

**VITESCO CONSULTING: MARKETING FORECAST OF  
AUTOMOTIVE EXTERIOR DOOR HANDLES**



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**VITESCO CONSULTING: MARKETING FORECAST OF AUTOMOTIVE EXTERIOR DOOR HANDLES**

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**ABSTRACT**

This thematic paper has been conducted to study the change of the exterior door handles of electric cars and provide recommendations for automotive suppliers in this industry to prepare for the change.

Automotive database and qualitative interviews from two automotive suppliers are used to forecast the change of exterior door handles. The result can be concluded that electric cars will be taking over the automotive market by 2030. As more electric vehicles are produced, the popular pull-out handles should be replaced with more air-resisting handles like mechanical flush handles, half flush handles, and power flush handles. To reduce the air resistance to the fullest, vehicles with no door handles could be an option.

For automotive door handle suppliers to survive in the long run, the recommendations would be to invest in mechanical flush handles, half flush handles, and power flush handles. As the EV market is growing, these handles will economize and become more efficient in play. To strengthen the suppliers' sustainable growth, it is worth investing in vehicles with no door handles to be able to be ahead of the game.

**KEY WORDS:** Electric vehicles/ Exterior door handles/ Pull-out handles/ Mechanical flush handles/ Power flush handles

35 pages

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# CHAPTER I

## INTRODUCTION

### 1.1 EV and Door Handles Background

To serve the sustainability trend, electric vehicles (EVs) have been one of the vehicle choices for consumers. These vehicles emit zero hazardous gas that could pollute the environment. Also, because no fuel is used, consumers started to shift to buying cars that use electricity to reduce petrol fees.

Other than car engines, consumers are concerned about the design, including the exterior door handles. Door handles allow passengers to access the vehicles. It cannot be denied that door handles are the first feature of the vehicle that interacts with the users. Because of this interaction, door handles create a style, while also providing experiences for consumers.

According to Lee, a study from JD Power, an automotive research firm, confirms that drivers are worried about door handles (Lee, 2023). Among the 93,000 vehicle owners of 2023 car models, the features that automakers should concern incorporate cupholders, door handles and even horns. The drivers felt that automakers are removing basic features to add more technology. Door handles have been added with “high-tech approaches”. For example, the flush door handles from Tesla. The door handle will only pop out when the driver presses the axle or approaches the vehicle. This type of door handle has been having issues. Even though flush handles help the aerodynamics of vehicles, consumers still feel that “the design is not so intuitive” (Lee, 2023). With this technology, this could make it hard for children to open the door. Adults also reported such issues. This could then affect the safety regulations. Therefore, if cars have problems with accessing it, this could reduce the satisfaction rate of consumers. It is then an important feature of a car from a consumer point of view.

## **1.2 Problem statement**

Due to an increase in the growth of the electric vehicle industry, suppliers are looking for ways to thrive as cars are evolving. Electric vehicles often have innovative technologies and futuristic design elements. This could be the overall exterior design or even the autonomous driving experience. However, one element that caught interest of the suppliers is door handles, which could enhance aerodynamics, aesthetics, and user experience. As many brands are launching more and more EV models, suppliers are eager to know how door handles could develop. Therefore, this paper aims to forecast how the exterior door handles will change with the growth of EV. This will then help suppliers to play efficiently and sustainably in the market.

## **1.3 Research question**

How will exterior door handles change with the growth of the EV industry?

## **1.4 Research objectives**

The purpose of this paper is:

- To identify the current used exterior car door handles
- To examine the growth and risks of the EV industry
- To investigate possibilities of exterior door handles only for EVs
- To recommend exterior door handles for suppliers to fit the upcoming EV trend

## 1.5 Scope of study

The research will include:

- Study the exterior door handles of automotives through a supplier's database
- Understand the growth of the electric vehicle industry
- Interview automotive manufacturers for insights about the EV industry and the future of door handles
- Recommend suitable door handles for suppliers to further develop



## **CHAPTER II**

### **LITERATURE REVIEW**

The purpose of chapter two is to review literature works done on explaining the electric vehicles, its industry, and the history of exterior car door handles.

#### **2.1 General Knowledge of Electric Cars**

“EV” has been used as a term that is abbreviated from electric vehicles. Electric vehicles as a whole meant vehicles that run on electricity power. On the contrary, conventional cars run on petrol, therefore are abbreviated to ICE or internal combustion engines. Nowadays, electric vehicles have a few types. For this paper, it will touch upon hybrid electric vehicles, battery electric vehicles and hydrogen electric vehicles in chapter 4. As a background, each type of electric vehicle will first be identified.

##### **2.1.1 Hybrid Electric Vehicles (HEVs)**

Before going fully electric, the automotive industry had hybrid cars or HEVs. These vehicles use both petrol and battery power. Thus, it is the combination of combustion engine and electricity. Because of this combination, the vehicles do not need to be charged at home or at public charging stations. Instead, the vehicles run with petrol and use a regenerative braking system to refill the battery power (Types of Vehicles Explained, n.d.).

##### **2.1.2 Battery Electric Vehicles (BEVs)**

BEVs are different from HEVs in terms of power. BEVs contain larger batteries than HEVs and petrol cars, hence the cars are able to run based on just the battery power. With no petrol involved, the cars will emit zero emissions and would not affect global warming nor climate change. To get the vehicles on the road, the batteries

must be charged through a standard power outlet that could be installed at home or at public charging station (Types of Vehicles Explained, n.d.).

Throughout this paper, BEVs will be the main focus and will be abbreviated as EVs or electric vehicles. This will demonstrate that electric vehicles mean vehicles that use only battery power and must be recharge through a power outlet. The vehicles do not refer to ones that use petrol or hydrogen power.

### **2.1.3 Hydrogen Fuel Cell Electric Vehicles (FCEVs)**

FCEVs also have electric motors. The difference from BEVs would be that FCEVs must have hydrogen gas and oxygen gas to convert fuel into energy to supply electricity for the motor.

## **2.2 Design of Electric Vehicles**

Unlike combustion engine vehicles, electric vehicles must be aware of the exterior design since it could affect the performance of the vehicles. According to Ge and Li, the drag coefficient has a high impact on electric vehicles' performance. The coefficient of drag is the air resistance. "Air resistance or drag is a resistive force that pushes on any object that moves through a fluid, be it a gas or a liquid (Puscasu, 2022)". This force will drag down the vehicle which will consume fuel and will make an impact on noise and top speed. The exterior features are the most important factor to either increase or decrease the drag coefficient. These features include "car intake grilles, sunroofs, body skirts, car rearview mirrors, front and rear bumpers, car lights, wipers, door handles, car outer walls and windshields, and rear exhaust pipes" (Ge and Li, 2021). Hence, the exterior door handles of an electric vehicle have a high influence on the speed and the powertrain. In other words, it will affect how fast the vehicle can go and how far it can travel. To reduce the coefficient of drag, many types of door handles are developed. Tesla introduced the hidden side door handle with its Model 3. This made the car body smoother and the air resistance smaller (Ge and Li, 2021).

## **2.3 Thailand Lays Out Bold EV Plan, Wants All Electric Cars by 2035**

From 2035 onwards, Thailand plans to sell only zero-emission vehicles for Thai consumers (Thanthong-Knight, 2021). To successfully execute this plan, Thailand must change from a Southeast Asian manufacturing center for conventional cars to electric cars. And, Thailand has the potential to become one.

Thailand's post-pandemic automotive industry plan is to align with the world's situation. Other countries have been moving rapidly into supplying more and more EVs to the market. Thanthong-Knight referenced Kawin Thangsupanich, the adviser of the national committee in the Energy Ministry. Thangsupanich believed that with the existing supply chains of Thailand's automotive industry, Thailand can manufacture lots of EVs in the near future. In the current automotive industry, there are more than 850,000 workers who contribute to the manufacturing of combustion engine cars that have been exported to other countries like Malaysia, Indonesia, and Philippines.

By 2030, Thailand should be able to raise the percentage of new registered cars to be EVs. There should be an increase from 30% to 50%. This increase in adoption rate could happen by increasing the incentives for manufacturers and consumers. The government should promote manufacturing by proposing tax incentives, investing in infrastructures, and coming up with safe regulations for manufacturers. Consumers also must be incentivized to buy electric cars by exempting taxes or building free charging infrastructures.

Hence, Thanthong-Knight forecast the increased growth of Thailand's EV market. In 2020, the EV sales increased 1.4%, while the combustion engines cars sales decreased 26%. This shift suggests how the automotive industry in Thailand is moving towards producing more EV cars. Consumers are purchasing EV cars over combustion engines when the right incentives from the government are given. This increase in EV consumption suggests a focus on these cars. To launch these cars for the market, there are various possible designs. Automotive suppliers should be prepared to manufacture such cars. Door handles will be one of the automotive parts that should not be neglected.



## 2.4 General Knowledge of Exterior Door Handles

With EV thriving in the automotive industry, the innovation of vehicles will change according to the trend. Before predicting the exterior door handles, it is worth knowing the history and its current market.

The types of exterior door handles could be categorized by the motion of opening the door. Throughout the history of the automotive industry, the door handles had been changing its designs and styles to fit the current designs of the vehicles and the technological innovations. The common car handle types include archaic, push button, trigger, flap, pull-up, pull-out (strap), mechanical flush, half flush, and power flush handles.

### 2.4.1 Archaic Door Handle



**Figure 2.2: Example of Archaic Car Door Handle (Source: [https://carspiritpk.com/car-door-handles-then-and-now/#google\\_vignette](https://carspiritpk.com/car-door-handles-then-and-now/#google_vignette))**

In the beginning of the automobile industry, the door handles were inspired from the conventional door handles for home use. The shape of the car door handles resembles the house door handles completely (Usman Ansari, 2018). However, these handles were very fragile and were only used for primitive vehicles (Lock and Go: Exploring the Different Types of Car Door Handles, n.d.).



### 2.4.2 Push Button Door Handle



**Figure 3.2: Example of Push Button Car Door Handle (Source: [https://carspiritpk.com/car-door-handles-then-and-now/#google\\_vignette](https://carspiritpk.com/car-door-handles-then-and-now/#google_vignette))**

During the 70s, the push button door handles were commonly used. These push button door handles were made of heavy metal. To open, simply push the button. For some vehicles, the button contained the key opener. Nevertheless, the government dropped out this type of door handles due to its safety matters (Lock and Go: Exploring the Different Types of Car Door Handles, n.d.).

### 2.4.3 Trigger Door Handle



**Figure 2.4: Example of Trigger Car Door Handle (Source: [https://carspiritpk.com/car-door-handles-then-and-now/#google\\_vignette](https://carspiritpk.com/car-door-handles-then-and-now/#google_vignette))**

This type of door handle was also found in the 1970s like the push button door handles (Usman Ansari, 2018). There were metal and plastic trigger door handles. Apart from using buttons, these door handles have a trigger which was placed inside of the door handle. Squeezing into the trigger would open the door.

#### 2.4.4 Flap Door Handle



**Figure 2.5: Flap Car Door Handle in Honda Civic (Source: <https://motor-car.net/honda/item/11204-civic-5th-gen-1992-95>)**

Flap door handles' mechanism was to pull the back of the flap to open. They have been employed in cars in the 60s and 70s (Usman Ansari, 2018). During the 90s, they were still in use in some cars, for example, the fifth generation of Honda Civic. This model was manufactured from 1991 to 1995 and were all equipped with flap door handles (Honda Civic Fifth Generation, n.d.).

#### 2.4.5 Pull-up Door Handle



**Figure 2.6: Example of Pull-Up Door Handle (Source: [https://carspiritpk.com/car-door-handles-then-and-now/#google\\_vignette](https://carspiritpk.com/car-door-handles-then-and-now/#google_vignette))**

The pull-up door handles are the ones that need to be pulled up vertically, unlike flap handles which were opened horizontally. These door handles were very popular in the 80s and 90s due to their low production cost. Later, the pull-out types became the alternative because pull-outs were safer (Usman Ansari, 2018).

#### 2.4.6 Pull-out Door Handles (Strap Handles)



**Figure 2.7: Example of Pull-Out Door Handle (Source: [https://carspiritpk.com/car-door-handles-then-and-now/#google\\_vignette](https://carspiritpk.com/car-door-handles-then-and-now/#google_vignette))**

Moving to more recent types of door handles, the most common type of door handles that are still in use now by many automotive manufacturers is the pull-out door handles or strap handles. These handles were launched into the market in the 90s, mostly for premium cars. As its popularity rose, mid-range and affordable vehicles began to have strap handles (Lock and Go: Exploring the Different Types of Car Door Handles, n.d.). Moreover, it is the safest way compared to all the old ones since strap handles are not fragile and much more cheaper. In other words, these handles would not break easily since the grab part and the latch part comes in one piece (Usman Ansari, 2018). These handles are easier and more convenient to use because the direction of force of opening the door is associate to the direction of pulling the door. These days, the strap handles have a touch sensor attached to increase user's convenience and become more innovative. To open the door, the consumer must touch the sensor on the handle to unlock, then pull the handle.

### 2.4.7 Mechanical Flush Handle



**Figure 2.8: Example of Mechanical Flush Handle (Source: <https://www.digitaltrends.com/cars/tesla-model-3-handles-freeze/>)**

The Tesla model 3 introduced the mechanical flush handle to the current market. For this type of door handle, to categorize, it would be push-down type door handle. The consumer must approach the handle and push the handle with a thumb for it to turn around on an axle. The handle would swing out and would allow the consumer to pull the handle to open. Thus, it is a push then pull concept. This allows the car to have a low coefficient of drag which reduces air resistance. However, it can be hard to open sometimes. According to Schroeder, in extremely cold weather, it is hard to push the handle out even after defrosting it (Schroeder, 2022). To reduce the problem, Tesla released a new feature through its smartphone application for the door to automatically unlatch (Klender, 2022).

### 2.4.8 Half Flush Handle



**Figure 2.9: Half Flush Handle in ID.4 Model (Source: <https://arstechnica.com/cars/2020/09/volkswagens-new-id-4-electric-car-how-far-how-much-and-when/>)**

In the recent models, touch-type handles are becoming common for EVs and premium cars. Half flush handles are one of them. All previous Volkswagen ID models use half flush handles, for example, the Volkswagen's ID.4 model. The pocket handle has a switch with a sensor. By touching the sensor and squeezing it, the door automatically pops out. The consumer just pulls the handle once more for the whole door to open to be able to get in.

#### 2.4.9 Power Flush Handle



**Figure 2.10: Power Flush Door Handle in Tesla Model S (Source: <https://www.consumerreports.org/video/view/cars/auto-test-track/2371716971001/tesla-model-s-door-handle/>)**

Instead of using the thumb to push the handle to come out like the mechanical flush handle, the power flush handle made it easier for consumers. Once the user approaches the door, a simple push on the door handle would force the door handle to completely pop out automatically by translation or rotation. Then, a pull on the popped-out handle will be done. This could be seen with the Tesla Model S. Similar to the mechanical flush handle, this type of handle has a high tendency to resist the coefficient of drag and could have problems with opening. Once the motor is stuck, the door handle would not pop out and could be hard to open.



## CHAPTER III RESEARCH METHODOLOGY

In this chapter, the purpose is to provide the methodology used. To recommend such door handles for suppliers, the database will be analyzed, and interviews will be conducted.

### Research Instrument

#### 3.1 Vitesco Database

To understand the automotive door handles best, the data findings would come from the database Vitesco received from its supplier. In this database, it comes with information that includes the name of the models, segment categorization, production years, engine type, platform, end market up to 2030, shown in figure. For exterior door handles and interior door handles, the database only has what each model is currently equipped with. Then, with the scattered data, a pivot chart is created to categorize the data into each Volkswagen brand. Each car model will be predicted to understand how the brand will evolve them, including the exterior door handles. By focusing on Volkswagen brands, it will become the baseline for this paper to do further research. It will provide a trend that could happen for other brands.

Doing Model		Historical after 2023				Future Model																
Focus in next 5y		Year volume in 2024-2028				Year volume in 2024-2033					Year volume in 2029-2034 (no volume in same year before 2029)											
Brand	Model	Segment	Platform	Platform	Sum of CY 2024	Sum of CY 2025	Sum of CY 2026	Sum of CY 2027	Sum of CY 2028	Sum of CY 2029	Sum of CY 2030	Sum of CY 2031	Sum of CY 2032	Sum of CY 2033	ICE	ICE Plug/Start	Fuel Cell	Hybrid Full	Hybrid Mild	Electric	Exterior Door Hand	Interior Door Hand
Volkswagen	B Segment	Beetle	MQB	MQB AD	41795	40136	41561	41881	41918	41918	41918	41918	41918	41918							Stop Handle	Stop Handle
Volkswagen	B Segment	Polo	MQB	MQB AD	239117	244811	242943	246030	246030	246030	246030	246030	246030	246030							Stop Handle	Stop Handle
Volkswagen	B Segment	Polo Vivo	MQB	MQB AD	0	0	0	0	0	0	0	0	0	0							Stop Handle	Stop Handle
Volkswagen	B Segment	Polo Vivo	FC21/FC2	FC21/FC2	24768	21176	19761	18913	17492												Stop Handle	Stop Handle
Volkswagen	B Segment	Santitas	MQB	MQB AD	70366	73992	74911	87026	10383												Stop Handle	Stop Handle
Volkswagen	B Segment	Santitas	MQB	MQB AD	0	0	32031	45318	49321												Stop Handle	Stop Handle
Volkswagen	B Segment	Touareg	FC22	FC22	48889	13144	21997	0	0												Stop Handle	Stop Handle
Volkswagen	B Segment	Touareg	MQB	MQB AD	17131	10561	21380	20264	21223												Stop Handle	Stop Handle
Volkswagen	B Segment	Touareg	MQB	MQB AD	13188	14087	14627	15787	16162												Stop Handle	Stop Handle
Volkswagen	B Segment	Touareg	MQB	MQB AD	24861	21206	18130	17129	17495												Stop Handle	Stop Handle
Volkswagen	B Segment	VW Crafter	MQB	MQB AD	11592	16742	42636	84701	87719												Stop Handle	Stop Handle
Volkswagen	C Segment	Beetle	MQB	MQB A/B	21106	17476	16143	16241	16408												Stop Handle	Stop Handle
Volkswagen	C Segment	Caddy	MQB	MQB A/B	109715	110411	107911	10549	10979												Stop Handle	Stop Handle
Volkswagen	C Segment	Scirocco	MQB	MQB A/B	0	0	0	0	0												Stop Handle	Stop Handle
Volkswagen	C Segment	Caddy	SSP	SSP Volume	0	0	0	0	0												Stop Handle	Stop Handle
Volkswagen	C Segment	Scirocco	MQB	MQB A/B	29179	27184	23918	24534	24944												Stop Handle	Stop Handle
Volkswagen	C Segment	Scirocco	MQB	MQB A/B	16900	17286	17467	14640	14944												Stop Handle	Stop Handle
Volkswagen	C Segment	Scirocco	SSP	SSP Volume	0	0	0	40884	17988												Stop Handle	Stop Handle
Volkswagen	C Segment	Scirocco	MQB	MQB	18280	18410	18565	18327	4896												Stop Handle	Stop Handle
Volkswagen	C Segment	Scirocco	SSP	SSP Volume	0	0	0	0	12240												Stop Handle	Stop Handle
Volkswagen	C Segment	Scirocco	MQB	MQB	8979	8861	9746	10470	4524												Stop Handle	Stop Handle
Volkswagen	C Segment	Scirocco	SSP	SSP Volume	0	0	0	0	8132												Stop Handle	Stop Handle
Volkswagen	C Segment	Scirocco	MQB	MQB	74024	9084	10926	10792	4284												Stop Handle	Stop Handle
Volkswagen	C Segment	Scirocco	SSP	SSP Volume	0	0	0	0	10284												Stop Handle	Stop Handle
Volkswagen	C Segment	Scirocco	MQB	MQB	4324	4988	4818	4954	4487												Stop Handle	Stop Handle
Volkswagen	C Segment	Scirocco	SSP	SSP Volume	0	0	0	0	0												Stop Handle	Stop Handle
Volkswagen	C Segment	Scirocco	MQB	MQB A/B	279921	23089	21952	20275	19079												Stop Handle	Stop Handle
Volkswagen	C Segment	Scirocco	MQB	MQB A/B	20826	19924	20278	19771	18918												Stop Handle	Stop Handle
Volkswagen	C Segment	Scirocco	MQB	MQB A/B	11958	11126	10703	9413	11273												Stop Handle	Stop Handle
Volkswagen	C Segment	Scirocco	MQB	MQB A/B	11793	10438	10119	10181	24716												Stop Handle	Stop Handle
Volkswagen	C Segment	Scirocco	MQB	MQB A/B	15424	16832	13151	10818	10703												Stop Handle	Stop Handle
Volkswagen	C Segment	Scirocco	MQB	MQB A/B	103278	9039	7978	7660	4218												Stop Handle	Stop Handle
Volkswagen	C Segment	Scirocco	MQB	MQB A/B	430106	26466	24611	24210	24374												Stop Handle	Stop Handle
Volkswagen	C Segment	Scirocco	MQB	MQB A/B	10410	10087	9811	9216	4488												Stop Handle	Stop Handle
Volkswagen	C Segment	Scirocco	MQB	MQB A/B	270006	21110	21283	21788	21616												Stop Handle	Stop Handle
Volkswagen	D Segment	Atlas	MQB C1	MQB C1	49443	73182	72745	83546	81064												Stop Handle	Stop Handle
Volkswagen	D Segment	Atlas	MQB C1	MQB C1	0	0	0	0	0												Stop Handle	Stop Handle
Volkswagen	D Segment	Atlas Cross Sport	MQB	MQB C1	37940	41614	32008	34426	30860												Stop Handle	Stop Handle
Volkswagen	D Segment	Atlas Cross Sport	MQB C1	MQB C1	0	0	0	0	0												Stop Handle	Stop Handle
Volkswagen	D Segment	Atlas	MQB	MQB	47414	82008	84540	87305	88461												Stop Handle	Stop Handle

Figure 3.1: Parts of Vitesco Database Used to Analyze

**Limitations:**

However, the received data has a lot of models restricted to Europe and could be better applied for Vitesco. This could limit its efficiency for other automotive suppliers outside of Europe.

**3.2 Interview Method**

To see the match between the predictions from Vitesco findings, the qualitative interview method will be used. This paper will examine in-depth interviews to see what the manufacturers in the automotive industry think. The interview will be an interactive conversation taking around 50-60 minutes, where the interviewer and interviewee had an online one-to-one session.

**3.2.1 Part I. Background Information**

The interviewees will be asked to give an introduction of their company, how the company contributes to the EV market, and its sales for EV components.

**3.2.2 Part II. EV Market**

In this part, the interviewees will answer about their stance on the EV market. This includes how the manufacturers see the EV market in the next five years, what are the risks if the whole world goes fully electric, and what could be the substitutes of EV cars. These questions show the insights of the manufacturers and give a big picture to what the world could change into.

**3.2.3 Part III. Door Handles for EVs**

To answer the research question better, this part will be the manufacturers' view on the design of EVs, especially the exterior door handles. The questions include the importance of EV door handles to be different from others, how long will a certain door handle design stay and what is the tendency for brands to follow each other's design. The section will end with how the manufacturers think the EV door handle design in the future will be like.

### **3.2.4 Sample selection:**

For the interview, two automotive suppliers will be used. Both companies are in related fields and have been doing business in the automotive industry for a long time. Hence, the insights are from a long-term player. The first company, company A, with its general manager, Yang, has been in the industry for 23 years. The manufacturer produces various automotive parts for several companies. The parts include headlights, rear lights, and silicone parts for the controller. Company B has been doing business for 30 years with Lee as the general manager. The company supplies different parts, for example, electronic parts like sensors, headlights, and rear lights. For the past few years, company B had been manufacturing EV batteries, inverters, and charging station's connector sockets for several EV brands.

### **Limitations:**

As these manufacturers are based in Thailand for a long time, their way of doing business has been restricted to Thai laws. Thus, most of their insights may seem to be directed to how Thailand would change.



## **CHAPTER IV**

### **RESEARCH FINDING**

In this chapter, the data from the database and the qualitative research by interviews will be analyzed and summarized.

#### **4.1 Vitesco Database**

##### **4.1.1 EV Market**

The database suggests that all brands in the Volkswagen group have a high tendency to go electric. In 2023, all brands will launch full electric vehicles. For the next five years, many combustion engine cars will either turn into hybrid first or straight to full electric cars. In the future, the trend could be that all ICE vehicles would die out. New vehicles will be electric which can be seen through how all the future models are electric.

Volkswagen, for example, will discontinue its pure combustion engine cars by 2026, says the database. Hence, Volkswagen will be launching all electric vehicles from 2026 onwards.

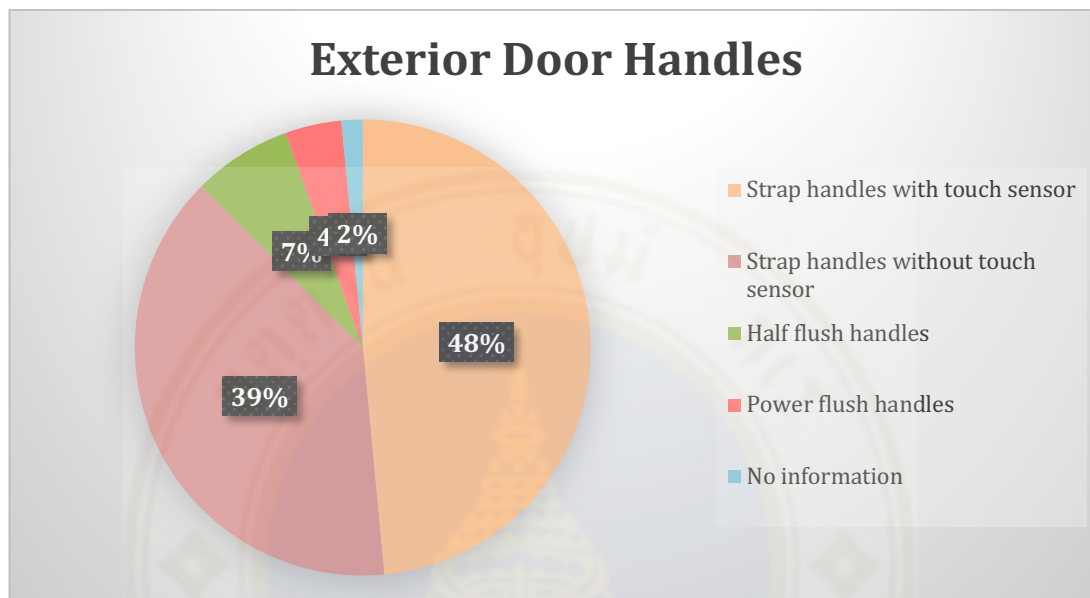
In 2023, Volkswagen introduced the ID.7 Tourer model as its full electric vehicle. This model is a good representative for the brand as it shows the new stance where future models will be full electric vehicles. Thus, in the future, Volkswagen will continue to supply only electric vehicles to the market. The leak images suggest that the vehicle is designed with an EV engine and power flush door handle (Rozier, 2022).

##### **4.1.2 Door Handles**

According to the database, the current types of door handles can be identified as strap handles with touch sensor, strap handles, half flush handles and power flush handles. Across the 109 models of Volkswagen group's vehicles, about 48.5% of the vehicles employed strap handles with touch sensors. Secondly, 39% of these vehicles have strap handles. Third, 7% are half flush handles. Fourth, 4% are equipped with

power flush handles. And for the rest of the vehicles that have not been launched, there is little-to-no information leaked to identify the door handles. Table 1 below summarizes the percent of each type of exterior door handles used today in Volkswagen Group.

**Table 4.1: Summary of Exterior Door Handles Used in Volkswagen Group**




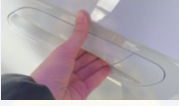


From this, it could be said that in the current market, strap handles are the most popular type of door handles. To add more innovation, the strap handles are equipped with touch sensors which would aid users to open the door more conveniently.

Among the Volkswagen group, the Volkswagen brand has the highest sales and will be used to forecast the change of exterior door handles. Previously, the ID. 7 Tourer model is shown to have power flush door handles. This is a new model coming out in 2023. The previous EVs in the ID family, whether it be ID.4, ID.5 and ID.6 all have half flush handles. Even though the new ID.7 model is a large vehicle in segment D, this could suggest that there is a shift from half flush handles to power flush handles. In the future, the brand could only be using power flush handles. Table 2 below summarizes the findings across each ID model.

**Table 4.2: Summary of Volkswagen ID Models (Source: Adapted from Vitesco database, Image Source:**

**<https://www.autoexpress.co.uk/volkswagen/id4>,<https://www.youtube.com/watch?v=14LzvKhvmGM>, <https://www.youtube.com/watch?v=1Ic19D6ICuE>,  
<http://autoboomb.co.il/en/catalog/cars/Volkswagen/id6/1-generation/suv-5-doors/62717>, [www.frandroid.com/marques/volkswagen/1346341-volkswagen-id-7-tourer-le-futur-break-electrique-a-un-nom#pid=4](http://www.frandroid.com/marques/volkswagen/1346341-volkswagen-id-7-tourer-le-futur-break-electrique-a-un-nom#pid=4))**

Model	ID.4	ID.5	ID.6	ID.7
Image of Model				
Engine Type	EV	EV	EV	EV
Production Years	2020-2034	2022-2034	2020-2034	2023-2031
Exterior Door Handle	 Half flush handle	 Half flush handle	 Half flush handle	 Power flush handle

## 4.2 Manufacturer Interview

From the database, there is a clear trend that new car models introduced to the market are altering from combustion engine vehicles to electric vehicles. It is possible for EVs to use power flush handles. To further understand the change, two automotive OEM suppliers were interviewed. In this section, the interviewees' responses regarding their experience in manufacturing parts for EVs and their insights about the future of the industry are documented for the purpose of analysis. This interview will end with their thoughts on how the door handles of EVs could change.

## **Part I. Background Information**

### **4.2.1 Interviewees Background**

The first interviewee is an automotive supplier located in Thailand and will be regarded as company A. The general manager, Yang, described that his factory has been manufacturing silicone parts and headlights for several automotive brands' manufacturing sites located in both Thailand and Europe. The second interviewee, Lee, is another manager in an automotive OEM company in Thailand and will be called company B. This company specializes in manufacturing electronic sensors, EV battery, inverters and connector sockets for customers in Thailand and Europe.

From the interview, both suppliers started with manufacturing parts for combustion engines vehicles. Due to the industry's trend, both suppliers have been investing into R&D and technologies to produce parts that are related to electric vehicles.

Company A has been producing silicone parts for the controller and the lighting system. The controller acts as the main controller board, taking responsibility for controlling all the processes in the EVs.

*"I have been producing a lot of silicone components for the controller used in EV cars for almost 4 years. These silicones components serve as an insulator that protects key parts in the controller. Our product range also covers headlights and rear lights. In the automotive lighting system, halogen bulbs are being replaced by LED and concept lighting because power consumption is very crucial for electric vehicles. Due to a decrease in demand for halogen bulbs, we invested in technologies and production lines for subminiature bulbs that have unique characteristics that LEDs are not able to replace."* Yang, Company A

Company B runs by Lee has been known for electronic sensors such as parking sensors and sensors that notifies the driver if other vehicles are too close. Currently, the company added more production lines to fit into the EV trend by producing batteries and inverters.

*"Our company produces several parts like electronic sensors for all types of cars, also EV batteries and inverters. Recently, other than the parts in the vehicles, we have been conducting research about the electric charging stations. We are starting to*

*manufacture EV connector sockets that connect the vehicle and the charging station. Lee, Company B*

#### **4.2.2 Supplying for Electric Vehicles vs. Combustion Engine Vehicles**

Since each supplier has been in this business for more than 20 years, the change from combustion engine vehicles to EVs altered the companies. Both suppliers have implemented new corporate strategies to ensure that the business has innovations that are able support the market trend. For combustion engine vehicles, it has been more straightforward and cheaper since the suppliers have been in this industry for a long period of time, more importantly the industry has already matured. Their know-how made production fast and efficient. On the other hand, electric vehicles are still considered as developing products, therefore components used are always changing. The new requirements are also emerging as the nature of electric vehicles are different from combustion engine vehicles. Yet, these drawbacks could be overseen by the manufacturers because it is the future trend that they must adapt to survive in the long run.

*“To produce the lighting and silicones for EV cars, our company must comply with more requirements when compared to producing parts for combustion engine cars. For every part, we are required to run various tests to check insulation and our production site must improve continuously to prevent any static electricity, which is very crucial to reduce the chances of non-conformity. Also, we need to ensure that our products’ quality can satisfy the market. The development of the EV industry forces us to expand our R&D to find better raw materials and become more innovative to support our customers in their advanced models.” Yang, Company A*

*“We have become more agile because of the EV industry. It is very different from manufacturing parts for combustion engines. The battery before is much smaller, thus the production is fast. With our innovation, we are used to producing small batteries for many years. When EVs were first introduced, we were forced to form a team that specialized in conducting research on EV batteries. It is very costly but for the business to catch up with the trend, it is inevitable. We brought in more engineers and machinery to support the production of EV batteries. Because the EV batteries are huge, it is much more dangerous. Leakage could cause harmful accidents and serve as*



*risks for us. So, as a manufacturer, we must come up with methods to ensure safety during our production and to ensure that products used by consumers are at the highest quality. Due to the alteration required, it has been more complicated for us when compared to the time when we only supplied for combustion engine vehicles.” Lee, Company B*

#### **4.2.3 Sales of Supplying EV Parts**

Each supplier has been working in the EV industry for about 4 years. To see the growth of the EV industry, the sales could be an indicator. For both companies, sales have been climbing higher and higher to fulfill the demand.

*“The demand for silicone parts of electric vehicle controllers has been increasing dramatically which can be seen in both recent orders and forecasts provided by customers. Compared to last year’s sales, the number of orders was just 5,000 pieces per month. This year, we are currently supplying 50,000 pieces per month and the demand is still increasing.” Yang, Company A*

For company B, due to confidentiality, they are unable to provide the exact number. However, it is said from Lee that the EV batteries had increased 400% when compared to the previous year, while the connector socket’s order per month had increased about 200% from last year. As there are no global standards for sockets yet, Lee stated that they would not invest in a huge amount yet as there is too much uncertainty.

From this, it shows how the industry is growing. Whether it be the silicones, EV batteries or connector sockets, the percent increase in demand has been multiplied. The sales of the silicones skyrocketed to 900%, the batteries had more than 400% increase in orders and the connector sockets increased for about 200%. As a result, it could be suggesting how the EV trend is growing and will probably grow more in the future.

## **Part II. EV Market**

#### **4.2.4 EV Market in the Next 5 Years**

From Yang’s insights, one of his customers’ roadmap presentations on their EV plans show that it is certain that the company is planning to invest a lot in EV. By

2025, the company plans to release a lot of zero emission models and by 2030, there will only be zero emission vehicles. Therefore, from this data that Yang received, he agrees that there is a high potential that EVs will take over the market.

*“I have been to my customer’s presentation about their future. I can definitely say that electric vehicles will be a main trend in the future. We will be seeing less ICE but more hybrid than EV cars. It might take some time for Thailand to move to EV not because there are not enough EVs, but because the infrastructure of the whole country is not able to support. Due to this factor, my analysis is that hybrid cars will take a huge part of the market first. And in the next 10 years, EV cars will take over the market completely. The infrastructure of Thailand does not fully provide trust for the consumers to buy EV cars yet. You see that there are a lot of charging stations concentrated in Bangkok, but there are many provinces here. People travel back and forth to many provinces that are not so developed. These provinces with less tourism will take a longer time to follow up with the automotive trends in Bangkok. Other than that, it is hard for automotive brands to market and target the low-income group to switch to EVs. Yes, the brands are trying to reduce parts and trying everything to cut costs for retail price reduction. Still, it is a new technology that we, as a supplier, also must invest in and study to be able to save costs, which will eventually make these cars cheaper. These reasons make it challenging for Thailand to go fully electric in the near future.” Yang, Company A*

For Lee, the EV cars will be heavily funded by all sorts of organizations. This will then increase the powertrain. Other than that, the aesthetic designs could be more developed from that.

*“I believe that the EV industry will be growing much larger than we could ever imagine. Many organizations are funding scientists and engineers to develop the efficiency of powertrain. Consumers in the future could be driving an electric car with a long range and are equipped with fast charge technologies or even battery swap. Another factor that I believe they could improve later would be the design. We see that the EVs look quite similar now due to aerodynamics, but automotive manufacturers will find designs that would help distinguish their cars from others.” Lee, Company B*

#### 4.2.5 Risks of EVs from a Manufacturer Point of View

If driving electric vehicles has become the major trend, there could be risks from the manufacturing side. Driving the EVs promised zero emissions, but still manufacturing and recycling the automotive parts could be polluting the world. Yang's company A specializes in producing headlights and rear lighting. To produce lighting for EVs, the cars are employed with concept lighting throughout the whole car. Concept lighting for EVs lights up by having different electronic components like diodes and resistance. Unlike combustion engines, these types of cars use halogen bulbs and incandescent bulbs. EVs have PCB boards which contain hundreds of these LED lights. When one light is out, the whole PCB board needs to be replaced instead of just replacing that one malfunctioned LED. Doing so would create more electronic waste which could contribute to global warming with poor waste management.

*“For EV cars, the concept lighting is to use hundreds of LED bulbs. And all these bulbs will act as one main board of light called the PCB board. This is a new concept used widely for EV cars since combustion cars do not take into power consumption during the design phase. But it would be different for EVs. When one or two LED lights on the PCB board is damaged, the lighting is still fine. Then, when 10 or more lights are gone, the lighting would affect the driving experience, making it more dangerous for drivers during the night. The tricky part to change these LED lights would be that the whole PCB board needs to be replaced. All the LED lights then would be put to waste, creating more unwanted electronic waste on the field.” Yang, Company A*

Company B mentioned about the battery used in EVs. In combustion cars, the batteries are quite small and contain sulfuric acid. To dispose these batteries would be easier than for EVs. Therefore, inefficient ways to discard EVs could be hazardous for humans and the earth.

*“There would be three main parts to dispose batteries used in ICE. First, the lead-acid grid could be dissolved and will be used to produce new batteries. Second, the plastic case of the battery can be easily recycled. Third, the battery contains sulfuric acid. To properly dispose, the acid should be neutralized, then the weaker acid could be used to produce household detergent. This process is easier than disposing the battery of EVs. The new batteries are much larger than the ones for combustion engines to be able to ensure high powertrain. But recycling the battery is very dangerous and risky*



*because the battery is made of lithium. It is important to maintain the temperature of lithium ions. High temperature could cause the lithium ions to leak out of the battery, producing hazardous carbon monoxide and hydrogen cyanide elements that are harmful to humans. Out of the elements in the battery, cobalt is the only one that could be and worth extracting out to recycle. Lithium and aluminum, for example, could be recycled but at a higher cost. It also comes with high risks to the human health. Other elements are too costly for suppliers like us to do so. It would not be worthy to spend so much money on something like this. Now, the government has been pushing us to come up with other materials to build EV batteries for better waste management.” Lee, Company B*

Hence, the EV cars would contribute positively to the sustainability trend due to the fact that the cars do not emit pollutants. However, on the manufacturing side, the process of recycling automotive parts of EV cars is still challenging. With poor management, global warming would still be an ongoing problem for upcoming decades.

#### **4.2.6 Substitutes for EVs**

Due to the risks that EVs could create, it is worth mentioning substitutes that could be another option to serve the sustainability trend. There could be substitutes for EV cars like hydrogen fuel cell cars. Yang mentioned how one of the big Japanese players is investing in hydrogen cars in which Lee confirmed the same fact. Manufacturers are testing different renewable energy that could give similar effects like electric vehicles. To comply with zero emissions regulation, instead of pure electricity, the vehicles will run using hydrogen fuel to power its motors. The two suppliers believed that hydrogen, as an abundant element in the world, can be a new source of renewable energy. Other than that, using hydrogen fuel cells would provide a lot of benefits such as allowing vehicles to deliver longer ranges for one tank of hydrogen. It is certain that it takes a shorter time for a vehicle to get the tank fueled by hydrogen or water than charging their cars. However, when asked about the percentage of success that this future model would take over the EV market, both interviewees are not certain. This future technology is very new and still costly for the manufacturers. It is also not certain whether the risks in manufacturing and recycling could be lower than EVs. More importantly, hydrogen is a combustion gas. Technologies must be developed to ensure

safety for consumers before hydrogen cars can take over the market. For the government or private business, it would be easier because there are already available in gas or oil pipes, which can easily be changed to transfer hydrogen or water to fill up the tank.

*“We had just gradually changed the consumer behavior to switch from buying combustion engines to electric vehicles, so I think it is hard to add hydrogen cars in the next 10 years. But not like it would never happen.” Yang, Company A*

*“Hydrogen fuel cell cars could be the future that could be a substitute or just a competitor to electric vehicles. We want vehicles that emit zero emissions, cheap, and convenient to use. So, manufacturers are investing a lot. But then, it is worth taking to account the infrastructure of every country. As we are racing with time and how fast global warming is affecting, it is important to start with EV and eventually switch to hydrogen fuel cell cars. It is also not certain if hydrogen fuel cells cars will not have any risks.” Lee, Company B*

### **Part III. EV Exterior Door Handles**

#### **4.2.7 Overall Change in Designs of EVs in the Future**

The forecast of designs of EVs in the future will become a benchmark of how each aesthetic element would be. For Yang, the beauty of the car is important for electric cars. Since aerodynamics play a big role in designing the cars, manufacturers have to come up with supplies that could reduce the drag, for example, door handles. Lee, similarly, stresses about how the powertrain could improve from technological development. For the powertrain to change, aerodynamics is the key to success. Likewise, every part of the vehicle must not increase the aerodynamic drag.

*“In my opinion, EV cars do look quite the same and may be similar in the future. I think it has to do with aerodynamics. To be able to increase the range of the vehicle, the electric cars must have a certain shape. Even the door handles matter since it could affect the driving drag. Look at Tesla, its cars have flush handles to alleviate the aerodynamic drag. Hopefully, we will see this innovative aesthetic design in more of the future electric cars.” Yang, Company A*

*“I think one thing that could be heavily changed would be the size and the type of the battery. Many companies are trying to increase the powertrain of EV cars so that consumers can drive farther. The battery could be larger, much more practical, and*

*powerful to attract more customers. It is important to keep in mind that the powertrain has to do with the aerodynamic drag. With a huge battery, but high air resistance, the car would not go as far. Therefore, every part of the vehicle should reduce the coefficient drag. Another factor for the designers to consider is the product cycle. When the battery reaches its limit, we must think about waste management and how to recycle it.” Lee, Company B*

#### **4.2.8. Difference of EV Door Handles**

Currently, combustion engine cars use strap handles or the pull-out type. For EVs, strap handles are not the best option. Strap handles do not lessen air resistance that could affect the powertrain. As a result, it is important for the door handles of EVs to be different from others. One important feature would be door handles should be flat to align with the cars.

*“Yes. It is important for the door handles of EVs to be somewhat different from petrol cars. Again, aerodynamics is the vital point here. Strap handles are not aligned flat with the door. When cars are driven at high speed, air resistance doubles and could be reduced with a smooth surface. Strap handles, on the other hand, are stuck out and will make the car consume more energy. At the same time, more energy used will decrease the preferred distance travelled.” Yang, Company A*

*“EVs run on a different system than ICE cars. When increasing speed, combustion engines have a gas tank to fuel speed even with air resistance. EVs still need to wait for the battery to charge and with aerodynamics, it has no gas tank to compensate. This will eventually reduce the powertrain when more energy is used. Then, the overall smooth design and even door handles should be different from ICE to become efficient.” Lee, Company B*

#### **4.2.9 Tendency to Use Similar Designs**

Door handles do follow the same trend for other manufacturers. When asked about the mechanical flush door handles that were first used by Tesla, both manufacturers agree that other brands will be adopting this type of door handles soon. This would be because once a certain technological innovation is introduced into the market, it is often used by other manufacturers to follow the trend. Vehicles in the luxury

segment would start employing the innovation. Then, once the technology is stable and could be produced at a lower cost, middle and low-segment vehicles will have the same technology.

*“From my experience, I do think that door handles, just like other innovations, will follow the same trend. Once Tesla puts out mechanical flush handles into the market, not long after, other brands will be doing the same. Also, other Tesla models will use similar materials. It is how the industry works. Before LED bulbs become a popular choice for all vehicles, brands only want H4 12V 60/55W halogen bulbs. However, once LED is introduced to the market, many brands want to adopt the new technology. Luxury cars will be the first to have such innovation since these cars can be sold at a high price and are always required to be advanced in technology. Then, the technology will mature. This is the point where a lot of research and development is invested to make the technology cheaper. Mid- and low-level cars will start having them too.” Yang, Company A*

*“Door handles will follow the same trend. I have been in the industry for quite a long time. I have seen many innovations that are copied and then will be replaced with new ones. In the past, only premium cars had lane assist sensors. Today, even pickup trucks have them. This technology is now used in every car segment. It will be interesting to see how the technology of door handles will elevate. Then, the cheapest electric cars will eventually have them too.” Lee, Company B*

#### **4.2.10 Duration of Design in the Market**

Generally, a new technology could thrive in the automotive industry for about 5-10 years. This could depend on various factors. Like the lane assist sensors, Lee stated that it could be in the trend for at least another 5 years. Therefore, for new technology and design for door handles, it could trend for 5 to 10 years too.

#### **4.2.11 Forecast of Door Handle Design for EVs**

From the manufacturers' point of view, by considering the coefficient of drag, the mechanical flush and power flush handles could be used a lot in future EVs. As innovation tends to stay for a while, Yang believes the mechanical flush will still be thriving in the near future. Both Yang and Lee strongly agree about power flush handles.

This type of handle could be added with many technologies like smartphones and smartwatches.

*“In my opinion, since it is inarguable that designs are copy over and over, the mechanical flush type from Tesla will be seen for awhile. This innovation does reduce the coefficient of drag. However, from what I saw, many users are having difficulties opening them, especially in extreme weather conditions. The other flush handles, similarly, have the same characteristics. Whether it be the half flush handles or power flush handles, both has the tendency to reduce air resistance. All of these are very innovative and stylish. Moreover, it might be good to see that the door handles can be unlatched from a smartphone or other smart devices too. Power flush handles make the surface of the door very smooth. To awake the system, a tap from a smartphone or even a smartwatch would be a great idea. Or even a door with passcode like in household is another option.” Yang, Company A*

*“I would say that power flush is the future of car door handles. This type of door handle contributes less to air resistance and gives an innovative look for door handles. It might take quite some time to get the door handle out, but it is still very innovative. To reduce waiting time, having no door handles could be another solution. Pressing on a button on the door could be a way for the door to pop out. This really reduces the drag. But it might take some time for the industry to get into that. It would also really reduce the role of door handle suppliers too. They have to come up with other ways to still be in the game.” Lee, Company B*



## **CHAPTER V**

### **CONCLUSION**

In this chapter, recommendations to the suppliers will be provided and the paper will be concluded.

#### **5.1 Conclusion**

The recommendation could be separated into two categories: exterior door handles in the near future and in the future. For the near future, EVs could have mechanical flush door handles. This type of door handle has a lower cost than flush power flush handles. According to the interview, mechanical flush handles will economize and will be much more available for cheaper EVs. Still, this type of door handle can be concerned with health issues. Users complain about its difficulty to open because of its high torque electric motor that could hurt their fingers (Clayton, 2022).

Then, to make vehicles more innovative, power flush door handles could be used. Power flush could replace half flush handles, like how Volkswagen changed its design in the ID.7 model. This would make the cars more stylish, while preserving high air resistance. As history suggested, car door handles could be inspired from household door handles. There is a high likelihood that the innovations from household door handles will be implemented to vehicles. To add similar elements, key fobs may not be handy enough, thus, to access the vehicles, users can scan their fingerprints or enter a passcode for the handle to pop out. Smartphones can be installed with applications that could urge the handles to come out. Smartwatches can work similarly like smartphones too. Users just have to tap the watch to get the handle.

In the future, according to the interview, cars could have no door handles. The fingerprints or passcode could change from prompting the handle to pop out to the whole door. This could help the sustainability trend too. From the interview, manufacturers are worried about waste management. No door handles would mean no



door handle waste. The figure below summarizes the advantages and disadvantages of each recommended exterior door handle.

**Table 5.1: Summary of Recommended Exterior Door Handles**

Types of Exterior Car Door Handles	Advantages	Disadvantages
Mechanical Flush Handles	<ul style="list-style-type: none"> <li>• Help with resisting aerodynamic</li> <li>• More stylish than strap handles</li> </ul>	<ul style="list-style-type: none"> <li>• Still at a higher price than strap handles</li> <li>• Safety issues: fingers can get hurt from its high torque electric motor</li> <li>• Could break easily if opened in the wrong way</li> </ul>
Power Flush Handles	<ul style="list-style-type: none"> <li>• Help with resisting aerodynamics</li> <li>• More stylish and innovative than mechanical flush handles</li> </ul>	<ul style="list-style-type: none"> <li>• More costly than mechanical flush handles</li> <li>• Do not allow access if low battery</li> <li>• Harsh weather conditions like snow could not pop-out handles</li> </ul>
No Door Handles	<ul style="list-style-type: none"> <li>• Reduce waste from making handles</li> <li>• Reduce waste management risks</li> </ul>	<ul style="list-style-type: none"> <li>• Still under research and development</li> <li>• Decrease role of automotive door handle suppliers</li> </ul>

## **5.2 Recommendations**

In conclusion, the growth of the EV industry encourages the growth of other elements, especially exterior door handles. With the drag of coefficient, it holds back the electric vehicles to drive at high speed and range. Hence, it is significant to produce exterior door handles that prevent air resistance. To answer the research question, this paper then suggests manufacturers to further research and develop two possible handles in the near future: mechanical flush handles and power flush handles. These handles are already in the market and could be economized to reduce the price of the electric cars. It is also worth funding in new technology like cars with no handles. Suppliers could invest in to see the possibility of cars with no handles and what other products could be supplied instead to increase their source of income. To get a heads up will allow the suppliers to prepare and still sustainably prosper.

## **5.3 Limitations**

For this paper, only two automotive manufacturers were interviewed. Therefore, the first limit is from the number of interviewees. This could exclude other possible answers and insights that could be important and different. It would be more beneficial to add more manufacturers, especially other automotive door handle manufacturers. Second, a literature review of vehicles with no door handles could be attached. There is not much information whether it is an idea that could happen or even what are the steps to take to get there.

## **5.4 Future Work**

Based on the listed limitations, the paper could be expanded to reach more conclusions. Other than interviewing manufacturers, it would be better to have insights from consumers. Qualitative analysis from consumer interviews can be included to see what the market wants. Does the public want cars with mechanical flush or power flush door handles? To what extent would they want the door handles to be technologically innovative? Would they be driving cars with no door handles? Even

though consumers usually do not know exactly what they want, there could be interesting ideas that could be developed from. In addition, working with automotive brands will bring out various perspectives. It would be significant to know the future steps of each automotive brands. Then, it is worth analyzing whether the segment of the cars could affect the design of the door handles.



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