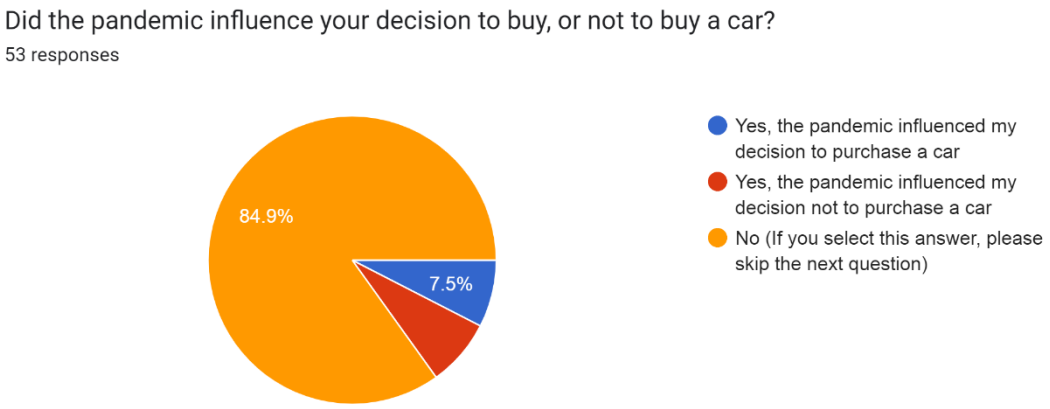

Figure 9. The influence of the pandemic on the consumer to buy a car or not

4.3.3 Future of the car industry

This section focussed on the consumers' thoughts and wishes regarding the path the car industry will take from this point onward.

4.3.3.1 Will the pandemic have a lasting effect on the industry?

As shown in figure 10, 39% of consumers believe that the pandemic will have a lasting effect on the industry, while 37% are unsure. This means a large portion of consumers believe that the car industry will either permanently change, or potentially experience permanent change as a result of the pandemic. For an industry that has been around for more than a century, that is a very significant alteration of consumers' perceptions of how that industry will act.

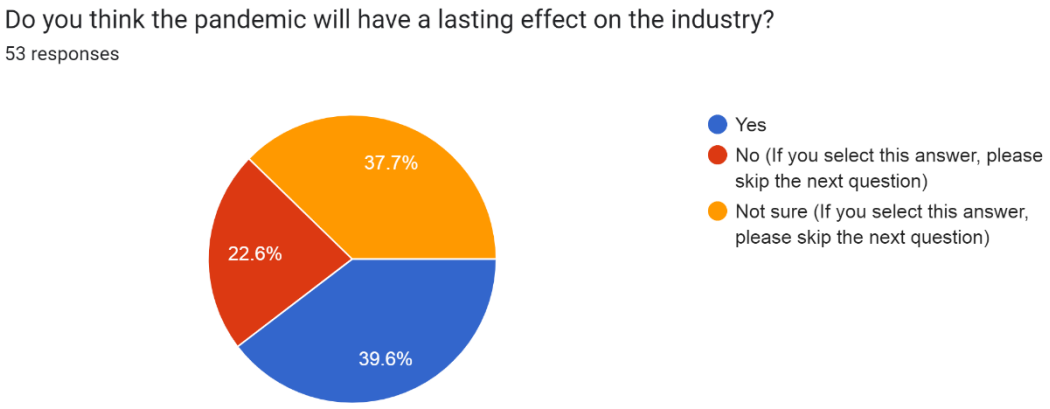

Figure 10. Will the pandemic have a lasting effect on the car industry?

Consumer perceptions of the pandemic's lasting effects on the car industry have been collated into table 6 below. The answers in this questionnaire were purposely left open ended in order to collect accurate thoughts from the respondents. There were some noticeable themes amongst their answers which allowed them to be grouped as they are below. Please note, some have been inputted into more than one category as certain respondents gave more detailed answers.

One of the main themes was increased costs in future. For increased costs, as shown in section 4.3.2.6, consumers already pay around 36-40% more than previously on average in both Finland and the UK. Combined with the ongoing parts scarcity of semi-conductor chips and the general level of inflation in both of these countries being comparatively high to previous years, this prediction becoming true is highly likely. Certain aspects of the price rises are made up from strong expectations from consumers in both countries too. For example, a Dacia Sandero was one of the cheapest cars within the UK. The starting price grew from £7995 to £9845 in 2020. A lot of this cost was attributed to the lack of sales for the previous base version. British buyers do not want manual windows and no radio, making the previous low specification version a bad seller for Dacia (Cinch 2023).

The other strong theme emerging was that people will not purchase cars as often. Two main reasons were given for this. The first reason is that with the increase of people working from home, consumers cars will either last longer or be completely redundant and therefore sold. This reasoning was also found within subsection 4.3.2.8, when consumers were asked if the pandemic had influenced their decision to buy a car. Since working from home is a trend which is predicted to further increase in the future (Hamingson 2023), this prediction seems to be an accurate trend too. If this prediction is correct, as the car industry operates on a model using economies of scale (Cassey 2015), the prices will naturally increase as a result of less sales. Accordingly, the second reason respondents cited that cars will not be purchased as often is the constantly increasing costs.

13% of respondents also stated that the acquisition method of parts will change. This also seems like a reasonable assumption given how the car industry's "just in time" methodology has failed during the pandemic, as cited in chapters 4.1 and 4.2. Furthermore, if this happens then it will likely further increase costs as a result of the car industry not pursuing the most efficient procurement method available (just in time).

Table 5. Respondents predictions on how the car industry will change in the future

Drivers	Quantity	Percentage
Increased costs	6	26%
Cars will not be purchased as often	6	26%
The acquisition methods of parts will change	3	13%
Sales will decrease for manufacturers	2	9%
Greater demand	1	4%
Scarcity will continue	1	4%
A new variety of cars will be made and tailored to suit the increase in local holidays	1	4%
Less cheap cars and more high spec models	1	4%
Lots of car companies will go bankrupt	1	4%
Manufacturers will increase information about running costs, in order to help consumers make purchasing decisions easier	1	4%

4.3.3.2 Changes the respondents would like to see in the car industry in future

During this segment, consumers could select as many options as they wished. They also had the option of creating their own choice below the pre-populated answers.

As displayed in table 7, there are 3 themes which consumers overwhelmingly wanted in their future vehicles. More alternative power cars was the most desirable feature that consumers wanted in their cars. This means consumers would like to see an upsurge in electric vehicles as well as other green initiatives such as hydrogen. This is a very reasonable aspiration for the respondents, as many car makers and governments (including the UK and Finland) have committed to stop the sale of petrol and diesel cars by 2035 at COP 26 (Accelerating to Zero 2023).

The other two desirable themes that respondents want to see in cars is the introduction of more efficient cars and cheaper cars. This correlates with the consumers' main priorities within a car as discussed in subsection 4.3.2.2. The respondents preferred the most efficient car to be sold at the lowest possible price. These goals are potentially more far-fetched. While the new generation of electric vehicles will certainly get more efficient over time, the current power crisis within the world

will undoubtedly have repercussions on the price consumers pay to use their cars. Simultaneously, the parts scarcity for semi-conductor chips will keep prices high for many years while the automakers try to resolve their inventory issues. This problem on prices will likely be further exacerbated by a lack of sales coming from less use of cars as consumers continue to work from home as a result of the pandemic.

Table 6. Consumers' wishes for which kind of trends emerge in the future for the car industry

Preference	Count	Percentage
More alternative power cars	35	66%
More efficient cars	34	64%
Cheaper cars	33	62%
More choice of different types of cars	8	15%
More automated cars (self driving)	5	9%
More reliable cars	2	4%
Honesty	1	2%

4.3.3.3 Eco friendly options for the industry

Following on from this, the consumers were asked if there will be a shift towards eco-friendly options, and also specifically which eco-friendly options the industry will move towards in the future.

Figure 11 indicates that consumers are extremely aware of the industry and governmental commitments mentioned in the previous subchapter, with the vast majority of consumers believing that the industry will shift towards more eco-friendly options in the future.

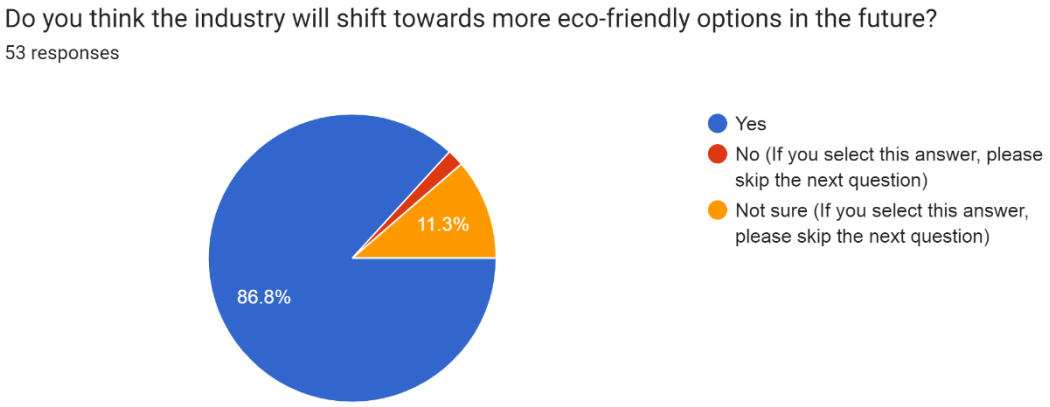

Figure 11. Will the car industry move towards eco-friendly options in future?

Table 8 reveals exactly which options that consumers believe the industry will move towards. Unsurprisingly 90% of respondents believe that electric cars will be a significant direction that the car industry moves in. These electric cars have gained a huge amount of media attention, and considerable interest from consumers at the same time. Car manufacturers have also strongly committed to producing electric vehicles. In both the UK and Finland, they are now more popular choices than diesel when purchasing a new car (Gov.uk 2022; Acea 2022, 3)

Hybrid cars are very useful for the current era of cars. However, lots of respondents are incorrect in assuming that hybrid vehicles will be a significant part of the car industry's future if the currently planned regulations come into effect. This is because as previously mentioned in subchapter 4.3.3.2, both Finland and the UK have signed up to the COP 26 commitment to eliminate petrol or diesel cars being sold within either country. While hybrids are partially electric, the other side of their power production relies on either petrol or diesel fuel making them unsuitable to be sold when the new regulations are implemented.

Hydrogen cars being picked by half of the respondents was not expected. While hydrogen has been talked about for a long time and has the potential to be a superior fuel resource to electric, it has never really had serious investment into it to make it viable. For example, in the UK there are 11 hydrogen fuel stations across the entire country. The majority of these are in the South East of the country, with large parts of the country having none at all (Soguard Hydrogen Producers 2022). They also represent under 0.2% of the car sales throughout the UK (Gov.UK 2022). There are however, large amounts of interest in hydrogen both commercially and internationally from governments. The UK government has shown interest in making hydrogen the de-facto choice for replacing gas by 2030 (Gov.UK. 2021). This, amongst other similar initiatives have the potential to propel hydrogen as a viable fuel source for cars in the future, after countries have installed sufficient infrastructure to power them.

Table 7. Which eco-friendly options the car industry will use to power its' vehicles

Fuel method	Count	Percent
Electric cars	44	90%
Hybrid cars	35	71%
Hydrogen cars	26	53%

4.3.3.4 Car manufacturers improving their experience for customers

Respondents were asked how they thought car manufacturers can improve their car purchasing experience for customers. This was left open ended so people could make as many or as few suggestions as they wanted. Table 9 shows several significant themes. Respondents think that

manufacturers are not transparent, that they do not pass on cost savings to customers and that their warranties are not good enough.

In terms of transparency, consumers' confidence in car companies has often been low because many large manufacturers have often sought to cheat the consumer. This goes back many decades, for example Ford were convicted of endangering customers when they knowingly created their Pinto with a fuel tank that would instantly explode on impact, killing 500-900 people (American Museum of TORT Law 2023). More recently, VW had to pay over $32 billion in costs because they installed a device on all of their vehicles which fooled emissions readers, with the real world emissions being around 35 times higher than the recorded amounts (Jacobs & Kalbers 2019). These are only two examples from a long chain of controversial and often dangerous decisions made by manufacturers in order to cut costs on their cars. In these scenarios they have often put a price on the life of a human in order to improve their bottom line, rather than use often cheap and easy fixes to prevent loss of life. From this perspective, the car industry has a long way to go in general to repair the damage it has done to consumer trust over decades of bad decisions. This is evident with 18% of consumers feeling that this is the car industry's biggest problem.

This lack of transparency is also often seen in the more customer facing parts of the business, with only 9% of consumers trusting car salespeople (Cison 2017). Within the questionnaire 8% of respondents thought that this is something that the car industry could improve on. They also stated that during the sales process, the salesmen should be more knowledgeable about the product they are selling and more honest about its pros and cons.

Passing on any cost savings to customers is a critical element that car manufacturers need to seize given the climate. While many customers are now experiencing a change in their circumstances as a result of the pandemic, they are finding that car ownership is not as vital as it once was. With these declines in potential buyers, manufacturers need to do all they can to tempt potential buyers into showrooms. One key element of this is trying to find a way of offsetting spiralling costs, rather than merely passing them on to customers.

Finally, people wanted a better experience when they actually owned the car. 18% of suggestions came in the form of improving and lengthening the warranty to cover more things, for longer. Car warranties remained stagnant for a long time, but in the last decade or so they have generally started to increase in length and quality. Now for example, Toyota offers a 10 year warranty on every new and used car within the UK and Finland, as long as customers service it at Toyota (Toyota UK 2023; Toyota Finland 2023). However, some manufacturers lag far behind these

offerings, revealing a lack of confidence in their own vehicles. Other respondents suggested that vehicle longevity could be improved as well as increased support for owners of used vehicles.

Table 8. Car manufacturer's potential improvements for customers

Extra features	Quantity	Percentage
More transparency/honesty	9	18%
Pass on reduced costs to customers (when they can)	9	18%
Improved warranty	5	10%
Better customer service during sales	4	8%
More online presence	3	6%
Avoid subscription models	3	6%
Faster delivery	3	6%
Provide leasing as a cheap/easy alternative	2	4%
Cheaper finance rates	2	4%
Better support for owners of used cars	2	4%
Improve vehicle longevity	2	4%
Assistance with charge point infrastructure for electric vehicles	1	2%
More choice of electric cars	1	2%
More customisable options on new cars	1	2%
Create simple solutions for swapping commonly changed parts such as light bulbs	1	2%
Reduce sexism towards female customers	1	2%
More choice of practical cars	1	2%

4.3.3.5 Expected spend on future car purchases

The final question that respondents were asked was whether they expected to spend more, less or the same on future car purchases.

Respondents seemed very aware of the patterns in car pricing in general. Only 9.4% intend to spend less on car purchases in the future. The vast majority believed that they would either spend more or the same as they currently spend. While in subsection 4.3.2.2, consumers overwhelmingly prioritised price as a major factor when purchasing a car, they can only compare price based on what is currently available on the market when they are making their purchase. In this case, consumers likely expect that due to the new cars coming on to the market at bloated prices as a result of the pandemic, they will not have any choice but to spend either more or the same. Their expectations are probably also altered by the results from subsection 4.3.2.6, where they spend 36-40% more than they used to spend. This would naturally shape their expectations for the future of the car industry.

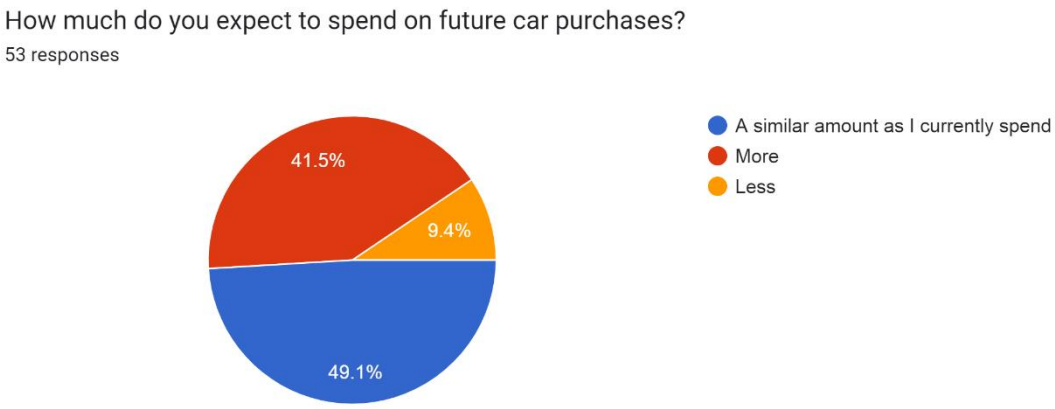

Figure 12. Expected spend on future car purchases

5 Conclusions

This chapter will focus on the research questions along with the outcomes from those questions.

5.1 Key findings

The main research question of this thesis was: how has B2C consumer behaviour in Finland and the UK changed within the car buying industry, as a result of a lack of parts caused by the pandemic?

To answer this research question, it was split into five investigative questions:

1) What has been the cause of the shortage of parts?
2) Which parts are in short supply in the car manufacturing industry?
3) What was the consumer behaviour like before the pandemic?
4) What has changed in consumer behaviour since the pandemic started?
5) What are the consumers' hopes for the future of the car industry?

The first question was answered in section 4.1. The result of this was that because of the political actions taken to ease the spread of the COVID-19 virus, the consumers were unable to purchase cars which set off a chain reaction along the supply chain. In turn automotive factories were shut down and parts which car manufacturers regularly ordered, were put on hold. The result of this was that parts manufacturers filled their excess manufacturing capacity by producing parts for other industries, and then had no space to fulfil orders from the car industry when car production started again. It was also revealed that certain items that the car industry uses are in short supply because of natural causes such as leaf disease and low prices.

Natural rubber and semi-conductor chips were the parts in short supply for question 2. Rubber is potentially interchangeable, by using other materials such as synthetic rubber or different plants than hevea trees. However, the shortage semi-conductor chips were, and remain to be a significant problem for the car industry. This was put down to not only the car industry's reaction to the pandemic of stopping the supply of semi-conductor chips, but also the opportunity cost that the chip manufacturers would incur by selling to the car industry rather than the more profitable chips of the tech industry. The semi-conductor shortage will not end any time soon, as the car industry has such high requirements for the longevity and resilience of their chips which takes years of testing and development before it is ready for production.

Questions 3-5 were answered by a questionnaire answered by car owners in Finland and the UK. For questions 3 and 4, consumer behaviour was compared directly before and during the pandemic. The pandemic did not change the respondents' time between car purchases. Their priorities when purchasing a vehicle was another factor which did not change as a result of the pandemic. Platforms that people used to source their cars changed, with less people buying from dealerships compared to previously and more people opting for completely online platforms to buy their cars. Although dealerships still dominated the platforms that people used to purchase their cars, online sales are likely to progressively get stronger and even more common over time. The time people take to buy their cars has changed slightly, with people making faster purchasing decisions when compared to before the pandemic. The largest single change that people felt as a result of the pandemic was in the purchase price of their vehicle. In both the UK and Finland, the purchase price rose by 36-40% as a direct result of the pandemic. A direct consequence of this was that people moved towards finance as a form of payment compared to the previously dominant cash payment method.

Finally, for question 5 the consumers are realistic in their assumption that prices will not go back down and could potentially continue to rise. Their hopes for future cars rest on more alternative powered cars such as electric vehicles, hybrids and hydrogen. They also hope for efficiency gains to make the cost of motoring cheaper throughout their ownership. Respondents still wanted cheaper cars, even though they indicated that they believe cars will either stay the same or get more expensive in the future. Electric vehicles were the most commonly selected alternative powered vehicle that consumers believed will be dominant in the future. For the car industry itself, customers wanted more transparency, better warranties and for the industry to pass on reduced costs to the customers when they can.

5.2 Recommendations

The car industry should move away from the "just in time" model that has been the darling of automotive makers for years. They should instead focus on the more resilient "just in case" model. This would mean they have a higher level of inventory to carry them through difficult times as well as more suppliers in more countries to fall back on. If they had operated this model during the pandemic, they possibly would not have suffered in the same way that they had with the shortage of semi-conductor chips.

Secondly, to avoid the complete disconnect with their customers and to become more trustworthy car manufacturers should move away from the current franchised dealership network model. Instead, they should incorporate the dealerships into their own business so that they can run

everything themselves. This would mean that dealerships would be able to communicate much better with the manufacturer as they would be part of the same company. It would allow the manufacturer to have much better oversight of how many cars it needs to make and give the manufacturer greater control over the frontline staff who interact with the customers. As the current salesmen are seen as untrustworthy, they could implement their own policies instead of relying on the franchise to govern the salesmen for them.

Finally, automakers need to improve their websites. Online platforms are becoming increasingly popular, and most manufacturers still have websites which operate in a similar fashion to what they did 10 years ago. The websites ideally need to become more interactive and feed the consumers information in a more effective manner.

5.3 Validity, reliability and relevance

The war in Ukraine has affected the world since the pandemic began. This has prolonged some problems, which were already caused by the pandemic. For example, it would have contributed to some of the ongoing running costs that respondents are referring to in their survey. However, neither Russia nor Ukraine are major players in the global car industry, so the effect that they have had on parts of this thesis are marginal when compared to the pandemic. Also, if the result of the war were to be brought into this thesis, it would widen the scope too much and make the thesis unviable.

Apart from the war, the author believes that this thesis is valid, reliable and relevant. Quality sources have been used throughout to produce the theory framework, and to answer the questions for sections 4.1 and 4.2. The car industry and the consumers' that rely on it continue to suffer as a consequence of the actions that were taken by the industry during the pandemic, so this research is very relevant.

The number of respondents were enough to give reliable answers with some variations but also some patterns. The results that the respondents gave are also generally in line with research done by other people and companies, proving it to be highly accurate.

5.4 Suggestions for further research

This thesis revealed that there is a lack of transparency within the car industry from the perspective of consumers. On this basis, future research should examine what are the root causes of the lack of trust, and how the car industry could overcome these causes.

5.5 Reflection on learning

For the author, this thesis process was difficult and drawn out. The pandemic definitely impacted the process, by restricting the author to have face to face meetings with advisors. While calls were used as a substitute and the thesis advisor's "virtual door" was always open to talk, it still made it more complex to get advice. During this process the author had also begun full time employment. This has limited the amount of free time available to complete the thesis, with the author often needing to do a full day in work before swapping laptops and then carrying on at the same desk.

The questionnaire was rapidly designed but could have had more thought put into it to give it a better structure. The introduction to the questionnaire should have also been clearer as to exactly what was required. Some respondents needed to clarify certain aspects of the questionnaire which indicates that the instructions were not sufficient. Some of the answers also took a long time to evaluate because the respondents were given open ended questions. This was good for some questions, but unsuitable for others and some answers did not match the question at all, meaning they had to be removed from the results.

In conclusion, the author is happy with the outcome and process of the overall thesis. It is the largest single document that the author has ever produced, and the author believes that it completely achieves the objectives originally defined in chapter 1.

References

Accelerating to zero 2023. Signatories. URL: https://acceleratingtozero.org/signatories-views/. Accessed: 24 April 2023.

Acea 2022. New car registrations by fuel type, European Union. URL: https://www.acea.auto/files/20221103_PRPC-fuel_Q3-2022_FINAL.pdf. Accessed: 24 April 2023.

American Museum of TORT Law 2023. Grimshaw v. Ford Motor Company 1981. URL: https://www.tortmuseum.org/ford-pinto/#:~:text=Estimates%20by%20Mother%20Jones%20attribute,had%20not%20burst%20into%20flames.. Accessed: 24 April 2023.

Anderson, B. 2021. After semiconductors, automakers are now facing a rubber shortage. URL: https://www.carscoops.com/2021/04/after-semiconductors-automakers-are-now-facing-a-rubber-shortage/. Accessed: 14 April 2023.

Arslan, A. 2022. What does nm mean for CPUs? How does it make a difference? URL: https://www.makeuseof.com/what-does-nm-mean-cpu-does-it-make-difference/. Accessed: 06 April 2023.

Baggott, J. 2022. Stellantis car buyers being ‘forced’ to pay for new cars still stuck in ports. URL: https://cardealermagazine.co.uk/publish/stellantis-car-buyers-being-forced-to-pay-for-new-cars-still-stuck-in-ports/276370. Accessed: 02 April 2023.

Bazeley, P. 2015. Mixed methods research. URL:]=#. Accessed: 11 December 2021.

BBC Future 2021. Building resilient supply chains after disruption. URL: https://www.bbc.com/storyworks/future/a-better-tomorrow/building-resilient-supply-chains-after-disruption. Accessed: 28 November 2021.

BTMA 2023. What are tyres made from. URL: https://btmauk.com/about/what-are-tyres-made-from/. Accessed: 07 April 2023.

Buckley, J. 2020. How coronavirus plagued the UK car market in 2020. URL: https://www.driving.co.uk/news/features/coronavirus-plagued-uk-car-market-2020/. Accessed: 12 April 2023.

Car sales base 2020. Finland Car Sales Data. URL: https://carsalesbase.com/finland-car-sales-data/. Accessed: 13 April 2023.

Car sales statistics 2021. 2020 (full year) international: worldwide car sales. URL: https://www.best-selling-cars.com/international/2020-full-year-international-worldwide-car-sales/. Accessed: 12 April 2023.

Cassey 2023. What does 'economies of scale' mean and why is it important to cars? URL: https://www.carthrottle.com/post/what-does-economies-of-scale-mean-and-why-is-it-important-to-cars/. Accessed: 24 April 2023.

Centers for Disease Control and Prevention 2021.COVID-19 Overview and Infection Prevention and Control Priorities in non-US Healthcare Settings. URL: https://www.cdc.gov/coronavirus/2019-ncov/hcp/non-us-settings/overview/index.html#background. Accessed: 28 November 2021.

ChainPoint 2023. Traceability. URL: https://www.chainpoint.com/solutions/supply-chain-traceability/#:~:text=Supply%20chain%20traceability%20allows%20you,other%20and%20how%20they%20perform . Accessed: 01 April 2023.

Chaplin, R. 2023. Stellantis and Renault ask staff to retrain as HGV drivers as shortages continue to halt deliveries. URL: https://cardealermagazine.co.uk/publish/stellantis-and-renault-ask-staff-to-retrain-as-hgv-drivers-as-shortages-continue-to-halt-deliveries/280630. Accessed: 02 April 2023.

Cheng, T. C. E. & Podolsky, S. 1993. Just in Time Manufacturing An introduction. Chapman & Hall. London.

Cheng, T. C. E. & Podolsky, S. 1996. Just in Time Manufacturing An introduction. 2nd Ed. Chapman & Hall. London.

Cinch 2023. Dacia Sander starting price raised to £9,845. URL: https://www.cinch.co.uk/news/dacia-sandero-starting-price-raised-to-9845. Accessed: 24 April 2023.

Cison 2017. Research shows dealers are overestimating trust from customers. URL: https://www.prnewswire.com/news-releases/research-shows-dealers-are-overestimating-trust-from-customers-not-completely-knowledgeable-about-vehicles-and-significantly-dropping-price-

300437700.html#:~:text=Dealers%20are%20overestimating%20their%20trust%20by%20customers.&text=That%20is%20a%20huge%20disconnect,of%20trust%20in%20car%20salespeople.. Accessed: 24 April 2023.

Cole, C. 2022. Why the heck is there still a chip shortage for cars? URL: https://www.cnet.com/roadshow/news/features/automotive-cars-computer-chip-shortage-2022/. Accessed: 07 April 2023.

Corcoran 2023. Using opportunity cost. URL: https://www.econlib.org/using-opportunity-cost/. Accessed: 07 April 2023.

Coruba 2022. Natural rubber: The end of the line? URL: https://www.coruba.co.uk/blog/natural-rubber-the-end-of-the-line/. Accessed: 14 April 2023.

Davies, E. 2021. URL: https://www.motortrader.com/motor-trader-news/automotive-news/dealers-transition-to-multi-channel-strategy-for-stock-sourcing-19-05-2021. Accessed: 13 April 2023.

Deloitte 2015. Big data and analytics in the automotive industry. Automotive analytics thought piece. London. URL: https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/manufacturing/deloitte-uk-automotive-analytics.pdf. Accessed: 31 March 2023.

Eisenstein, P.A. 2019. Closing the border with Mexico could bring the auto industry to a halt, experts say. URL: https://www.nbcnews.com/business/autos/closing-border-mexico-could-bring-auto-industry-halt-say-experts-n989966. Accessed: 02 April 2023.

Electronics-Sourcing 2022. How many chips are in our cars? URL: https://electronics-sourcing.com/2022/05/04/how-many-chips-are-in-our-cars/. Accessed: 06 April 2023.

Evans, C. 2021. Can I still buy a car during the latest coronavirus lockdown? URL: https://www.whatcar.com/news/can-i-still-buy-a-car-during-the-latest-coronavirus-lockdown/n22230. Accessed: 12 April 2023.

Evans, C 2023. Your legal rights if something goes wrong with your car. URL: https://www.whatcar.com/news/your-legal-rights-if-something-goes-wrong-with-your-car/n3307. Accessed: 23 April 2023.

Feigin, G. 2011. Supply Chain Planning and Analytics: The Right Product in the Right Place at the Right Time. Business Publisher Express. New York.

Fernandez, C. 2021. Supply Chain Volatility in the Automobile Industry. Global Risk Insights. URL: https://globalriskinsights.com/2021/10/supply-chain-volatility-in-the-automobile-industry/. Accessed: 28 November 2021.

Finnish Competition and Consumer Authority 2023. A defect in a second-hand car. URL: https://www.kkv.fi/en/consumer-affairs/cars-and-parking/second-hand-car/a-defect-in-a-second-hand-car/. Accessed: 23 April 2023.

GEP 2023. What is a just-in-case supply chain strategy?. URL: https://www.gep.com/knowledge-bank/glossary/what-is-just-in-case-supply-chain-strategy. Accessed: 01 April 2023.

Gopani, A. 2022. The race to reduce nanometers in chips. URL: https://analyticsindiamag.com/the-race-to-reduce-nanometers-in-chips/#:~:text=Today%2C%20the%20standard%20length%20of,too%20compact%20with%20the%20transistors.. Accessed: 06 April 2023.

Gov.UK 2021. UK government launches plan for a world leading hydrogen economy. URL: https://www.gov.uk/government/news/uk-government-launches-plan-for-a-world-leading-hydrogen-economy. Accessed: 24 April 2023.

Gov.UK 2022. UK open for travel with all restrictions removed for eligible vacinated arrivals. URL: https://www.gov.uk/government/news/uk-open-for-travel-with-all-restrictions-removed-for-eligible-vaccinated-arrivals. Accessed: 07 April 2023.

Gov.UK 2022. Vehicle licencing statistics: April to June 2022. URL: https://www.gov.uk/government/statistics/vehicle-licensing-statistics-april-to-june-2022/vehicle-licensing-statistics-april-to-june-2022#new-car-registrations-by-fuel-type. Accessed: 24 April 2023.

Gregiore 2018. How money changes the way you think and feel. URL: https://greatergood.berkeley.edu/article/item/how_money_changes_the_way_you_think_and_feel#:~:text=Psychologists%20who%20study%20the%20impact,no%20matter%20our%20economic%20circumstances.. Accessed: 22 April 2023.

Hamingson 2023. Communication technology and inclusion will shape the future of remote work. URL: https://www.businessnewsdaily.com/8156-future-of-remote-work.html. Accessed: 24 April 2023.

Hart 2021. A Comprehensive Overview of Sales and Operations Planning (S&OP). URL: https://blog.hubspot.com/sales/sales-operations-planning#:~:text=Here%20are%20some%20key%20benefits,Improved%20inventory%20management . Accessed: 30 March 2023.

Hiles, A. & Fry, K.N. 2016. Creating & Maintaining Resilient Supply Chains. Rothstein Publishing. Connecticut.

International Trade Centre 2020. The great shutdown: How COVID-19 disrupts supply chains. URL: https://intracen.org/news-and-events/news/blog-the-great-shutdown-how-covid-19-disrupts-supply-chains. Accessed: 01 April 2023.

Isidore, C. 2021. Automaker's problems are much worse than we thought. URL: https://edition.cnn.com/2021/09/28/business/auto-industry-supply-chain-problems/index.html. Accessed: 13 April 2023.

Jacbos, D. & Kalbers, L.P. 2019. The Volkswagen Diesel Emissions Scandal and Accountability. URL: https://www.cpajournal.com/2019/07/22/9187/. Accessed: 24 April 2023.

Lareau, J.L. 2021. Everything you need to know about the chip shortage that's plaguing automakers. URL: https://eu.freep.com/story/money/cars/2021/06/15/car-chip-shortage-2021/7688773002/. Accessed: 15 April 2023.

Lehne, S. 2021. Why can't Eurpe cope with the coronavirus? URL: https://carnegieeurope.eu/strategiceurope/84286. Accessed: 07 April 2023.

Lumen 2021. The "Black Box" of consumer behaviour. URL: https://courses.lumenlearning.com/clinton-marketing/chapter/reading-the-black-box-of-consumer-behavior/. Accessed: 29 November 2021.

McEachran, R. 8 September 2021. Rethinking just-in-time ordering. Raconteur. URL: https://www.raconteur.net/supply-chain/rethinking-just-in-time-ordering/. Accessed: 18 March 2023.

Mercedes-Benz 2023. The first automobile. URL: https://group.mercedes-benz.com/company/tradition/company-history/1885-1886.html#:~:text=On%20January%2029%2C%201886%2C%20Carl,1. Accessed: 06 April 2023.

Moody 2021. Why it's high time to move on from 'just-in-time' supply chains. URL: https://www.theguardian.com/commentisfree/2021/oct/11/just-in-time-supply-chains-logistical-capitalism. Accessed: 12 December 2021.

Netimperative 2019. Click and collect cars? 27% of Brits would buy a car online without test dive. URL: https://www.netimperative.com/2019/07/05/click-and-collect-cars-27-of-brits-would-buy-car-online-without-test-drive/. Accessed: 12 April 2023.

Obara, S. & Wilburn, D. 2012. Toyota by Toyota. CRC Press. Safari O' Reilly ebook. Accessed: 17 November 2022.

OECD 2020. Average wages. URL: https://data.oecd.org/earnwage/average-wages.htm. Accessed: 29 November 2021.

OECD 2021. COVID-19, international mobility and trade in services: The road to recovery. URL: https://www.oecd.org/coronavirus/policy-responses/covid-19-international-mobility-and-trade-in-services-the-road-to-recovery-ec716823/. Accessed: 02 April 2023.

Ono, T. 1978. Toyota Production System Beyond Large-Scale Production. Productivity Press. Massachusetts.

ONS 2023. Average weekly earnings in Great Britain: March 2023. URL: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/averageweeklyearningsingreatbritain/march2023#:~:text=Figure%201%3A%20Average%20weekly%20earnings,(COVID%2D19)%20pandemic). Accessed: 22 April 2023.

Oponeo 2020. What are tyres made of? The nature of tyre rubber. URL: https://www.oponeo.co.uk/blog/what-are-tyres-made-of#:~:text=Traditionally%2C%20it%20came%20from%20Hevea,created%20by%20tapping%20Hevea%20trees.. Accessed: 07 April 2023.

Parkinson,G. 2020. COVID-19 Timeline betrays European countries' different responses. URL: https://newseu.cgtn.com/news/2020-03-24/COVID-19-timeline-betrays-European-countries-different-responses-P4X9fbgzYs/index.html. Accessed: 07 April 2023.

Pinto, J. K. & Venkataraman, R. R. Operations Management: Managing Global Supply Chains. URL: https://edge.sagepub.com/venkataraman/student-resources/chapter-17/learning-objectives#:~:text=The%20objective%20of%20the%20S%26OP,costs%2C%20and%20increase%20customer%20satisfaction. . Accessed: 30 March 2023.

Pollard, T. 2021. The year that dealership shut their doors: car sales slump to worst year since 1992. URL: https://www.carmagazine.co.uk/car-news/industry-news/uk-2020-car-sales-analysis-winners-and-losers/. Accessed: 12 April 2023.

Przybyla 2023. Shortage of drivers in the EU. URL: https://truckmobility-info.com/shortage-of-drivers-in-the-eu/#:~:text=According%20to%20the%20latest%20research,shortfall%20may%20increase%20to%2014%25.. Accessed: 02 April 2023.

REC 2022. HGV Driver Shortage – The causes, the facts and the potential solutions. URL: https://www.rec.uk.com/our-view/news/news-our-business-partners/hgv-driver-shortage-causes-facts-and-potential-solutions. Accessed: 02 April 2023.

Roser. June 21 2016. What is "Just in Time"? AllAboutLean. URL: https://www.allaboutlean.com/what-is-just-in-time/. Accessed: 25 October 2022.

SAP Insights 2021. What is a resilient supply chain? URL: https://insights.sap.com/what-is-a-resilient-supply-chain/. Accessed: 29 November 2021.

SAP Insights 2023. Inventory optimisation. URL: https://www.sap.com/insights/inventory-optimization.html. Accessed: 25 March 2023.

Schengen Visa Info 2021. Timeline of EU member states reopening their borders. URL: https://www.schengenvisainfo.com/news/timeline-of-eu-member-states-reopening-their-borders/. Accessed: 07 April 2023.

Schlosser, A., Hoppe, W.D. & Saeftel, F. Diversification trends in the automotive sector. URL: https://www.adlittle.com/en/insights/viewpoints/diversification-trends-automotive-supplier-sector. Accessed: 01 April 2023.

Shih, W. 2022. Why are automotive chips still in short supply? URL: https://www.forbes.com/sites/willyshih/2022/11/20/why-are-automotive-chips-still-in-short-supply/. Accessed: 06 April 2023.

Soguard Hydrogen Producers Ltd 2022. How many hydrogen fuel stations are there in the UK. URL: https://www.soguard.uk/how-many-hydrogen-fuel-stations-uk. Accessed: 24 April 2023.

Surgiura, E., Tanaka, A. 2021. Automakers hit limits of 'just in time' supply chain management. URL: https://asia.nikkei.com/Business/Business-Spotlight/Automakers-hit-limits-of-just-in-time-supply-chain-management. Accessed: 14 April 2023.

Swain, F. 2021. The wonder material we all need but is running out. URL: https://www.bbc.com/future/article/20210308-rubber-the-wonder-material-we-are-running-out-of. Accessed: 14 April 2023.

Swinhoe 2018. A history of computer code in cars. URL: https://www.idgconnect.com/article/3576783/a-history-of-computer-code-in-cars.html#:~:text=But%20how%20did%20cars%20go,fuel%20injection%20and%20transmission%20shifting.. Accessed: 06 April 2023.

Take-Profit.org 2023. Finland wages: minimum and average. URL: https://take-profit.org/en/statistics/wages/finland/#:~:text=Average%20wages%20for%20high%20skilled,(4788.031%20USD%2FMonth).. Accessed: 22 April 2023.

Toyota Finland 2023. Toyota Relax. URL: https://www.toyota.fi/omistajalle/takuu/toyota-relax. Accessed: 24 April 2023.

Toyota UK 2023. Toyota Warranty. URL: https://www.toyota.co.uk/owners/toyota-warranty. Accessed: 24 April 2023.

Verhoeven, M. 2023. Transitioning supply chains from 'just in time' to 'just in case'. URL: https://www.cips.org/supply-management/opinion/2023/january/transitioning-from-just-in-time-to-just-in-case/. Accessed: 01 April 2023.

Wetzstein, M.E. 2013. Microeconomic Theory Concepts and Connections. Second Edition. Routledge. Abingdon.

WTO 2021. Easing trade bottlenecks in landlocked developing countries. URL: https://www.wto.org/english/res_e/booksp_e/02_landlocked2021_chapter_2_e.pdf. Accessed: 02 April 2023.

Appendices

Appendix 1. Preliminary table of contents for the thesis

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Appendix 2. Questionnaire

Changes in B2C (Business to consumer) car purchasing behaviour within Finland and the UK, before, during and after the COVID-19 pandemic

This questionnaire is to assist the author with thesis research into changes in consumer behaviour within the new and used car market. Specifically, these market changes will be focussed on the increase in prices and scarcity of parts, caused by the COVID-19 pandemic. This questionnaire will focus on 3 segments of this car purchasing behaviour and try to draw comparisons:

-Pre-COVID-19 (Before November 2019)
-During COVID-19 (December 2019 to present)
-The future of the car industry

Please only answer questions about cars which have been purchased as a consumer (rather than for a business).

For protection of data, please do not write your name or any other data which can be used to identify you. To ensure anonymity of all respondents, if anything of this nature is written it will be removed prior to the thesis being published.

Information about the respondent

Which country do you reside in?

What is your annual income (to the nearest â‚¬ 10,000)

Pre-COVID-19 pandemic

Prior to the pandemic, how often did you buy a new or used car?

Please enter the choice which is closest, or enter your answer into the "other" category at the bottom.

Prior to the pandemic, what were the most important factors influencing your decision to buy a car?

If your preferred option isn't here please type in the field labelled "other".

Please select all that apply

Prior to the pandemic, which methods did you use to buy your cars?

Please select all that apply

Prior to the pandemic, from the initial idea of purchasing a car, through to the point of purchase, how long did it usually take?

Prior to the pandemic, did you prefer to buy new cars, used cars, or a mix of both?

Please select all that apply

Prior to the pandemic, what was the approximate average value of your car purchases from 30/11/2009 - 30/11/2019?

These dates are required because inflation has a large impact on car prices.

If your most recent car purchase was before 30/11/2009, please put N/A as your answer.

Prior to the pandemic, how did you usually pay for your car?

During COVID-19 pandemic

During the pandemic, how often have you purchased a new or used car?

If you answered above that you have purchased a car during the pandemic: From the idea of buying a car through to the point of purchase, how long did the purchasing process usually take?

Did the pandemic influence your decision to buy, or not to buy a car?

If you answered yes to the question above, please detail how it influenced your decision.

Has the pandemic influenced your priorities when buying a car?

If you answered yes to the question above, how has the pandemic influenced your priorities when buying a car?

If you purchased one or more cars during the pandemic, which platform did you use to purchase? If you have not purchased a car during the pandemic, which platforms do you think you would use?

Please select all that apply

During the pandemic, have you preferred to buy new cars, used cars, or a mix of both? If you have not purchased a car during the pandemic, which options do you think you would use?

Please select all that apply

What is the approximate average value of your car purchases since the pandemic? If you have not purchased a car during the pandemic, what would be your estimated budget for a car?

During the pandemic, how have you paid for your car? If you have not purchased a car during the pandemic, how do you think you would pay for it?

Consumers hopes for the future of the car industry

What changes would you like to see in the car industry in future?

Comment in the "other" field at the bottom if you have more suggestions

Please select all that apply

Do you think the pandemic will have a lasting effect on the industry?

If you answered yes to the question above, how do you think it will be affected?

Do you think the industry will shift towards more eco-friendly options in the future?

If you answered yes to the above, what eco-friendly options do you think the industry will move towards?

Comment in the "other" field at the bottom if you have more suggestions

Please select all that apply

How do you think car manufacturers can improve the car purchasing experience for customers?

How much do you expect to spend on future car purchases?