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Strategically Managing Product Innovation to Create Consumer Value: An Analysis in the Context of the Australian Electric Vehicle Market

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Strategically Managing Product Innovation to Create Consumer Value: An Analysis in the Context of the Australian Electric Vehicle Market

by

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A thesis submitted to the University of Notre Dame Australia in total fulfilment of the requirements of the degree of Doctor of Philosophy

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Declaration

This thesis is the candidate's own work and contains no material which has been accepted for the award of any degree or diploma in any other institution.

To the best of the candidate's knowledge, the thesis/dissertation contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

Candidate's Name: Brendan Koehler

Candidate's Signature:

Date: 10/01/2018

Abstract

This thesis encompasses a body of research which looks to explore how strategic management, consumer value and product innovation interrelate. In particular, this research will evaluate such a unilateral relationship in specific reference to product innovations developed as a result of emerging and disruptive technology. Therefore, this research will be conducted in the context of the Australian electric vehicle industry. This industry was selected as it has displayed traits of an industry with companies that have a desire to incorporate electric vehicle product innovations into their portfolio from a strategic perspective; yet these product innovations have no particular consumer demand or consumer value.

Therefore, the relevance of this research is to identify the interoperability of strategy, innovation and value in order to deliver upon the strategic initiatives of a firm while delivering a valuable product to the consumer. All this must be encapsulated within a competitive environment and with reference to technological feasibility.

The literature review will identify a gap in knowledge: there is no clear theoretical understanding of how strategic management, product innovation and consumer value interrelate. Subsequently, the research methodology will take a qualitative approach by conducting interviews with both managers and consumers on the subject matter of electric vehicles as a new product innovation. There will be a combination of content and thematic analysis of the data; this will additionally be triangulated against secondary data sources such as business literature in order to serve the principles of validation.

Subsequently, the analysis of the research data will present several themes across strategy, innovation and value, which both managers and consumers consistently identify. However, by analysing the depth of themes, a clear separation will be uncovered between management perspectives and consumer perspectives in reference to electric vehicle product innovations.

As a result, the discussion of the research will present a requirement for the strands of strategy, innovation and value to be closer aligned in theory and in practice. The thesis will explore how a closer alignment of these strands is not possible under current value-based models, such as the value chain; particularly when discussing radical product innovations that emerge as a result of new and disruptive technology.

Therefore we will introduce a new value-based theory, termed here the *Value Paradigm.* This value paradigm will be presented as a new theoretical contribution underpinning that, in the context of new markets formed under greenfield principles, that a closer alignment between strategy, innovation and value is necessary to ensure market success. Such an alignment is predicated on considering the concurrency of influences between strategy, innovation and value. The value paradigm is fundamentally different to other value-based models as it moves away from a traditional linear approach to creating value and incorporates a far more integrated and non-linear approach. Its application is not exclusive to the subject matter of electric vehicles and has a broad theoretical relevance to any innovation-based industry, which is increasingly becoming every industry.

Foreword

It is full of gratitude that I comply with my grandson Brendan Koehler's request and find myself writing these lines.

I look back on the years 1956 to 1965, my early years of employment in the automotive industry with General Motors Holden. I was fortunate to be submerged in the beginning of what has meanwhile developed into state-of-the-art technological reality: the transformation to modern automotive manufacturing practices.

At the time of my employment, computer technology was not present and we conducted our work in a far more manual process than we know it today. We used mathematical methods such as the never-ending applications of the 'Gompertz curve' to calculate market forecasts in the automotive industry. It was pure hard work and all done by hand. This was how we did things back then. It's astonishing when you look back and see how far the industry has come along since then.

I spent the majority of my career with Daimler-Benz AG in Stuttgart, where I worked across the fields of marketing, planning, competitive intelligence and analysis until my retirement in 1988. Over those 30-plus years working in the automotive industry, I witnessed the comprehensive transformation and implementation of new managerial, operational and marketing practices. As I reflect back on the development of the industry I can recognise that what we see now as present-day automotive technology has only come about due to the application of modern state-of-the-art technology.

I find it quite remarkable and positive to see that the elementary foundations that were laid during my time and the methods we applied then have ultimately and quite logically ensued into modern-day automotive practice.

As I reflect on what has led to the transformation of the automotive industry during my service and following it, I can conclude that it has been the combination of computerisation, modern marketing and – most importantly – advances in technology that has enabled automotive manufacturers to develop and focus their resources on new segments such as practicality, usability, safety, efficiency and sustainability. To put it in a nutshell: Industry 4.0. New products and technologies are continuing to emerge more frequently, with more benefits to the consumer, and bringing about more disruption among the industry. The opportunity for automotive manufacturers to capitalise on these advancements is enormous; however at the same time, there is an immense responsibility and extensive challenges for manufacturers to work with the consumer in light of these advancements.

I wonder now: with the emergence of electric vehicles, are we heading towards a future of zero-emission vehicles on our streets in the near future? We are indeed on the threshold of a new era. I hope that this research will help us better understand how we can get there.

Rolf Koehler

Retired Automotive Manager

General Motors Holden – Melbourne, Australia 1956–1965

Daimler-Benz AG – Stuttgart, Germany 1966–1988

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I would like to acknowledge and thank first and foremost my supervisor Professor Hélène de Burgh-Woodman. Hélène, your support and dedication were absolutely remarkable. Your guidance and insights were first-class. When things seemed dire, like I was stuck in a dark maze, you would not only help me find the light at the end of tunnel, but also drag me there. Your supervision was the perfect balance of enabling my autonomy while making yourself available for support at the drop of a hat. Such is your dedication to your field that I am certain you will be exerting a similar ‘around the clock’ commitment to your future candidates, students and academic work. I could not have done this without you. Thank you.

Next I would like to thank all the research participants. Your identities remain hidden, but I know who you are and I would like to thank each of you for volunteering your time and allowing this project to become a reality. Without your involvement, I would have been unable to deliver this contribution. Thank you.

To my employer: thank you for supporting my endeavour to complete this research. Balancing my full-time career with this academic work was at times a struggle. However, I believe that with this contribution delivered, we can reap the rewards together. I appreciate the autonomy you provided me to allow me to juggle my time between work and study. Thank you.

Last, thank you to my family and friends. I appreciate your support as I worked through this thesis. Inevitably, it meant I may have missed the odd arrangement or was unable to support you in the ways I should have. I appreciate you overlooking these shortcomings and standing by me when I needed it most. Thank you.

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List of Abbreviations

EV = Electric Vehicle

ICEV = Internal Combustion Engine Vehicle

HEV = Hybrid Electric Vehicle

PHEV = Plug-in Hybrid Electric Vehicle

BEV = Battery Electric Vehicle

OEM = Original Equipment Manufacturer

TCO = Total Cost of Ownership

Chapter 1 Introduction

With the ever-increasing rate of technological advancement, the implications of new technology are readily affecting everyday consumer products. This new era of leveraging new technology to facilitate product innovation, to the benefit of the consumer, has a significant impact on contemporary managerial practice. While the importance and impact of new technology and product innovation upon modern management are not new concepts (Abernathy & Clark 1985; Dosi 1982; Eggert et al. 2014; Euchner & Ganguly 2014), this research aims to investigate how uncharted innovations and markets affect traditional management practices and identify any possible implications or evolutions of theory.

This research has been conducted in the context of the Australian electric vehicle (EV) market. The Australian EV market is one, which from an OEM perspective, is a purely retail orientated industry. This is due to that fact that the production of local vehicles in Australia has been significantly wound back and is on the verge of almost a complete exit. Therefore, in the context of this research, the Australian EV industry refers predominately to the retail element of these vehicles in Australia.

The role of electric vehicles in Australia is yet to be defined: prior research highlights that the Australian EV industry is still in its infancy (ClimateWorks Australia, 2017). It is speculated that EVs may have a crucial role to play in the development of the Australian automotive industry, given that there is an escalation in the development and future availability of a raft of EV models around the globe (ClimateWorks Australia, 2017). However, such prospects at this point are purely speculative in the industry. Concurrently, there is also limited scholarly research conducted in the context of the Australian electric vehicle industry, despite its potential for both practical and scholarly insights. Subsequently, this study aims to address this lack of scholarly depth by tracing innovation in a greenfield environment. Therefore, this research draws on extant scholarly work across the themes of strategic management, product innovation and consumer value from other industry sectors. Addressing this research from a variety of industries has a high degree of relevance, since the principles unearthed from the increased rate of technological change across various industries will, in turn, inform both the research presented here and the theoretical developments it seeks to explicate. Thus, this research seeks to capitalise on the fledgling nature of the Australian EV market in order to illuminate deeper insights into how uncharted innovations challenge conventional understandings of the value chain and consumer value creation.

The Australian EV experience suggests that radically new product innovation such as EVs requires new theoretical approaches and managerial practices that more closely align existent theories from the fields of strategy, innovation and value; since the products of a firm (and any product innovations) are central to the core business of strategic managers and, concurrently, highly dependent upon consumers. Subsequently, there is a requirement to analyse the academic themes of strategic management, product innovation and consumer value in unison, rather than in isolation or singular combination.

The Australian EV industry acts as a suitable bedrock to apply this research as it acts as an industry which is attempting to integrate new technology into its portfolio whilst maintaining and slowly phasing out an incumbent technology. This exemplified transition in technology has broad theoretical relevance to any technological and innovation based industry, which is largely becoming everyone. Therefore the implications of this research will be applicable not only to the Australian EV industry, but many other industries both in Australia and globally.

Subsequently, by analysing the aforementioned academic themes in the context of the Australian EV industry this research will highlight a gap in the literature that there is a requirement for strategic management, product innovation and consumer value to be integrated both at the level of theory and practice; thereby suggesting the need for theoretical development in how such integration might be achieved. Addressing this gap in knowledge will allow for a greater understanding of how product innovation can be brought to market as a valuable product to consumers, while also achieving the strategic goals of a firm. This research will focus on competitive advantage (Coyne & Subramaniam 1996; Dobbs 2014; Levitt 1969; Porter 1991; Rosenkranz & Weitzel 2007), the role of strategic alliances (Agnihotri 2013; Cool & Schendel 1987; Rosenfeld 1997; Wonglimpiyarat 2006) and zero-sum and positive-sum competition (Balakrishnan & Pathak, 2014; Porter & Teisberg 2004; van Heerde et al. 2008; Zhang & Dongsheng 2010) as the theoretical bases for showing how strategic, innovation and value-creation concepts can be better integrated to develop new theorisations of the traditional value chain. Furthermore, the research at hand will explore the application of radical and continuous innovations (Corso & Pellegrini 2007; Denning 2010; Denning 2013; Linton 2007; Lynn, Morone & Paulson 1996; Milé 2002; Soosay & Hyland 2008;); the role of group dynamics in acting as a catalyst for innovation (Al-Laham et al. 2011; Baba 1989; Hamel, Doz & Prahalad 1989; Powell, Koput & Smith-Doerr 1996); and reviewing product innovation within its role of creating new value (Govindarajan et al. 2001; Jones, Knotts & Udell 2011; Veryzer 1998). To conclude, this thesis will review the literature surrounding consumer value, specifically the consumer's perception of value (Bowman & Ambrosini 2000; Lado & Wilson, 1994;

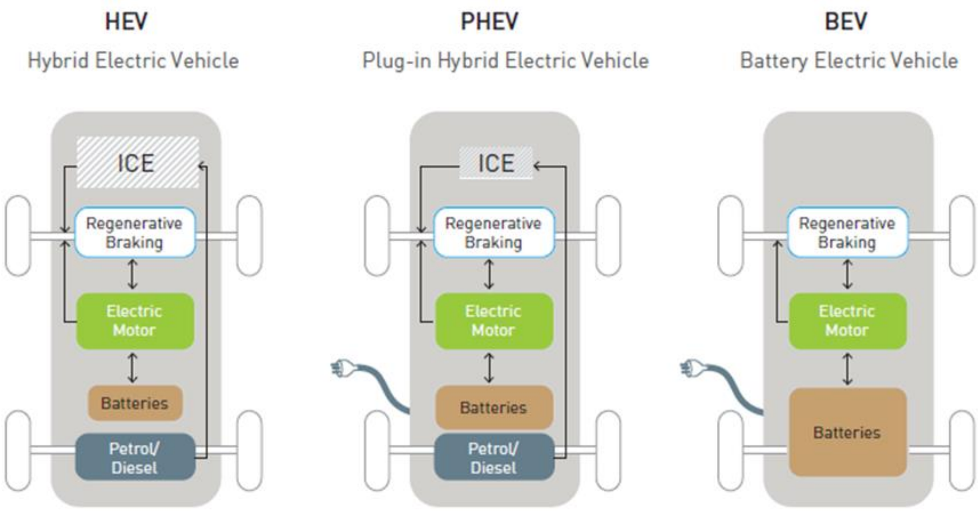
Sela et al. 2013; Sheth & Uslay 2007; Zeithaml 1991), the relationship between product positioning and consumer value (Chen & Chang, 2013; Cuadros & Domínguez 2014; Kotler 1972; Kroeger & Weber, 2014; Lampikoski et al. 2014; Narver et al. 2004) and the role of product innovation in stimulating value creation (Foxall 2014; Moreau & Herd 2010; Payne, Storbacka & Frow 2008; Rimlinger 2011; Vargo & Lusch 2004).

1.1 Main definitions

The definition of EVs has been subject to frequent conjecture due to the continual innovation of the electric vehicle concept. There are now several different types of electrified vehicles, such as: Mild Hybrid Electric Vehicles; Plug-in Hybrid Electric Vehicles; Battery Electric Vehicles; Range Extended Electric Vehicles; and so on. Recently, the industry has tried to simplify the different variations of EVs (Climate Works 2017; State Government Victoria 2013) into three groups (see also Figure 1):

- **Hybrid Electric Vehicle (HEV)** – A car with an internal combustion engine, fuel tank, electric motor and batteries but without a plug, so it cannot be charged from external sources; e.g. Toyota Prius
- **Plug-in Hybrid Electric Vehicle (PHEV)** – A car with an internal combustion engine, fuel tank, electric motor and batteries, with a plug so that it can be charged from external sources; e.g. Audi A3 e-tron or Mitsubishi Outlander PHEV
- **Battery Electric Vehicle (BEV)** A car with an electric motor and batteries only, with a plug to charge from external sources; e.g. Nissan Leaf and Tesla Model S

Figure 1: Electric vehicle types (State Government Victoria 2013)



Importantly, for the purposes of this research, unless specified otherwise, the term electric vehicle (EV) is used to identify any vehicle that can be charged from external sources via a plug. Gauging from the above, this means that for the purpose of this research, 'EVs' refers to PHEVs and BEVs, yet excludes HEVs (which cannot be charged from external sources via a plug).

Because this thesis largely compares EVs and non-EVs, this thesis also needs to define all conventional, non-EV, vehicles. The most common form of vehicle can be classified as internal combustion engine vehicles (ICEVs), which are powered by a fuel that is combusted in order to propel the vehicle. The most common fuel sources for ICEVs are petrol and diesel. However, alternatives to petrol and diesel exist in gas (both Liquefied Petroleum Gas (LPG) and Compressed Natural Gas (CNG)), bio-fuels and other niche fuel sources. Because all these fuels are combusted, vehicles powered by them therefore will be classified under the one banner of ICEVs. Importantly, since HEVs for the purpose of this research will not be classified as an EV, they will be included under the ICEV banner. Hydrogen-powered vehicles are not covered within the context of this research, due to the fact that there are no hydrogen-powered vehicles currently available on the Australian market for private consumers to purchase.

1.2 Research significance

This research is significant due to a few crucial factors. First is the ever-increasing role technology plays in radical new product innovations coming to market in a greenfield manner. EVs are one such technology that can be considered within the scope of a greenfield product developed using technological advancements. Second, the Australian EV market provides an excellent test bed for this research, since the product innovation of EVs has been available in the market long enough to generate some consumer and managerial exposure to offer relevant data for research, but not so long that the technology is no longer considered disruptive or the innovation radical. This test bed of the Australian EV industry was particularly selected because of the initial failure of EV products in the Australian market. As will be highlighted throughout this research, the failure of EVs in Australia was primarily due to issues associated with the product's usability, in particular its range and recharging, and the purchase price. Studying these impacts of the product innovation of EVs, and investigating why the consumer initially found no value in these products, is a crucial element of this research. With this understanding, we must also research the role of strategic managers and the initiatives they employed – or should have employed – to circumvent the issues consumers had with the product. Therefore, we address the gap in the existing literature by aiming to better understand the relationship between strategic management, product innovation and consumer value.

This research seeks to elaborate on the relationship between strategy, product innovation and perceptions of value to better theorise how these elements must drive each other. By considering these three themes together, this research aims to contribute new knowledge that can potentially open the path to a greater theoretical understanding of how to successfully manage the ever-accelerating rate of product innovation in an increasingly demand-driven marketplace. It is also the goal of this research to show how this reconceptualisation of strategy, innovation and value can play a significant role across a broad range of industries.

With product innovation becoming ever more significant in the contemporary corporate environment, and as historically longstanding conventional business models come under increasing scrutiny, this research is timely. Product innovation, in collaboration with technological development, is becoming more disruptive to existing industries and businesses (Dosi 1982; Euchner & Ganguly 2014). As the rate of innovation continues to increase, the pressure builds on industry to continue to embrace innovation as a mechanism to remain competitive. As the implications of product innovation become more significant, the risk of failing to manage product innovation effectively becomes more consequential (Abernathy & Clark 1985). As a result, this research helps to deliver new knowledge in order to address the growing significance of product innovation.

Consistent with previous findings (Klein 1991; Machikita & Ueki 2015; Nam 2011; Piller & Ihl 2009; Schirmer 1996; Zucchella & Siano 2014), this research also highlights the relevance of managing product innovations in foreign markets. As product innovation decisions occurs primarily in centrally located headquarters, the management of these product innovations needs to be individually considered for each market. Because of different cultures and different value perspectives, the marketing of product innovations must be specifically tailored to individual markets (Franke et al. 2009).

Importantly, the significance of this research is to highlight that in order for product innovations to be successful in the marketplace, strategic managers, product innovators and consumers (along with their value perspectives) must be considered as part of one big picture, rather than in isolation.

1.3 Framework and Research Question

After initially laying the conceptual groundwork through the literature review, the research framework converges the three themes of strategic management (Barney 2002; Joshi, Kathuria & Porth 2003; Porter 1979, 1980, 1991; Williamson 1991), product innovation (Baba 1989; Hamel, Doz & Prahalad 1989; Govindarajan et al. 2001; Lynn, Morone & Paulson 1996; Soosay & Hyland 2008; Veryzer, 1998) and consumer value (Bishop 1984; Delkhah et al. 2014; Doyle 1984; Walter et al. 2001; Zeithaml 1988) into one integrated viewpoint.

The research of these three themes will be conducted in the context of the Australian electric vehicle market. Electric vehicles have been at the centre of both academic literature (Bohnsack et al. 2014; Egbue & Long 2012; Gärling & Thøgersen, 2001; Hawkins et al. 2013; Krieger, Radtke & Takanuki 2013) and industry literature (ABMARC 2012; ClimateWorks Australia 2017; Mader & Bräunl 2012; McKinsey and Company 2016; State Government Victoria 2013).

This research seeks to use the themes of strategic management, product innovation and consumer value in the context of the Australian electric vehicle industry in order to answer the following research questions:

- *To understand how strategic management, product innovation and consumer value interact within a retail context to deliver upon strategic initiatives of OEMs and deliver value for their consumers.*
- *Can a deeper integration of strategic management, product innovation and consumer value principles better facilitate the uptake of emerging technology?*

To answer these questions, this research has identified the EV industry as a suitable context for study; yet it should be reiterated that the theoretical contributions offered in this research are intended to have broader implications. Industry professionals working in the Australian EV industry were selected to participate in depth interviews to form part of the qualitative research methodology. In addition, Australian consumer interviews were conducted to inform the consumer perspective on the subject matter.

1.4 Methodology

This research encompasses a largely qualitative methodology (Lincoln & Guba 1985; Maxwell 1992; Merriam 1998; Schwandt 1997). The research has been structured as follows: content analysis of both the existing academic literature and industry reports followed by depth interviews with industry professionals and consumers.

Conducting a content analysis (Carley 1992; Duriau, Reger & Pfarrer 2007) of both the existing academic literature and industry reports allowed a full understanding of existing knowledge and the identification of any relevant gaps in knowledge. In accordance with the use of content analysis, data was coded and analysed for concept frequency. This allowed for inferences to be drawn in order to access the embedded concepts (McTavish & Pirro 1990).

Depth interviews (Cooper & Schindler 2008; Punch 2005) were conducted with key industry leaders from the Australian electric vehicle industry, and with Australian consumers. The use of depth interviews (Cooper & Schindler 2008; Punch 2005) is justified as it allowed for maximum focus on the key issues of the research, while facilitating the participants' ability to share their expertise in their area of specialty and, in the case of consumers, to provide detailed insights into their preferences and perceptions.

Interview questions with consumers were designed to initially garner a sense of consumer awareness of the current landscape of the overall Australian automotive industry before moving towards a more specific line of questioning around the role of EVs. The resulting interview data was recorded, transcribed and coded, before moving on to a thematic analysis (Daly, Kellehear & Gliksman 1997; Fereday & Muir-Cochrane 2006; Rice & Ezzy 1999) of the data. The thematic analysis highlighted key themes, which will be elaborated further in the analysis.

The final aspect of the methodology came in the form of triangulating (Golafshani 2003; Jick 1979; Johnson 1997; Mathison 1988; Patton 2002; Punch 2005) the data sets – literature review, industry reports and interview data. The triangulation combined the results of the thematic analysis of the interview data and the content analysis of the literature review and industry data into one final thematic analysis. This analysis forms the basis of the discussion chapter and provides grounds for the theoretical developments suggested. This final thematic analysis highlights all the major and relevant themes that emerged from the qualitative research data. The research methodology, containing information such as participant details and data collection, is discussed in full detail in Chapter 4.

1.5 Scope of study and limitations

This research aims to address a gap in knowledge – of how the themes of strategic management, product innovation and consumer value work in collaboration – by investigating the Australian automotive industry (inclusive of electric vehicles) with participants from a range of different backgrounds: for example, consumers from different socioeconomic backgrounds. A main limitation of this study is that participants only formed a small sample of the overall stakeholder population in the Australian automotive industry. As a result, while their perspectives form a significant portion of this research, they cannot be deemed to reflect the entire consumer landscape or the global industry as a whole.

1.6 Thesis Outline

This thesis consists of ten chapters, including the introductory chapter, which provides an introduction to the research, highlights the significance of the research, and outlines the research approach. Chapter 2 offers an overview of the Australian EV industry in order to provide a context for study. Chapter 3 presents a review of existing academic literature on the themes of strategic management, product innovation and consumer value. Chapter 4 highlights the research methodology, research structure and research design. Chapters 5 to 8 present the analysis of data. Chapter 9 features a discussion of the results and yields both academic and managerial implications of the research. The conclusion of this research is presented in Chapter 10 with a summary of the research, the findings, recommendations, limitations and recommended areas of future research.

Chapter 2 Context for Study

The present research focuses on the Australian EV industry. This context for study was selected as it constitutes a greenfield market, where manufacturers are contending with the challenge of how to develop their product and bring it to a market that remains largely uncalibrated for change. In this respect, the Australian context represented a timely study, which traces the various challenges facing the industry as a basis for developing new insights into how such challenges may be more effectively apprehended. The Australian EV industry only accounts for a minute portion of the overall Australian automotive industry: less than 0.1 per cent of new car sales (VFACTS 2016). Due to the size of the Australian automotive industry, this research only accounts for vehicles (EVs and ICEVs) distributed by automotive vehicle manufacturers (also known as Original Equipment Manufacturers or OEMs) in Australia. This study does not consider any vehicles, electric or otherwise, that are privately imported, converted locally, manufactured by third parties or specially imported by OEMs for purposes other than public sale.

2.1 The electric vehicle market: a focus on Australia

Currently, EVs have limited uptake both globally and in Australia, occupying less than 0.1 per cent of the Australian new passenger vehicle market (ClimateWorks Australia, 2017; VFACTS, 2016). Globally, only seven countries in the world exceed one per cent market share for EVs (International Energy Agency, 2016), which highlights that the uptake of EV technology is low globally. One of the reasons for this low market share is the high purchase cost of EVs, which impacts on the value equation for consumers (AECOM 2011; KPMG 2014) and means the products do not sell in the competitive marketplace. Obviously, this high cost has affected sales, but it has also discouraged other manufacturers from importing available overseas EV models into Australia, restricting competition among manufacturers and limiting consumer choice. Subsequently, OEMs have had relatively little success offering EVs in Australia.

As the cost of manufacturing EVs begins to drop, EVs may progressively become more affordable; this may make them more appealing for OEMs to import and ultimately make EVs more attainable for average consumers, resulting in a prospective increase in market share. However, the combination of lower prices and increased model availability, which has been progressing naturally over time, has not resulted in the assumed sales growth. Rather, the annual sales of EVs in Australia undergo immense fluctuations with frequent phases of varying growth and decline. Table 1 highlights the sales history of EVs in Australia.

Table 1: EV sales history in Australia (VFACTS, 2017)

Model	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**Total**
Audi A3 e-tron	0	0	0	0	0	60	60	**120**
BMW i3	0	0	0	0	33	150	92	**275**
BMW i8	0	0	0	0	3	61	32	**96**
BMW 330e	0	0	0	0	0	3	74	**77**
BMW X5 40e	0	0	0	0	0	2	60	**62**
Holden Volt	0	0	80	101	58	8	0	**247**
Mercedes-Benz C Class 350e	0	0	0	0	0	8	168	**176**

Mercedes-Benz GLE Class 500e	0	0	0	0	0	0	40	**40**
Mercedes-Benz S Class 500e	0	0	0	0	0	2	0	**2**
Mitsubishi i-MiEV	112	30	95	0	0	0	0	**237**
Mitsubishi Outlander PHEV	0	0	0	0	863	753	49	**1665**
Nissan Leaf	0	19	77	188	173	136	42	**635**
Porsche Cayenne S e-hybrid	0	0	0	0	3	58	54	**115**
Porsche Panamera S e-hybrid	0	0	0	1	3	0	0	**4**
Renault Fluence Z.E.	0	0	1	3	0	0	0	**4**
Renault Kangoo Z.E. (Commercial Vehicle)	0	0	0	0	5	0	0	**5**
TESLA Model S (estimated)	0	0	0	0	100	800	1,000	**1,900**
TESLA Roadster (estimated)	0	5	5	0	0	0	0	**10**
Volvo XC90 T8 Twin Engine	0	0	0	0	0	0	72	**72**
Total	**112**	**54**	**258**	**293**	**1241**	**2028**	**1743**	**5729**
Growth		*-51.8%*	*377.8%*	*13.6%*	*323.6%*	*63.4 %*	*- 14.1 %*	

The table highlights an increase of model availability over time but the assumed volume growth across the market is unstable, with periods of immense growth and periods of immense decline, year on year. Generally speaking, however, the data reflects an upwards trend in EV sales, led primarily by an increase in model availability. The predicted growth of EVs in Australia has been covered in the industry literature and publications which will be explored in the next section.

2.2 The Australian electric vehicle industry – industry literature and publications

The industry reportage and publications on the Australian EV industry highlight many complications that are apparent in the current Australian EV market. The key problems, which the majority of publications highlight, relate to both the product and its commercial conditions. From a product perspective, the data highlights that the key problems with EVs in Australia are: 1) the high purchase price of EVs; 2) the limited range of EVs; and 3) long charging times.

From a use case perspective, EVs carry key product differences to ICEVs. Like ICEVs, EVs are limited in range by their onboard fuel source. For ICEVs, this is primarily petrol or diesel stored in a fuel tank, and for EVs it is electricity stored in batteries. The problem arises in how the specific product uses the onboard fuel. ICEVs can get over 500 kilometres of range on a single tank and can be refuelled at amply available fuel stations in a matter of minutes (Energy Supply Association of Australia 2013). In contrast, EVs have far less range at their disposal from a single ‘charge’. The actual range depends heavily on the type of EV, but, in most cases, the range of a typical EV is well below half that of an ICEV (Energy Supply Association of Australia 2015). To further complicate the issue, refuelling an EV takes significantly longer than an ICEV; it's a matter of hours rather than minutes. Considering the implications of reduced range and longer refuelling times upon the consumer, we can easily identify that consumers may be hesitant to adopt this technology. In addition, considering the higher purchase price of an EV that has these product issues, it becomes overtly apparent that an EV is not a suitable alternative to an ICEV for the average consumer.

The industry data also identifies further product-related issues for consumers, such as battery longevity, safety, lack of performance and practicality. All these points are raised throughout the industry reportage (see ABMARC 2012; KPMG 2014; Mader & Bräunl 2012; McKinsey and Company 2016; Simon Kucher and Partners 2016; State Government Victoria 2013). These product-related issues largely stem from consumer perception and preferences. Throughout the industry literature there is an assumption that these particular product features are an issue for consumers because they are different to what the consumer is currently accustomed to with an ICEV. The industry reportage sets out that in order for EVs to become more successful in the marketplace, these product issues must be addressed in order for the consumer to be able to accept the technology. Ultimately, the literature highlights that the goal is for an EV to replicate the product experience and user experience currently evident among ICEVs. That means a more comparable price, comparable range and comparable refuelling/recharging time and associated infrastructure.

Concurrently, the industry reportage raises a variety of commercial issues around: 1) the lack of public charging infrastructure; 2) the lack of public awareness; and 3) the lack of government policy and support (see Climate Works 2017; Energy Supply Association Australia 2013; Energy Supply Association Australia 2015; McKinsey and Company 2016; Mock and Yang, 2014; Simon Kucher and Partners 2016; State

Government Victoria 2013). These concerns further exacerbate the product issues in the marketplace. Since there is a lack of charging infrastructure, the product issues of lack of range and long charging times are further complicated, reducing the appeal of such a product to consumers. Likewise, due to the lack of public awareness, there is little traction in the marketplace among commercial entities, government and consumers to educate the general public on the new technology; there is no communication on new user habits, behaviours or solutions that may circumvent the apparent product-related issues.

Last, the lack of government policy and support in Australia is further reducing any advancement in the appeal and market uptake of EVs. In particular, the lack of financial incentive for EVs and lack of financial penalty on ICEVs results in a disproportionately high price of EVs for consumers, which means EVs remain unjustifiably expensive for consumers. In the face of these issues, it can be observed that the industry literature is quite clear on the fact that in the current scheme of things, EVs are not an appealing product in the Australian marketplace.

However, the industry data does highlight that EVs can play a relevant role in the future of the Australian automotive industry, particularly in the context of Australian emissions targets. The industry data highlights that EVs can be a useful method for reducing the overall emissions intensity of the Australian passenger vehicle fleet, thereby contributing to broader carbon dioxide equivalent (or C02e) emissions reduction initiatives, such as those arising from the Paris Agreement (ClimateWorks 2017). In addition, industry data suggests that transitioning to a higher proportion of EVs in the Australian vehicle fleet provides further environmental, social and economic benefits: reduced smog in urban areas, improved air quality, reduction in respiratory dieses, improved national fuel security, lower cost of ownership for consumers and increased GDP (see AECOM 2011; Dopita & Williamson 2009; Energia 2015).

Therefore, the industry data highlights that, while EVs will play an important role in the future of the Australian transportation sector, there are many obstacles that need to be overcome before EVs will be considered a feasible consumer alternative to an ICEV. However, the industry literature does not carry a theoretical underpinning that proposes how strategic managers can overcome the product barriers in order to meet consumers' demands. Therefore, we must explore the academic literature conducted in the context of the Australian EV industry in order to identify any theoretical contributions that resolve the above issue(s). These theoretical underpinnings will be presented in Chapter 3, where we will explore how strategic management, product innovation and consumer value interrelate in theory. Subsequently, by exploring these academic themes we can search for an answer to these practical concerns or in turn identify the emergence of a theoretical gap where this research could be positioned.

2.3 The Australian electric vehicle industry – academic literature

The academic research into the Australian electric vehicle industry is minimal due to the very limited penetration this technology has had in Australia. The limited Australian scholarly work conducted in the context of the Australian EV industry is generally of a more technical nature (Speidel & Braeunl 2014; Wager et al. 2016) or out of date and based on now-irrelevant EV technology (Byrne & Polonsky 2001). On the one hand, the absence of literature specific to the uptake of EVs in Australia presents a conceptual gap. On the other hand, the absence of literature reflects the greenfield nature of the industry, thus enabling us to trace possible new avenues for technology uptake and develop new theoretical perspectives.

Predominantly, the academic research that does exist in the field of EVs is often emerging internationally and is not specifically applied to Australia. As is the case in the Australian academic literature, the majority of the research conducted into EVs focuses on their technical elements – the technological advancements, complications and recommendations (Hawkins et al. 2013; Xiong et al. 2014) – as opposed to more business-oriented topics such as strategic positioning and marketing viability of EVs.

The existing business-oriented literature is slowly evolving as the focus of EVs begins to increase globally. However, this literature generally lacks depth and approaches the subject matter narrowly by analysing EVs as being technologically equivalent to ICEVs. Due to this assumption, the existing academic research generally focuses on the current state of EVs and highlights their high purchase cost as a barrier to consumer adoption (Crabb & Johnson, 2010; Hodson & Newman 2010; Krieger, Radtke & Takanuki 2013). While this research is not invalid, I contend that it lacks critical depth: it insufficiently analyses why EVs hold this position, and fails to explore the opportunity strategic managers have to leverage this technology, now and into the future. Some literature has been more advanced such as an analysis conducted in the context of how large OEMs have an incentive and opportunity to innovate with electric vehicles as environmental regulations evolve (Wesseling et al. 2015). However, this research focussed on the period of 1990-2011 which in the scope of existing EV technology, is not as relevant in the current era. Further business orientated EV related research of merit includes that of the role of EVs in smart grids (Niesten & Alkenade 2016). This research highlights that EVs have a significant role to play in new value based models in the energy sector, in particular in vehicle to grid services. These models are seen as profitable for the energy industry once EVs evolve into a consumer product of relevance with significant penetration into the market.

As highlighted above and covered in the previous section, there is a broad acknowledgment in the automotive industry that electric vehicles must be incorporated into a future global mobility strategy (KPMG 2014; McKinsey and Company 2016). Hence, we uncover a point of transition for global carmakers. Industry literature acknowledges that, for the long-term outlook of the industry, manufacturers cannot depend on just petrol and diesel vehicles (ABMARC 2012; McKinsey and Company 2016). As such, alternate fuel drivetrains such as electric vehicles must be developed.

This transition is complicated by the high investment cost of developing the innovations behind EV technology. Research by Eisenstein (2008) highlights how the Nissan-Renault alliance was the first group to set out a large investment in a risky strategy to put electric vehicles at the forefront of the car industry in the late 2000s, with a push into environmentally friendly EV technology. The effort consumed billions of dollars in research and development: capital that could have been invested in developing the then-current Nissan and Renault product lines. This left Nissan and Renault having to chase their rivals, who were investing their money elsewhere at the time (Eisenstein 2008). The example demonstrates the competing tensions between looking to necessary innovations while also concurrently maintaining a competitive advantage in the present marketplace.

Therefore, we are presented with an interesting and evidently risky scenario whereby the automotive industry is beginning to transition into mass-produced electric vehicles. The cost of developing and producing EVs is high, especially in comparison to traditional models, since the new technology requires copious resources for product development and innovation. However, it appears that despite this high cost, OEMs are making strategic decisions to invest in this relatively new product. Finally, as OEMs strategically invest in developing the EV product, there has to be a market for it, and associated consumer value in purchasing a product that, thus far, has the problematic limitations of range, long refuelling/charging times and a high purchase price. The competing imperatives of: 1) strategic management for competitive advantage; 2) product innovation; and 3) consumer value frame the current tensions endemic to the EV marketplace. Therefore, we need to turn our attention to these three principles in the literature review in order to better understand how the three principles interact in an underdeveloped market, and to shed light on how, by looking at these three principles synergistically, we can better appreciate the complexity that underpins innovation in the contemporary commercial environment. In doing so, we begin to address the core research questions that frame the present research.

Therefore, we can identify the need to better understand how the three fields of strategic management, product innovation and consumer value work closely in collaboration. A consumer will only buy a product if they can receive a benefit from it and will necessarily consider cost as part of the value equation (Homberg et al. 2015; Zeithaml 1988). EVs require investment in innovation to improve the product so that it is deemed valuable by a larger share of the population, rather than the current finite niche (Gärling & Thøgersen 2001; Kemp et al. 1998; Schot et al. 1994; Weber & Hoogma 1998). In order to execute this, OEMs and their managers must have a comprehensive strategy to deliver the right product to the right consumer segment (Cooper 2000). Subsequently, the literature review in the next chapter will dive deeply into these three strands of literature and establish the relevant conceptual framework underpinning this body of research.

Chapter 3 Literature Review

This chapter analyses the literature relevant to the context of this body of research and the theoretical nuances covered here will cover the fields of strategic management, product innovation and consumer value. Due to the broad nature of the themes of strategic management, product innovation and consumer value, along with the vast depth of literature among these themes, the literature review in this section focuses on the key theoretical aspects that fall under each theme and which thus provide a theoretical framework for the ensuing study.

This chapter has been structured as follows: Section 3.1 focuses on strategic management, primarily on how business can create and maintain a competitive advantage; and explores how business can leverage alliances to further increase such a competitive advantage. At the same time, the conceptual framework will review the implications of zero-sum competition and positive-sum competition. Section 3.2 on product innovation will evaluate the theoretical implications of radical and continuous innovation and describe how product innovation can be leveraged to create consumer value. This section will also evaluate how inter-group dynamics can act as a catalyst for innovation. Section 3.3 on consumer value will begin with a review of how consumers perceive value, examining the role of product positioning and consumer value perception. Finally, the section concludes by reviewing the relationships between product innovation and value creation. Table 2 provides an overview of the various conceptual frames forming from each strand of literature.

Table 2: Conceptual frame overview

Strand of Literature	**Conceptual frame**
Strategic Management	• Competitive advantage • Zero-sum and positive-sum competition • Strategic alliances and partnerships
Product Innovation	• Radical and continuous innovation • Inter-group dynamics; a catalyst for innovation • Creating new consumer value
Consumer Value	• Consumer perception of value • Product positioning and consumer value perception • Product innovation and value creation

Sections 3.1 through to 3.3 will review the literature and highlight that while the academic literature is extensive across the fields of strategic management, product innovation and consumer value, there is a clear gap in the literature in understanding the relationship between these three fields and how they overlap. Section 3.4 closes the chapter by uncovering the problem at hand and contextualises the gap in the literature, particularly in the context of new technology and the Australian electric vehicle industry. The problem that will be identified is that there is no clear alignment in the scholarly relationship between strategic management, product innovation and consumer value. This in turn will serve as the gap in our knowledge: that is, a lack of theoretical contribution and understanding of how these three themes work in unison, and the subsequent implications on businesses and their consumers.

3.1 Strategic Management

We begin this research by looking into some of the academic work conducted in the field of strategic management and the role it plays in influencing the way organisations operate (Barney 2002; Joshi, Kathuria & Porth 2003; Porter 1979). Porter (1991) defined strategic management as “making choices about how you position your company in its competitive environment” (p. 90). Strategic management is a discipline that has attracted much scholarly attention and constitutes a fundamental challenge for practitioners (Barney 2002; Joshi, Kathuria & Porth 2003). Porter’s (1979) publication in the *Harvard Business Review*, titled ‘How Competitive Forces Shape Strategy’, gave rise to a predominant way of understanding corporate strategy. Porter (1980) later defined and explained his model of three generic strategies: differentiation, cost leadership and focus (Miller & Dess 1993; Miller & Friesen 1996). Thirty-seven years on, Porter’s theories on strategic management and competition remain at the forefront of academic research (Dess & Davis 1984; Gurău 2007; Hamrick 1983; Nicovich, Dibrell & Davis 2007) and provide the foundation for much of the ensuing discussion presented here.

This study aims to establish the strategic management pillar of its theoretical framework using three specific principles that are heavily influenced by Porter (1979, 1980, 1981, 1985 and 1991): 1) competitive advantage; 2) zero-sum and positive-sum competition; 3) strategic alliances and partnerships. These three principles have specific relevance to the Australian EV industry which, as identified earlier, has many competing firms aiming to achieve a competitive advantage. The automotive industry is also a broad operating example of an industry where the practice of positive-sum competition can drive success for multiple firms concurrently (Schulze et al. 2015). In addition, a significant portion of OEMs operate as part of either an alliance or a partnership. It is for the above reasons that these three principles form the focus of the strategic management portion of the theoretical framework.

3.1.1 Competitive advantage

The concept of competitive advantage is fundamental to strategic management, since it drives core decisions regarding price, position, product and innovation strategies (Block et al. 2015; Carpenter 1999; Hoffman 2000; Jurksiene & Pundziene 2016; Miller 1988; Peters 1987; Porter 1980). In the instance of the EV market, tracing competitive advantage is central to our evaluation of how innovation and consumer value become defined. It is therefore essential that we visit the concept here.

In order to map the potential for competitive advantage creation, research into corporate strategy (Levitt 1969; Bagozzi 1974; Pepper & Rogers, 1993; Porter 1991) emphasises the need to analyse the industry structure and assess how the industry will evolve over time. The analysis of the external environment, in turn, drives the managerial evaluation of the industry's attractiveness. Equally, it is important to evaluate the company's relative position in order to establish and defend the right position in that market. An organisation's position in the market can be determined as the 'right position' relative to their chosen strategy (Nickerson, Hamilton & Wada 2001; Porter 1980). For instance, in the automotive industry, the right position for a company pursuing a low-cost strategy while maintaining an adequate standard (as General Motors and Toyota do) would be in the mass market. At the same time, the right position can rely on the right niche; in this circumstance, building a high-quality, high-priced limousine (such as a Rolls-Royce) can also be very profitable, despite the lack of sales volume and market size compared to the mass-market segment. Similarly, it is worth considering that organisations operating in underperforming industries can still achieve high profits and success by operating in the right market niche (Porter 1991).

Few organisations work within an industry without competition. Porter (1979) outlines that competition is not due to chance or bad luck (Grigore 2014). Rather, competition can be mapped through five forces (Dobbs 2014; Porter 1979): rivalry; bargaining power of suppliers; bargaining power of buyers; the threat of new entrants; or the threat of substitute products. In particular, Porter raises the importance of rivalry within an industry. Competition can be gentlemanly and subdued or warlike and vicious (Porter 1991). By balancing competition, and finding a competitive position in an industry, a business can create a competitive advantage.

Fundamentally, there are two ways to create competitive advantage: lowering costs without comprising quality to increase margins; and differentiating products to create a unique product for which a customer is willing to pay a premium (Porter 1991). Porter (1991) cautions that firms which attempt to pursue both strategies of cost leadership and product differentiation will become 'stuck in the middle' between demand and cost parameters. Even though Porter (1991) considers the two strategies of cost reduction and differentiation to be basically incompatible, several empirical and analytical studies indicate that the presumed trade-off may not be as strong as suggested, and that a firm's advantage is rarely based entirely on cost or differentiation (Brandenburger & Nalebuff 1996; Chaston & Mangles 2002; Coyne & Subramaniam 1996; Rosenkranz & Weitzel 2007; Renko et al. 2011). In reference to the automotive industry, we have recently seen Tesla disrupt the niche market that is 'the large performance sedan market' with a strategy of differentiation, while also maintaining cost leadership in this segment (Dyer et al. 2015). The strategies that Tesla implemented proved to overcome the rigid barriers of entry into one of the most established global industries, the automotive industry:

> The automobile industry's high costs of entry, economies of scale, and network effects from distribution, fuelling, and service lead many to conclude that new entrants have no chance. Tesla Motors has overcome many barriers to pioneer electric cars. Starting with partnerships and a minimum viable product, Tesla is working to innovate and scale up. Tesla now produces a top-selling luxury car and has a market capitalization twice that of Fiat Chrysler and half that of General Motors or Ford. Tesla has shown that a startup can enter and disrupt the status quo in one of the most established industries. (Stringham et al. 2015, p. 85)

The case of Tesla highlights the relevance of this study's theoretical frame to its subject matter. We are already observing how disruptive technology and its subsequent product innovations are challenging conventional business model theory. Therefore, an understanding of competitive advantage in the EV sector is crucial to this body of research.

Porter (1991) raises a final critical concept – of competitive scope – in the context of trying to build a competitive advantage. Competitive scope is where a business must determine whether to operate on a broad scope, to serve more or less all types of customers in an industry, or to focus on a narrow scope by concentrating on a smaller group of customers and tailoring the business to a specific niche (Porter 1991). Reflecting back to the Tesla example above (Stringham et al. 2015), we can observe how Tesla pioneered a segment with an elementary narrow scope. In the context of this research, it is important to consider scope when trying either to position EVs as a narrow-scope niche product, or to reflect the industry ambition (ClimateWorks 2017; McKinsey and Company 2016) that EVs should become a broad-scope, mass-market product.

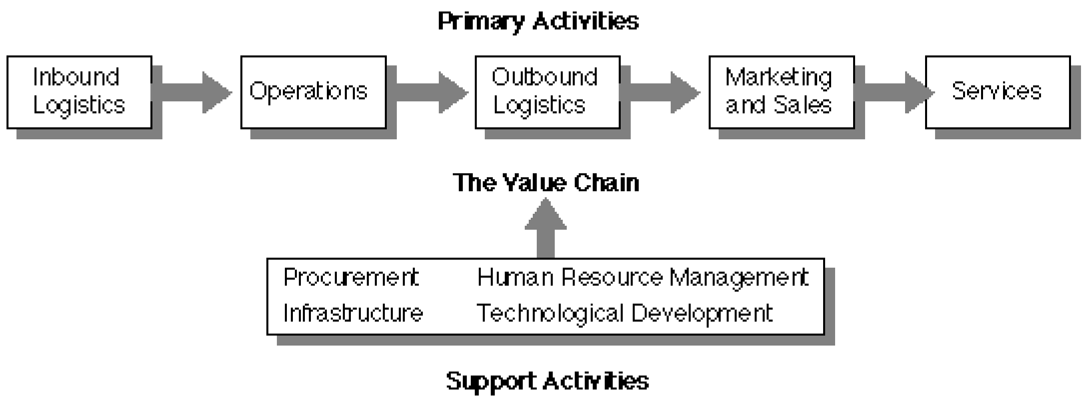
Corporate strategy therefore becomes relevant in the theoretical frame, as different OEMs with different scopes need to establish their individual strategic approaches to EVs. The type of corporate strategy a firm adopts – including how a firm creates and maintains a competitive advantage – is often defined by the industry it operates in; likewise, the history of that industry further indicates strategies that have proven successful and those that have failed (Baba 1989). As a result, we see that many organisations operating in the automotive industry look at their competitors and the history of the industry to determine how to best shape their own strategies for success (Caiazza & Nueno 2014). Corporate strategy is fundamentally driven by profit potential; yet it is in understanding the practical application of ‘profit’ that strategic management is often flawed into pursuing only short term profit targets. Rather than being lulled by the safety of equilibrium, management must remain alert to the faint signals that foreshadow the opening of new windows of opportunity (Anderson 1999; Hench 1997). Corporate strategy must remain rigid enough not to be compromised by unpredictable market conditions with minor implications, yet fluid enough to make strategic adaptations when encountering larger implications (Aaker & Mascarenas 1984). Instead of anticipating short-term payoffs, management must be patient and consider that the success of strategy is measured not in quarters but in decades. For those willing to embrace this approach to strategic management, the long-term rewards can be substantial (Chilles & Meyer 2001; Stacey 1996).

It is important to reflect on the role a sound corporate strategy plays in the automotive industry. Establishing short-term payoffs can be achieved rather easily by focusing on selling ‘today’s technology’ and neglecting the investment in future innovations. The savings achieved by not investing in new product development will, in turn, reap short-term success. However, this strategy will almost certainly compromise the future prospects of the firm through lack of innovation, and ultimately result in its falling behind its competitors. If an organisation can implement an effective innovation strategy, it has made the first step towards becoming successful in the long term (Kandemir & Acur 2012).

Ultimately, it is imperative for all firms, regardless of industry, to recognise their place in the market and identify how they aim to deliver a competitive advantage in that specific market (Chilles & Meyer 2001; Porter 1991). In the context of the Australian electric vehicle market, we can hypothesise that due to the higher purchase price of these vehicles, a strategy around cost differentiation will not be successful, let alone plausible (Brandenburger & Nalebuff 1996; Coyne & Subramaniam 1996; Rosenkranz & Weitzel 2007). As such, firms aiming to operate in this market segment must develop their corporate strategy around driving a competitive advantage not specifically related to cost. It is for these reasons that competitive advantage can be identified as a specifically important contribution to the strategic management pillar of this research’s theoretical framework.

Finally, in the context of reviewing the literature around building a competitive advantage, we need to extend the theoretical framework to identify a primary method by which firms build value in order to execute their corporate strategy. Therefore, we introduce the value chain (Porter 1985) as a longstanding academic theory which has been heavily critiqued in academic literature, resulting in the formulation of interpretations that are largely similar yet have small differences (Lampikoski et al. 2014; Madill et al. 2004; Porter 1985; Ryans et al. 2000). Primarily, the value chain theory argues that firms, through their various functions, add value to products along a linear chain. Porter (1985) theorises that the value chain is constructed of five primary activities: inbound logistics, operations, outbound logistics, marketing and sales, and service. Each primary activity is also complemented by a selection of support activities that enable the primary activities to operate at optimum efficiency and effectiveness. These are activities such as procurement, human resource management, infrastructure and technological development. Figure 2 illustrates the value chain as presented by Porter (1985).

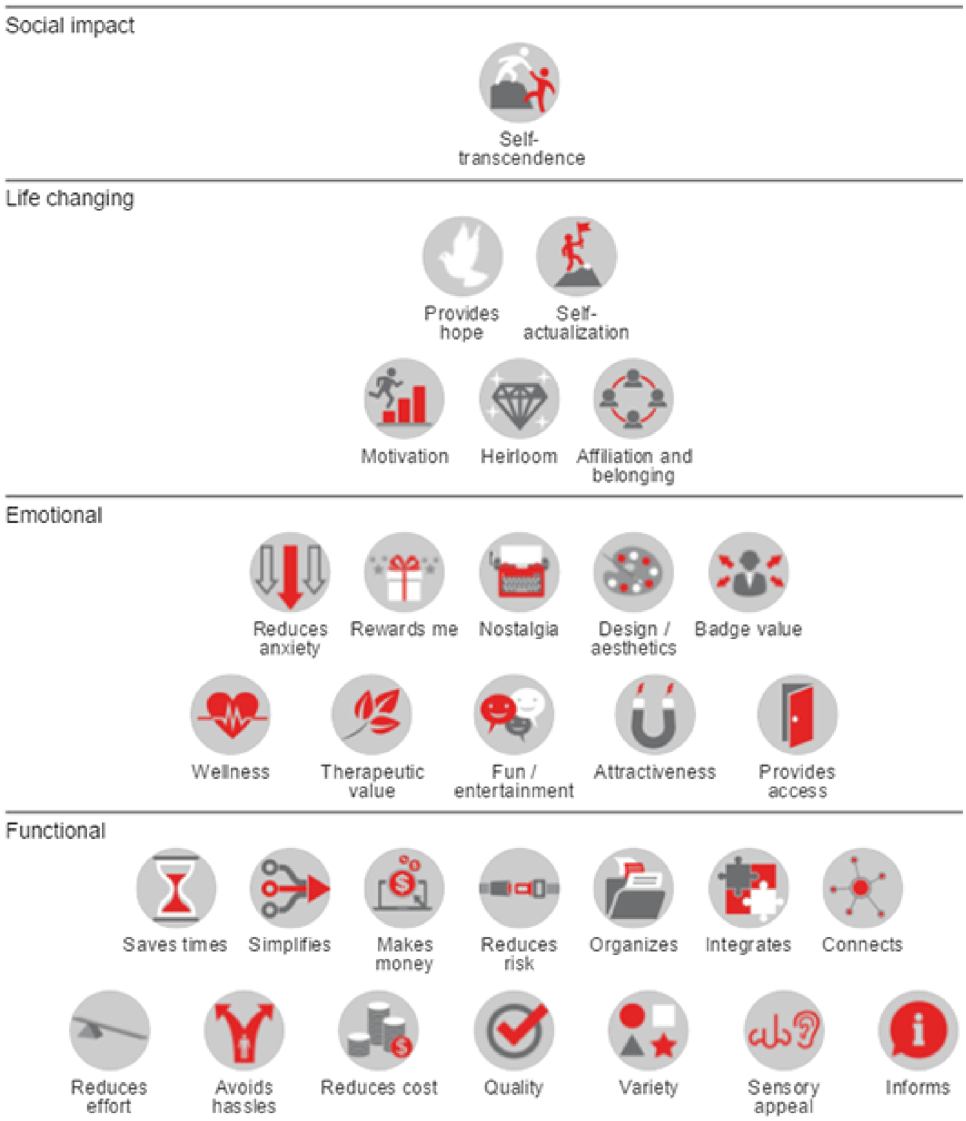
Figure 2: Value Chain (Porter 1985)



While the value chain showcases one common approach for firms to create value, different theoretical approaches have evolved to refine how firms can better create value in their products in order to complement a competitive advantage. One example is the Bain Value Pyramid (Almquist et al. 2016), which is predicated on a more consumer-oriented approach to defining value; it allows strategic managers to reverse-engineer consumers' value interpretations back into their own products. The ambition of this approach is to ensure strategic managers take a more consumer-centric approach in evaluating how to best establish a competitive advantage.

The value pyramid arranges the different elements of value in a hierarchy. The foundation of the pyramid is constructed with functional values that managers can largely quantify easily. However, as the elements rise up the pyramid beyond the functional values, they become more complex to define and integrate into various products. These elements in ascending order are emotional, life changing and social impact. Figure 3 shows the Bain Value Pyramid (Almquist et al. 2016).

Figure 3: Bain Value Pyramid (Almquist et al. 2016)



This initial section of the literature review has begun to establish the fundamental importance of firms finding a competitive advantage within the market in which they compete. The literature identifies that establishing a competitive advantage is a critical component of the overall roles and responsibilities of strategic managers. Further, the literature has highlighted relevant theories – such as the value chain (Porter 1985) and value pyramid (Almquist et al. 2016) – that propose how to achieve a competitive advantage in a firm's products. Therefore, we can begin to construct a theoretical framework which outlines the core relevance of particular elements of strategic management in the context of this research.

3.1.2 Zero-sum and positive-sum competition

We have now identified that the general concept of competitive advantage is a key pillar of the theoretical frame of this research. However, it is also important to dive deeper into the different methods of strategically building a competitive advantage in a marketplace. Because the automotive industry features many different firms competing alongside one another successfully for many years, theories of market competition become highly relevant to this study's theoretical framework. In particular we will focus on identifying the relevance of zero-sum and positive-sum competition, and the differences between them.

Porter and Tiesberg (2004) provide a clinical demonstration of zero-sum and positive-sum competition in a case study focusing on the American healthcare sector, highlighting the role of 'healthy competition'. They found that this particular industry is 'unhealthy' because it operates in a manner where competitors compete on the same level with similar products; competition is primarily driven by price. Porter and Teisberg (2004) describe this form of competition as ‘zero-sum’ in that it restricts consumers’ choice and access to alternative health services. Many industries operate in a similar manner, keeping faith with this dated concept of price-driven competition. These older forms of competition largely revolve around providing the same service as a competitor but at a lower price point (Zhang & Dongsheng 2010). Traditionally, this adjustment in an identical product’s purchase price forces competitors to reduce their prices to remain competitive (Bertini 2014). In turn, this leads to price wars in which the only change in the market is the purchase price; the product is never improved (van Heerde, Gijsbrechts & Pauwels 2008).

Zero-sum competition involves the pursuit of greater bargaining power rather than efforts to provide better value. Businesses try to negotiate better deals with suppliers or customers to increase their profit by either increasing sales or reducing costs; the quality and efficiency gains from these consolidations are, in reality, quite modest (Porter & Teisberg 2004).

By contrast, Porter and Teisberg (2004) show that other industries utilise competition in a ‘healthy’ manner: organisations competing in that industry are allowed to relentlessly improve processes and business methods to help drive down costs. Concomitantly, product and service quality rise steadily and innovation leads to new and better approaches that diffuse widely and rapidly (Balakrishnan & Pathak 2014; Efimova, Kuznetsova & Ramanauskas 2014; Porter & Teisberg 2004). Conversely, uncompetitive organisations and providers are restructured or go out of business. Value-adjusted prices fall and the market subsequently expands. This form of ‘healthy competition’, where the market evolves as a whole and the consumer makes considerable gains in value, is common to many well-functioning industries such as

IT, banking and, indeed, automotive. Porter and Teisberg (2004) define such healthy competition in an industry as ‘positive-sum competition’.

Porter and Teisberg (2004) apply their concept of positive-sum over zero-sum competition to encourage a change in the philosophy of competition in the American healthcare sector. They observe that instead of making care better and more efficient for customers, different healthcare products all offered the same range of services with the competitive cusp only determined by price; certain products and services appealed to certain customer segments more than others.

This theme is common in a raft of industries, including the automotive industry. As outlined earlier, the automotive industry is divided into many different segments. Each segment delivers an alternative product at widely varying price points. That is because each product carries a value that is perceived differently depending on the customer. Customers are willing to accept a higher purchase price if a product serves a better purpose and holds a higher degree of value (Brough & Chernev 2012; Chen et al. 2012; Teltis & Gaeth 1990).

OEMs employ differentiation strategies in order to create value by focusing on areas that some consumers value more highly than others, such as design, reliability, efficiency, performance, spaceand so on (Guerzoni 2013). Each of these elements can be leveraged to create value, and some customer segments will value some products at a higher price than others. This is why some OEMs produce two-seater performance cars (such as Ferrari or Aston Martin) at a cost of around AUD $500,000 and other OEMs produce two-seater micro cars (such as Smart) at a cost of around AUD $20,000. Essentially, both serve the same purpose (to transport two people from point to point) but certain customer segments value paying 25 times more for a car as it delivers more value on elements around performance and design. Following Porter and Teisberg's (2004) perspective, the automotive industry incorporates positive-sum competition whereby considerable segments of the market are willing to engage in a transaction based on factors more important than price. Subsequently, positive-sum competition evidently becomes a critical element of our theoretical framework, and the theory must be explored further below.

In any industry, competition should drive up value for customers over time as quality improves and costs fall (Zeithaml 1988). Porter and Teisberg (2004) found that in order for improvements to be made in the American healthcare system, the principles of positive-sum competition had to be implemented and zero-sum competition tendencies eradicated. For that process to begin, however, the focus of competition had to shift from "who pays?" to "who provides the best value?" This reorientation requires changes in the strategies of providers and payers, as well as in the behaviours of employers purchasing health plans. The end result of implementing positive-sum competition over zero-sum competition is that multiple rivals can be successful in one industry (Harrigan 1993). Strategic development must form around the principle that rivals can successfully compete in parallel, rather than fearing the competition; organisations must establish their strategy to best serve their target customers (Branson 2014). As such, strategy must be open and well communicated internally to suppliers, investors and affiliates without fear of competitors knowing the strategy (Cole 2001; Kaplan & Norton 2008; Kernbach, Eppler & Bresciani 2015). If rivals do uncover competitors' strategies, they can compete on another level rather than being dragged into a price war on the same product (Porter & Teisberg 2004). If we reflect on this in the context of the Australian automotive market, we see that many OEMs compete in the industry with over 50 different brands competing in the industry (VFACTS 2016).

As we have established, the industry is split into many different segments, and customers find different value in each product and segment. However, some brands do compete for the same customer segments. Mercedes-Benz, BMW, Audi, Lexus and Jaguar all compete among the premium market and all hold a strategy that is positive-sum but also well communicated. In the Australian context, BMW holds a clear and well-communicated strategy that it is striving towards being number one in sales, but that it will not compromise profitability to achieve that position and reiterates a strategy focused on sustainable growth (Nicholson 2015). By comparison, Lexus maintains a position that it will not be drawn into lowering its prices in a quest to achieve significant volume gains; rather, it focuses on maintaining its position as a premium brand that is highly valued and not discounted (Nicholson 2014). Audi, on the other hand, communicates that it focuses on its brand and customers (Nicholson 2017).

Analysing the premium car market in a global economic context, Klein (1991) explored the role of positive-sum games in economic growth. He found that competitiveness in international markets depended on the relative rate of improvement in a country's market basket of goods. The goods were measured in terms of improved product quality and a reduction in relative prices. In this way, Klein (1991) draws a comparison between the Japanese luxury car market and the German car market. Japanese manufacturers were able to supply a similar grade of product but benefited from the lower costs associated with producing the cars in Japan. The research suggests that, in international competition, the prices of luxury cars produced in Japan declined relative to the prices of similar products manufactured in Germany. This indicates that firms in Japan obtained an advantage by exploiting the previously undisclosed opportunities associated with production (Klein 1991; Schirmer 1996).

At the centre of positive-sum competition lies the ability for firms to innovate and find new value for their products. When a firm takes a significant technological risk to develop a product in order to improve its competitive position, success would impose a competitive risk for rivals. As a consequence, when a firm innovates successfully, it will benefit from a ‘negative tax’ in the form of increased profits and sales, while its rivals will have to pay a ‘positive tax’ in the form of reduced profits and sales (Klein 1991). As a result, firms have an incentive to innovate to escape a tax that might be imposed by one of their industry rivals. At the same time, the difference between winning big and losing big is large, and firms must engage in a certain risk when trying to apply the principles of positive-sum competition (Peart 2006). Assessing risk is imperative because the more ambitious the innovation, the more risk and uncertainty will be involved (Bjelke 2011; Klein 1991).

While the theory of positive-sum competition relies on the premise that firms operate with different product quality and price strategies, firms must be able to compete on both price and quality dimensions simultaneously in order to survive. A firm that competes in only one or the other dimension can be successfully challenged by a rival that performs as well along one trajectory but better along the other (Cheng & Peng 2014; Chioveanu 2012). As such, firms must take their competitors into active consideration in order to maintain their competitive advantage and to survive. Technically speaking, the presence of positive-sum competition can be identified in any industry where total output grows more rapidly than the sum of the weighted capital and labour inputs (Ishii 2014). Likewise, zero-sum competition can be identified when the outputs can be precisely accounted for in terms of inputs (Klein 1991). However, many industries involved in zero-sum competition receive windfall benefits in the form of technological advances brought about in other industries, which show up in the form of highly irregular productivity rates and are not accompanied by declines in relative prices (Grifell-Tatjé & Lovell 2014). By contrast, in positive-sum competition, industry productivity gains occur at remarkably steady rates (Klein 1991).

Competition and industry developments can enhance the progress of technological innovation and these innovations can often be a catalyst for a strategic change, creating new ways for businesses to operate and using new business models. As previously discussed, Porter (1991) suggests that firms have the option to create a competitive position by either reducing costs or differentiating their product. The strategic avenue a firm chooses to adopt often depends on the firm's initial market share. Historically, larger firms favour an approach to invest less in product and more in process innovation, whereby smaller firms focus on product innovation as the basis for advantage (Yin & Zuscovitch 1998).

Research conducted by Rosenkrantz and Weitzel (2007) on the strategic positioning of alliances shows that the larger the market potential, the more each firm that operates in that alliance increases its optimal total investment. Their model suggests that firms should optimally invest more in product differentiation than in cost reduction measures at the early stages of a technological lifecycle. Conversely, if market potential stagnates or decreases in later stages of the technological lifecycle, the model shows that investment in process improvement and cost reduction should be the most important strategy for alliances and competing firms alike (Rosenkranz & Weitzel 2007).

Smaller – and, typically, emerging – firms exhibit rapid and significant shifts in strategic priorities in the wake of a revolutionary technological advance.

Fundamentally, technological innovation requires a variation of new skills and new bases of competence (Lindegaard 2010). The very high importance initially associated with technical activities in the typical startup firm gives way to business priorities as the focus of innovation shifts towards commercialisation (Hamilton, Vilà & Dibner 1990).

We can link this theory especially to Tesla and how its innovations in the EV segment of the automotive industry have transpired. Initially, the company had a high technical focus to successfully innovate a technology and to develop a product (the Tesla Roadster) capable of competing in the established automotive industry. Once this was achieved, and the product was 'ready', the focus shifted from technical development to developing a sales and marketing strategy to bring the car to market (Stringham et al. 2015). A manufacturing process needed to be developed; supply chains and sales networks had to be established; the fundamental business priority moved from product development to establishing a business capable of manufacturing and selling a vehicle. After the launch of the Roadster, Tesla moved to establish itself as more than a startup. It designed an EV from the ground up with the Tesla Model S to compete among established conventional OEMs such as Audi, BMW and Mercedes-Benz (Stringham et al. 2015).

As the company grew, business priorities moved away from almost exclusively having an innovation focus on developing technology, and began to focus more on strategic commercialisation – increasing production volume (Hardman et al. 2015). Innovation remains at the core of Tesla's strategy, but we can observe that the company's business priorities have shifted significantly as it moves from a hopeful startup to an established competitor in the global automotive industry (Hardman et al. 2015).

The basis of Tesla's success was its business strategy, which strongly reflected the principles of positive-sum competition (Porter & Teisberg 2004). Tesla did something different and created a new market, which added new value to the industry. This foundation highlights the opportunity for other OEMs in the automotive industry to react and push towards bringing similarly innovative products to market. These new products create a competitive advantage for firms, which are largely positive-sum and ultimately create new value for consumers. Thus, we can see that in the context of this research, positive-sum competition is a significant concept to include in the theoretical framework.

3.1.3 Strategic alliances and partnerships

Strategic alliances and partnerships are a widespread commercial construct in the automotive industry. For this reason, it is important to explore the theoretical strengths and weaknesses of such constructs when establishing a theoretical framework specific to this body of research.

The concept of a strategic group has long been established as an integral part of the dynamics and structure of an industry (Rosenfeld 1997; Wonglimpiyarat 2006). The core competencies of strategic groups have been theorised from two perspectives: the industrial economic perspective (Newman 1973, 1978; Porter 1973, 1979) and the strategic management perspective (Hatten 1974; Hatten & Schendel 1977; Schendel & Patton 1978). Essentially, there have been two largely accepted definitions of a strategic group: "a group of firms in an industry following the same or similar strategy along the strategic dimensions" (Porter 1980) and "a set of firms competing within an industry on the basis of similar combinations of scope and resource commitments" (Cool & Schendel 1987). A strategic alliance has a strong link to corporate strategy, since the underlying premise of the above definitions is that companies need to have a clear perspective on how they might achieve a competitive advantage by being part of an alliance. In the automotive industry, a large majority of brands operate either as part of a strategic alliance or have been acquired as part of a group; for instance, the Volkswagen Group comprises Volkswagen, Audi, Skoda, Bentley, and other marques (Agnihotri 2013).

There are many reasons why organisations elect to operate under an alliance or strategic partnership. Some alliances are established to reduce transaction costs (Parkhe 1998) or to adapt strategic behaviour (da Rocha & Arkader 2000). The implied intent is to improve the performance of the participating firms with the benefits of greater efficiency and subsequently to build a stronger competitive position. For instance, this can be achieved by accessing a partner's resource in order to add value to an individual business without having to invest additionally for a specific resource (Wolff & Reed 2000). At the same time, operating as part of an alliance provides inherent benefits such as knowledge transfer and acquisition (Mowery, Oxley & Silverman 1996). Lundvall (1999) argues that knowledge is the most fundamental resource in the modern economy. By operating in an alliance, each firm can transfer knowledge on a range of strategic issues such as human resources, product development, innovation business process and corporate social responsibility (Powell, Koput & Smith-Doerr 1996; Simonin 1999). A clear example of knowledge transfer in the context of the EV industry is Daimler AG and Tesla's partnership. The partnership was predicated on Tesla transferring battery technology knowledge and

Daimler transferring assembly operational knowledge for the mutual benefit of both firms (Palmeri & Carey 2009; Schaefer 2014).

Strategic alliances need to focus on individual groups within an industry rather than an industry in its entirety (Amel & Rhoades 1988; Demsetz 1973). For instance, research conducted within the context of the banking sector found that collusion among all firms in an industry is unlikely, but that it will occur among groups of similar firms (Amel & Rhoades 1988). That said, operating in the context of a strategic group should not threaten firms' strategic positioning within an industry and their overall competitive advantage (Nickerson, Hamilton & Wada 2001). As such, any firm operating as part of a strategic group must not be prevented from reacting to the moves of competitors who operate within the same industry, be it operating individually or within a separate strategic group (Agnihotri 2013).

Firms within a strategic group operate on the premise of a perceived advantage in the marketplace – and the advantages can be significant. Inter-firm information and resource exchange can be easily achieved through the dense networks of professional, social and business relationships (Kim 2015): the higher abundance of skilled workers allows an increased level of specialisation to be shared as a common resource between the group; asset sharing reduces fixed costs; and finally, higher levels of innovation can be achieved as a consequence of firms pushing each other to continuously upgrade their capabilities and improve their products and services (Chilles & Meyer, 2001).

A key desired byproduct of a strategic group is the element of innovation (Lopez et al. 2009). More often than not, the hints that lead to new innovations, along with insights that catalyse the possibility of new competitive opportunities, result from chance conversations (Chilles & Meyer 2001). The benefit derived from strategic groups is synergy: a co-operative action in which the total effect is greater than the sum of the effects considered independently. Hence, synergistic behaviours within a strategic group play an all-important role in the generation of innovations (Klein 1991).

In the automotive industry, alliances are formed predominantly to contain development costs and utilise synergies in the manufacturing process by selecting a uniform supplier for largely identical components; there is a primary focus on finding a firm that can supply that component most cheaply for all participants in that particular group (Sadoi 2008). However, as participation in alliances often stretches between several brands, which occupy slightly different market segments, decisions may be based beyond an exclusive cost equation; they may focus on quality and supply chains (Forman 2014; Takeishi 2001) along with the ability to reduce competitive pressure (Burgers et al. 1993). Therefore, operating as part of an alliance allows firms to develop their initial traditional thinking to incorporate previously foreign concepts and perspectives from other firms.

Although the generation of new ideas may not be at the forefront when considering implementing a strategic alliance, innovation can be a powerful result of a successful strategic group (Wuyts et al. 2004; van Aduard de Macedo-Soares et al. 2016). Some firms may not have the capacity to bring in-house innovations to market. However, with the resource commitment of a strategic group, some innovations may be more successful than they might otherwise have been using the limited resources of a firm operating independently.

Often, innovations come from entrepreneurs who have traditionally operated in isolation and secrecy to improve the competitive advantage of their firm (Bygrave 1989). Van de Ven (1993) argues that the type of entrepreneurship required for the emergence of an innovation that drastically disrupts and/or creates a new industry is not the traditional form that emphasises the isolated behaviours of individual entrepreneurs. Rather, the creation of new industries requires a holistic, interactive, complex systems approach to entrepreneurship, which Van de Ven describes as a "macroperspective of entrepreneurship" (1993). Central to this perspective is the recognition that entrepreneurship is the collective achievement of numerous entrepreneurs in public, private, and not-for-profit sectors (Van de Ven 1993). As seen in the automotive industry, small firms external to the automotive industry often come up with innovations that can aid the automotive product. One such scenario is the development of new lightweight, high-strength materials such as carbon fibre, which was innovated outside of the automotive industry. However, carbon fibre is increasingly becoming a key material used in the automotive industry to reduce the weight of vehicles. This highlights that OEMs should include firms from other industries when it comes to facilitating innovation. It also further validates the inclusion of strategic alliances as part of this research's theoretical framework.

Although strategic alliances are often formed within an industry, and between firms of similar scope (Garcia-Pont & Nohria 2002), strategic alliances formed outside an industry are also prevalent and carry an inherent benefit. As defined by Porter (1990), strategic alliances that are established externally to an industry (that is, between organisations from different industries) are comprised of many related, supporting organisations of different purposes – for instance, universities, not-for-profit organisations, governments, and large, medium and small enterprises – which, when operating towards a collaborative mission, represent an important source of competitive advantage for all the participating firms. Firms operating in such alliances may draw on established networks of specialists that are decentralised, flexible, fast, and focused. The strategic feedback from these specialists allows the firms to connect the different industries within the alliance with the end product. resulting in:

> [m]utually interdependent growth and demand; reciprocal innovation and upgrading of resources; multidirectional flows of information; and mutually beneficial collaboration and joint problem solving. (Chilles & Meyer 2001, p. 78)

When organisations operate in affiliation with others outside of their industry, learning processes appear to play a central role in creating a capability for combining and reassembling knowledge to generate high rates of technological and product innovation (Lawson & Lorenz 1999). Organisations can take gains either from external industries and organisations that operate on a relatively symmetrical and similar scale (Midlarsky 1983); or from uniformly different organisations that operate on a rather different asymmetrical scale (Wen 2013). In the context of the automotive industry, the scale of a strategic partner is largely irrelevant. Rather, the key is determining the particular benefit each party gains from each specific external alliance, and how the opposing firms' resources and knowledge translate to creating a competitive advantage for each other.

Firms that work closely with technology, such as in the development of new-generation automobiles, can benefit from incorporating cross-industry alliances. As presented by Ryans et al (2000), technology-centric businesses like the automotive industry have less vertical integration than more mature and less technologically focused businesses. This often results in long market chains in technology-intensive industries, with different organisations playing key roles in creating and delivering the products and services utilised by the end consumer (Ryans et al. 2000). For this reason, successful competitors in technology-intensive industries are often companies that are very effective at developing relationships and alliances – both internally and externally of an industry – to achieve their desired success (Madill, Haines & Riding 2004).

We see this at OEMs that work closely with other industries to develop new technologies. As the automotive industry tries to incorporate more technology into the car, OEMs must work with a range of external industries to develop technology to make cars safer, more efficient and more connected. These outside partners can include high-tech engineering firms that supply the latest sensor technology to further driver assistance systems (Tran 2016; Warburton 2016), new-age component suppliers that help make cars more efficient (Wright 2001), right through to communications firms such as Google, Apple and Samsung to develop the connected cars of the future (Gomes 2016; Leggett 2015; Vijayan 2016).

When analysing an industry, and its suitability for forming a strategic group, we need to identify the differences in each organisation's strategy. Within the overall structure of an industry, some firms are solitary firms, which are strategically unique; some are secondary firms, which are loosely aligned with a multi-firm group; and others are core firms, which are tightly aligned with a multi-firm group (McNamara, Deephouse & Luce 2003; Reger & Huff 1993). Some firms need to maintain a balance on the 'competitive cusp' between differentiation and conformity within a strategic group (Deephouse 1999). From here, we can see that secondary firms will perform better when operating as a part of a strategic group than core or solitary firms. This is because secondary firms can align to common strategic positions within a group, while still maintaining the autonomy to be strategically independent and to differentiate themselves from other members of a strategic group in order to maintain their 'competitive cusp' (McNamara, Deephouse & Luce 2003).

There are inherent benefits for firms working in collaboration, such as the reduction of transaction costs while developing organisational learning (Calantone, Cavusgil & Yushan 2002; March 1991). The intent of the collaboration is to improve the performance of both firms by increasing efficiency, improving competitive positioning and/or accessing the specialised resources of the opposing firm. In turn, there is a very real risk for firms operating in collaboration that the opposing firm can easily acquire their resources for its own future benefit (Krause 2014). In the absence of an alliance, a firm's resources remain protected by barriers to imitation; obviously, the corollary to this point is that an alliance can be a way for firms to lose resources that would otherwise remain hidden (Wolff & Reed 2000).

Therefore, before engaging in a strategic alliance, firms must diligently assess the associated risks of aligning with another firm (Parkhe 1993). For example, do the benefits of an alliance outweigh the risk of exposing hidden resources and intellectual property? In the context of the automotive industry, firms explore the risks of collaboration in detail (Howell & Hsu 2002). Taking the (recently dissolved) Volkswagen-Suzuki alliance as an example, from Suzuki's perspective the goal of the partnership was to acquire an in-depth knowledge of diesel engine development. Concurrently, the partnership would open channels for Volkswagen into key potential markets where Suzuki was readily established, such as the Indian market; and Volkswagen would also take up a 20 per cent stake in Suzuki (Greimel 2015). The risk assessment for each organisation should have been to weigh the benefits and risks of the partnership's strategic, financial and intellectual property facets. However, both parties failed to adequately assess the risk and so the partnership ended abruptly after just a short period of time, serving no lasting benefit to either party (Kubota 2015). This further emphasises the importance of partnerships in forming a theoretical framework for this study, since the formation of partnerships is complex and saturated with risk.

Due to the continually developing rapidity of innovation and change, identifying the capacity of a strategic group – either prospective or existing – becomes critical (Norman 2004; Rolland & Chauvel 2000). Harrigan (1985) outlines strategic group mapping as:

> a useful way of tracking industry dynamics as firms become more similar to or different from each other. The matching of market segment changes with strategic group evolutions provides a useful means of predicting the nature of competition. Such analysis investigates the strategy and operating differences among firms within an industry, and by doing so, strategic group analysis can be a useful tool which focuses managers' attentions upon salient differences in how competitors approach the market-place. Such analysis is useful because it could help them to assess (1) the attractiveness of market opportunities for their firm (and for their competitors), (2) their abilities to exploit industry changes, and hence (3) their long term opportunities for profitability within the industry in question. (p. 55)

As Harrigan implies, an ideal way of illustrating an organisation operating as part of a strategic group is by drawing a 'market web'. Some alliances will be formed with other organisations within the industry, while others will be with organisations outside of it. The concept of a 'market web' entails tracking all the relationships a firm may have that need to be managed (Madill, Haines & Riding 2004; Ryans et al. 2000). At the centre of the web, a 'market chain' can be found, which consists of the focal company and a number of relationships both upstream and downstream from it. Surrounding the market chain are a number of ‘off-chain’ relationships that amplify the chain and, in turn, evolve it into a web (Madill, Haines & Riding 2004; Ryans et al. 2000).

As outlined above, the benefits of engaging in an alliance or partnership can be copious. However, there are also clear risks and implications associated with engaging in and developing corporate partnerships. There are also significant challenges in identifying the right partner firm. What the market web concept outlines and also flags is that, although corporate alliances can serve to increase a firm’s competitive advantage and strategic position, many factors need to be considered. Further, a significant range of variables affect the attractiveness of an alliance, and these are often dependent on a range of factors such as firm type, industry and time frame. Therefore, any firm must critically assess these many influencing factors before engaging into a formal alliance or partnership.

This section has highlighted that there are immense possible benefits for firms that choose to operate in an alliance. In particular, there is great potential for alliances and partnerships to drive innovation with technological advancements. However, such benefits must also be carefully balanced with the risks, drawbacks and complexities that exist in these partnerships. The abundance of partnerships operating in the automotive industry highlights the need to include strategic alliances and partnerships as a key aspect of the theoretical framework for this research, and serves to justify their inclusion.

On a broader scope, we can consolidate this section to identify that the particular strategic management elements of: 1) competitive advantage; 2) positive-sum competition; and 3) strategic alliances and partnerships are especially relevant to this body of research. Subsequently, the strategic management portion of the theoretical framework is well represented by these three focus areas. Further, this section has highlighted that there is a strong need to assess the strategic management topics in unison with both product innovation and the subsequent consumer value of those products. In order to better understand how product innovations can drive competition, we must review the theoretical framework behind product innovation in the next section.

3.2 Product Innovation

The second strand of literature that will form the conceptual framework of this research focuses on product innovation. Since EVs are evidently a new product, emerging from the advancement of new technology, it is imperative to explore the theoretical underpinnings of product innovation in a commercial sense.

The emergence of new technology as a result of applied innovation can signal drastic shifts in the nature and basis of competition within established industries, and ultimately influence business strategy (Nagy et al. 2016). As such, after discussing the strategic elements of the conceptual framework, such as competition, we must look at the role of innovation in shaping industries, in the context of strategically building a competitive advantage, and explore how this can be executed via collaborative methods such as alliances and partnerships. Revolutionary innovations often redefine the skills, resources and relationships upon which competitive positions are based and, along with bringing new opportunities to an industry, they also bring new challenges (Abernathy & Clark 1985).

Often, new firms emerge in an attempt to exploit the commercial potential of new innovations and technical advances (Dosi 1982). To profit from these innovations, emerging firms need to create and sustain a competitive position in an environment that is already highly dynamic and competitive. Initially, they may be able to overcome barriers by focusing on niche applications of the innovation. However, in the longer term, emerging firms will only maintain a competitive advantage if they can access a full range of assets required to commercialise the innovation (Teece 1987). A viable way to achieve this competitive position is to utilise the aforementioned benefit of alliances with firms that grant access to the required assets.

Emerging firms face an important strategic choice: whether to pursue selected innovations with, or via, an alliance/partner firm. Each stage of the innovation process can be carried out internally or externally, or through some combination of internal activities and external alliances (Hamilton, Vilà & Dibner 1990). This is strongly reflected in the activities of the automotive industry. Here, firms both internal and external to the industry uncover innovations and technological advancements and bring them to market using the combined resources of an alliance or partnership. This is especially relevant to the e-mobility industry, where we have seen clear collaborations between firms to bring new innovations to market: for example, Daimler AG and Tesla collaborated to develop battery technology (Palmeri & Carey 2009; Schaefer 2014), and Volkswagen Group and BMW Group combined resources to roll out charging infrastructure in the USA. What these examples tell us is that there is an inherent tendency for alliances and partnerships to enable innovations to create a competitive advantage. This begins to highlight some correlation between product innovation and the strategic management issues discussed in the preceding section. However, further evidence highlights a correlation between strategic management and product innovation: for instance, that product innovation is used as a key asset to complement positive-sum competition. Due to this correlation, we must explore the foundations of innovation in further detail, to better understand its role in the theoretical framework in conjunction with the strategic management topics covered in the previous section.

In the context of this research, specifically under the banner of innovation, there are key

Much research into innovation draws from Schumpeter's (1934) theory of economic development and has been covered extensively in academic literature (Dolfsma & Velde 2014; Gilbert 2006; Pitorac & Cismaș 2012; Ruttan 1959). Lazzarotti, Dalfovo and Hoffmann (2011) interpret Schumpeter's (1934) theory of business innovation as:

> The formation of new products or services, new processes, raw materials, new markets and new organizations. In all these cases, in order to ensure the concept of new combinations and to be characterized as innovative, it should be taken into account that no one has ever launched something similar or has experienced it, known it or existed. It must be something really unique to the market or the market segment of the firm… (Lazzarotti, Dalfovo & Hoffmann 2011, p. 122)

Schumpeter's theory of business innovation, as presented by Lazzarotti et al. (2011), offers an essential definition of product innovation. We can observe such products in the contemporary context, such as smartphones, Uber, Airbnb, Alibaba and, in the context of this research, electric vehicles. We will adopt this definition in the subsequent discussion of product innovation and draw on its conceptual base to focus on three key dimensions of innovation: 1) radical and continuous innovation; 2) inter-group dynamics as a catalyst for innovation; 3) creating new consumer value through innovation. These three dimensions are the necessary elements for understanding the role of product innovation in influencing strategic decisions. Concurrently, we can also begin to see the relationship between product innovation and driving consumer value.

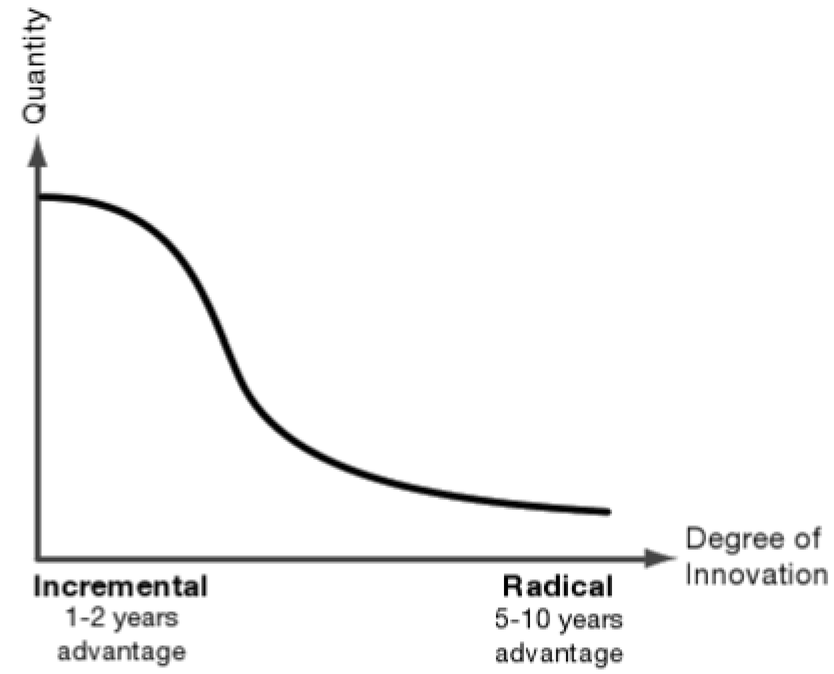
Importantly, it is relevant to consider relevant innovation theory that will not be covered specifically by 1) radical and continuous innovation; 2) inter-group dynamics as a catalyst for innovation; 3) creating new consumer value through innovation. These are for example transition theory (Kemp et al. 2007; Nil & Kemp 2009) that explores different ways to steer transitions in particular relating to technological shifts. Other relevant theories are lead user theory (Urban & von Hippel 1988) which highlights how emerging technologies are often in the need of a group of lead users that pay a high price for new technology which is in its early stages of application. Over time, these prices have a tendency to fall as the technology develops and the market grows and economies of scale are utilised. Last, relating back to the elements of strategic alliances is the theory of innovation systems (Lundvall 2010; Geel 2004) that highlights the need for multiple actors to combine in order to stimulate the transition to a new technology. These innovation based theories are relevant to consider in the case of EVs, however in order to explore the interrelation of the three pillars of strategy, innovation and value, we will focus on the aforementioned overarching theories around product innovation.

3.2.1 Radical and Continuous Innovation

In order to form a coherent conceptual framework, we need to differentiate the implications of more radical innovations, such as EVs, from more common continuous innovations, such as new ICEV models. Radical innovation and continuous innovation (sometimes referred to as continuous improvement or incremental innovation) are the two predominant forms of innovation (Corso & Pellegrini 2007; Denning 2010; Denning 2013; Linton 2007; Lynn, Morone & Paulson 1996; Milé 2002; Soosay & Hyland 2008). Radical innovation is concerned with a direct and disruptive model of innovation, involving activities which are large, abrupt and at times (not always) can be dispatched in a short timeframe (McDermott & O'Connor 2002), resulting in fast shifts within markets. The smartphone is one example of a radical innovation: the transition from a conventional mobile phone to a smartphone was executed in a quick, abrupt and market-disruptive manner. Continuous innovation can be classified as a series of small and often consistent 'activities' that produce a product or performance improvement on an ongoing basis (Jha et al. 1996). Comparatively, radical innovation is based on a "top-down" strategy (Milé 2002), and continuous innovation is based on a "bottom-up" strategy (Milé 2002). While research conducted by Harrington (1995) identified that all organisations require a combination of both radical and continuous innovation strategy, empirical evidence shows that continuous innovation is the major driver behind innovation (Harrington 1995).

Many companies have a higher ratio of continuous innovations to radical innovations due to the short- to mid-term focus of many businesses (Moore 2006). While continuous innovations tend to carry lower risk and can be brought to market more quickly, they usually have a lower possibility of sustaining a long-term competitive advantage (Moore 2006; Richardson 2010).

Subsequently, this short- to mid-term focus leads many businesses to have a high degree of continuous innovation with the frequency of innovation dropping off significantly at the radical innovation stage, as highlighted in the below illustration excerpt from Richardson (2010):



As outlined by Abernathy (1978):

> To achieve gains in productivity, there must be attendant losses in innovative capabilities, or conversely, the conditions needed for rapid innovative change are much different from those that support high levels of productive efficiency. (p. 4).

As a result, firms must prioritise a strategy around either radical or continuous innovation. Engaging in innovation carries risk, as resources are sacrificed from other areas of the business, thereby opening up a certain level of jeopardy (Caggese 2012).

Successful innovators combine risk-taking managerial principles with a firm policy of creating new markets by active product innovation (Baba 1989). The importance of product innovation has increased in recent years because customers' decision-making factors have changed from product price to product design (Moon, Park & Kim 2015). The success of a product depends on creating unique and superior product characteristics, as perceived by customers (Wu 2013).

Product innovation is a critical factor for the success of a product and the firm because it drives consumer demand. Applying this knowledge to the automotive industry, OEMs continuously endeavour to improve their products' appeal to their target market. As outlined by Baba (1989), investment in product innovation must be balanced with risk-taking managerial principles. OEM managers must therefore assess the risk in pursuing innovations rather than simply facilitating all innovations. Risk is often reduced by gradually incorporating new innovations into a specific model and, if successful, rolling it out into future models (Sobral et al. 2013). This approach to innovation is deeply tied to the lean manufacturing principles implemented in the contemporary automotive industry, most notably by the Toyota Motor Corporation (Duncan & Ritter 2014; Thurston & Ulmer 2016).

Such a strategy of basing innovation implementation on the product's success in the market highlights the need to consider the consumer at the forefront of innovation strategies (Heath et al. 2015). Consumer demand changes rapidly, and the importance firms place on product innovation must also change as consumers increasingly accept new technology (Davis 1989). As the world becomes more diverse and transitions between new technologies and innovations become more frequent, the requirement to innovate in order to maintain a competitive position becomes paramount (Chomvilailuk 2016). Since it is the consumer who makes the purchase decisions regarding new products, business strategy should focus on best serving the customer with the best possible innovations (Moon, Park & Kim 2015).

While continuous innovation has long been at the forefront of the automotive industry, the introduction of EVs as a radically new technological innovation brings the industry to the precipice of potentially the most significant radical innovation since the internal combustion engine was introduced. Therefore, the concept of radical and continuous innovations forms a fundamentally relevant element of the theoretical framework of this research and will be discussed in detail.

The development of radical innovations presents significantly greater risk than the development of incremental innovations, because radical innovations require substantial investments in new technologies or markets and have more uncertain outcomes. However, the introduction of radical innovations is crucial as firms endeavour to improve their competitive positions and to safeguard their long-term success (McDermott & O’Connor 2002). Radical innovations are new products that involve substantially new technology, offer superior customer benefits, and can, at times, demand considerable changes to consumer usage and consumption (Chandy & Tellis 2000). Therefore, the consumer’s acceptance of radical innovations depends on how prepared they are to change their mental models and perceptions (Calantone, Chan & Cui 2006).

Ultimately, when confronted with new products, consumers must first gain an understanding of the innovation in order to form a perception of the product – which can potentially be favourable, unfavourable or neutral (Rogers 1995). As a result, the success of an innovation can only be determined long after the investment has been completed and the consumer has passed judgement on the product. In the automotive industry, this dictates a high risk as vehicles generally take more than five years to transform from an initial internal innovative concept to a deliverable in-market product (Sturgeon & Van Biesebroeck 2010). This is due to the extensive time and resource commitment associated with research and development, quality assurance and supply chain network development, among other things. Even once a product offering additional benefits to the customer has been successfully delivered to market, the traditional mindset must be overcome in order for the consumer to understand the full value of the new product (Planning & Britzelmaier 2011).

Often, radical innovations result in a complex new product with little initial consumer knowledge. In order to understand the new product, consumers must exert a high level of cognitive effort (Kapoor, Dwivedi & Williams 2014). For products that have been in the marketplace for a prolonged period of time, such as conventional cars, consumers exert a sophisticated level of familiarity with these existing product schemes; they know how they work, when to use them, their limitations and their benefits. When it comes to new product innovations, these functions are relatively more complex to understand compared with existing products (Kapoor, Dwivedi & Williams 2014). This implies that a consumer might have a forceful resistance to an innovation despite its underlying benefits (Reinders, Frambach & Schoormans 2010). The focal point of this particular research offers one such case in point. There is a lack of uptake of new innovative technologies, such as electric vehicles, in the automotive industry. This may be explained by the above theory that suggests consumers resist this innovation because they do not understand the new technology and its inherent benefits (Egbue & Long 2012). Consequently, consumers continue to buy vehicles that are familiar to them – vehicles with internal combustion engines.

Although some innovations face an element of resistance, the reality remains that many product innovations are successful as the innovations are generally developed in line with a marketing strategy to find a suitable market position for the product (Pantano & Di Pietro, 2012). Yet to create a successful new product is not easy. Despite the advantages of new products, the development stage of these products can be problematic and requires considerable time and financial costs (Parker & Brey 2015). Often these costs are not offset by an equivalent return, bringing heavy losses to companies. Studies have shown that the significant resources companies devote to new product development and market introduction risk being wasted on unsuccessful product development projects (Cooper 2006; Graner & Missler-Behr 2015; Haverila 2010; Kraaijenbrink 2012); alternatively, new product development efforts are stopped before they are commercialised (Zemlickienė & Maditinos 2012). When failed new product developments are analysed, the contributing factors to their failure are often related to marketing (Allen 2003). Marketing is not just a useful means of conveying the value of product innovations; marketing must fundamentally play a role in the guidance of new product innovations. The literature around the relationship of marketing to product innovation continually outlines the success of integrating a sound marketing approach into new product innovations (Allen 2003; Beckman & Barry 2008; Ernst et al. 2010; Gupta & Wilemon 1990; Sherman et al. 2000; Zemlickienė & Maditinos 2012; Zhang et al. 2009). Zemlickienė and Maditinos (2012) outline the benefits of such an integrated approach:

> A well-developed marketing competency includes proactive consideration of the customer in the development process; it helps to guide technical specifications, determine appropriate market segments, establish cost targets to meet pricing objectives, and identify partners that will play a critical role in the

> value delivery process. In other words, it brings the voice of the customer into the innovation process. (p. 366)

As such, in order for OEMs to best position their investments in new innovations such as EVs, they must actively invest in analysing the potential market. However, in the context of radical innovations, it is difficult to determine what product the market would most likely accept. Defining the specific consumer demands for a particular product is difficult when, fundamentally, the consumer has no prior knowledge of the new product. This represents a key challenge that must be overcome as part of the technological fulfilment of an innovation.

It is often said that necessity is the mother of invention; and to some extent we can extend this to the principle of innovation. A rise in the price of a commodity should encourage consumers to search for ways to lower their dependency on such a commodity to reduce costs (Newell, Jaffe & Stavins 1999). Induced innovation is a change in the relative prices of the factors of production, which can spur invention (Hicks 1932). Newell, Jaffe and Stavins (1999) researched the induced innovation hypothesis. They tested whether an increase in energy prices would lead to technological change in, and sales of, less energy-efficient capital goods. The focal point of the research considered air conditioning and water heater technologies between 1958 and 1993, estimating the changing parameters in the transformation surfaces between product cost and energy flow. They found "little evidence of significant inducement effects on overall technological change" (Newell, Jaffe & Stavins 1999, p. 959). However, more efficient units, which were already technologically feasible, were increasingly offered for sale as energy prices rose (Newell, Jaffe & Stavins 1999). This study has a key relevance to EVs due to the benefits EVs have over ICEs in terms of running costs (ClimateWorks 2017).

Although the increasing price of petrol and diesel may not directly compel manufacturers to innovate and develop electric vehicles, there may well be a suggestion that, if EVs are available and positioned in the market competitively in contrast to ICEVs, they may be more prominently offered for sale as the price of petrol and diesel rises.

Research conducted into innovation in the automotive industry has found that knowledge associated with product innovation in research and development decays more quickly in the automotive sector than in energy-related industrial sectors (Crabb & Johnson 2010). At the same time, the diffusion of knowledge within automotive industry organisations appears much slower than in other industries. The combination of slower diffusion and quicker decay in the automotive industry raises concerns since both elements add to the costs of knowledge accumulation. Although this slow diffusion and rapid decay is troubling, the effect of the knowledge stock on subsequent innovation at least enables a degree of cumulative benefit (Crabb & Johnson 2010; Popp 2002; Roper & Hewitt-Dundas 2015). In principle, businesses that have always avoided innovation can find pre-existing knowledge stock a hindrance to the organisation. In organisations where the pre-existing knowledge stock has a consistent and significantly negative impact on subsequent innovation, this may indicate an industry at the point of innovative exhaustion (Mahmood, Chung & Mitchell 2013; Roper & Hewitt-Dundas 2015). However, it appears that the automotive industry is not at the point of innovative exhaustion so the knowledge stock should be leveraged in future innovations. The research by Crabb and Johnson (2010) highlights that it may benefit firms to adopt innovation strategies where diffusion of knowledge is facilitated in order to accelerate innovation and nullify the effects of decay. One such possible strategy is collaboration with a firm that has a culture of knowledge diffusion.

Ultimately, the research from Crabb and Johnson (2010) found that “the price of oil is strongly associated with a positive, statistically significant and nontrivial effect on energy-efficient automotive innovation” (p. 211). This substantiates the claim that, to some degree, necessity is central to innovation and invention. In other words, OEMs should seek to develop vehicles that will run on the most prevalent and economically viable fuel expected to be available in the future.

Innovation can be conceptualised as a deviation from conventional methods in the face of technology (Mick & Fournier 1998). As a result, new technology and design provide opportunities for consumers to achieve greater efficiency and social status. Subsequently, firms experience market share gains when they introduce design and technology innovations (Griffith & Rubera 2014). Technological breadth – that is, offering a greater number of technologies – dictates that firms determine whether to serve heterogeneous groups of customers, from those highly innovative consumers eager to have the newest technology to those consumers satisfied with current and more ‘mainstream’ technologies (Bordley 2003). Alternatively, firms can look to serve more homogeneous groups of customers that represent a specific niche.

In the case of the automotive industry, some OEMs offer a broad product portfolio by providing consumers with a variety of product offerings from which to choose (for instance, Audi serves customer segments from small car (A1) to large sedan (A6), right through to the R8 supercar) while other OEMs opt to focus on only a specific niche. Taking Tesla as an example in its endeavour of leading the e-mobility sector: since the e-mobility sector is still in its infancy, it is a well-established niche market, which is still split into various segments. However, rather than saturate various segments to reach as many potential customers as possible (for instance, by offering a small car, large car, SUV, and so on), Tesla focused initially on the sports car segment before working down into the large luxury sedan segment and then moving into the large luxury SUV segment. These segments are niche markets in their own right, positioning Tesla as a 'niche within a niche'. This strategy was predicated on offering vehicles in segments where the consumer price sensitivity is low and ultimately has led to tremendous sales success in those niche segments. This notion that product innovations can be utilised to drive a firm's strategic agenda continues to highlight the depth of the relationship between product innovation and strategy. We can subsequently continue to establish a theoretical framework constructed of various particular strategic and innovation related topics.

While utilising technology to create product innovations can create positive business outcomes, new technological innovations, such as e-mobility in the automotive industry, can carry a social risk (Djelic & Ainamo 2005). Although the product targets a niche segment, there is a high risk it will not be accepted by a homogenous customer group. Therefore, broader technological offerings give a firm greater opportunity to satisfy a heterogeneous marketplace, in turn enabling it to increase its market share (Griffith & Rubera 2014). So we can identify that although OEMs incorporate different strategies in their product portfolios, the high risk of new technologies not being accepted means that an e-mobility-specific OEM faces a struggle to become an overall market leader. As such, established OEMs (currently operating to serve heterogeneous customer groups) that venture into the e-mobility sector experience far less risk of failure than firms such as Tesla that have no 'fall-back position'.

Although the inherent benefits of innovation appear to be clear (while naturally carrying some risk, as highlighted above), many organisations take a reluctant or cautious approach to innovation (Allen 2004). Despite the total business strength of some organisations, often the larger and more successful firms in an industry lag behind the smaller firms in taking innovative initiatives (Bjerke & Johansson 2015; González-Benito et al. 2016). The delay in firms' adopting innovation initiatives can be attributed to: 1) a long history of reliance on official procurement, preventing firms from promptly reacting to market demand; 2) a management structure which adopts a 'group-centred decision-making' approach, often suppressing the effects of innovation; and (3) large investment in other areas of the business (such as production efficiencies), which can slow down a firm's investment in product innovation (Baba 1989).

A combination of the above factors explains why innovation is commonly not as heavily integrated into organisational strategy as it arguably should be. The automotive industry formed an integral part of Baba's (1989) research in identifying that in the Japanese automotive industry some firms innovate more rapidly than others. Some OEMs invest large portions of capital into new innovations and, while they are first to market with the idea, competitors can often replicate the innovation with significantly less capital investment (Wäldchen 2014); such practices are predicated on the fundamental automotive principle of scale, since the development of cars is highly resource-demanding (Pavitt 1984). These 'replicating firms' adopt a risk-averse decision-making matrix and should be regarded as 'defensive' innovators (Baba 1989). These firms do not want to be left behind by new technology but nor do they want to be the first to invest in a new concept (Freeman 1982).

This section highlights the complexities of how different firms approach innovation. It has highlighted that radical innovations such as EVs are often more disruptive and reshape how firms and consumers act and react. However, these strategies also carry inherently higher risk. Therefore, firms make varying strategic decisions about how to execute product innovations. What this section has highlighted is that there is an evident relationship between product innovation and strategic management. Concurrently, this section has also alluded to a separate relationship between product innovation and consumer value. The notion presented herewith is that there is a clear reaction from consumers towards product innovations; some innovations strike a more valuable proposition than others. Therefore, in order to expand the theoretical frame, we will look at how inter-group dynamics act as a catalyst for innovation within a strategic context, and how product innovation can drive the creation of new customer value.

3.2.2 Inter-group dynamics, a catalyst for innovation

Inter-group dynamics – such as formal partnerships, industry alliances, cross-industry alliances, internal groups and internal team structures – entail the broader application of different kinds of collaborative effort in contemporary business practice. Inter-group dynamics can be observed in scenarios where individual business managers come together from varying backgrounds to address things such as a specific project, product, issue or strategy (Baba 1989). These varying backgrounds can see individuals combine into a group from: separate organisations; separate departments within the same organisation; academia; government; or from any other avenue where these individuals do not conduct regular business with one another (Chen & Yaw 2014; Nisula & Kianto 2016; Yanadori & Cui 2013).

The fundamental desired outcome of inter-group dynamics is for each organisation to control the critical aspects of its business while leveraging any potential opportunity that may assist it in pursuing its goals (Rossignoli 2015). Inter-group dynamics enable innovation because they are not formed on the basis of conventional cost-saving models such as the Transaction Costs Economics theory (Williamson 1991), which focuses on the costs of processes that contribute to the delivery of a product (transaction costs and not production costs) – such as raw material or labour hiring cost – in order to determine the consumer transaction price. Rather, inter-group dynamics have a closer affiliation with the conventional Resource Dependence theory (Davis & Cobb 2010; Drees & Heugens 2013; Hillman, Withers & Collins 2009; Pfeffer & Salancik 1978), which argues that in order to survive, businesses must acquire resources such as technology, skilled labour and money (Pfeffer & Salancik 1978).

Because innovation is primarily derived from human resources (Zhou et al. 2013), when we consider innovation as a core outcome, inter-group dynamics must be primarily predicated on the individual 'human' contributors in the group, and their skilled labour and labour with knowledge of technology or innovation. Such a group can draw similarities from the 'virtuoso team' theory (Fischer & Boynton 2005) which compiles top individual experts into a group in order to deliver a result of maximum potential; the focus is on the individual (and their skill set and expertise) and not the organisation they represent (Fischer & Boynton, 2005).

The benefits of inter-group dynamics – including their effects on innovation – are often leveraged when organisations operate in a strategic partnership or alliance (Mowery, Oxley & Silverman 1996). Establishing a group (or groups) of individuals to drive new ideas in a partnership or alliance is a key element in facilitating a platform to enable innovation (Osarenkhoe 2010). Literature on alliances has identified that alliances are a prominent strategy that firms implement in order to acquire knowledge and learn new capabilities (Al-Laham, Tzabbar & Amburgey 2011; Hamel, Doz & Prahalad

1989; Powell, Koput & Smith-Doerr 1996). A single firm might not excel in both maximising productivity and innovation, whereas individual firms operating as part of a group can shoulder the responsibility for two contrasting targets (Baba 1989).

As a result, Baba (1989) found that inter-group dynamics play a major role in a ’hyperlearning process’ which, in turn, can transform a market-disrupting innovation to an innovation that is continuously improved by all players in that market (Baba 1989). In the automotive industry, EV innovations often emerge from more than one OEM. Given that, as we have already seen, many OEMs operate in some sort of collaborative alliance or partnership (such as the VW Group, Renault-Nissan Alliance or Fiat Chrysler Automobiles), this confirms that the development of many new technologies, and the generation of new innovations, stems from a group rather than one sole firm (Agostini & Caviggioli 2015).

The capacity for a “hyperlearning process” is also justified as a real-world application in the automotive industry. As OEMs collaborate and combine resources, innovations are continually improved as each party applies its specialised knowledge to develop a specific innovation. The theory of inter-group dynamics can be further supported to include external stakeholders (such as suppliers and agencies), as well as stretching the geographic boundaries to learn from international distributors and foreign markets to access alternative knowledge (Machikita & Ueki 2015).

The concept that both internal and external groups work together to innovate depends heavily on a team’s ability to shift goal orientations as it moves back and forth between challenges in idea development and idea promotion (Alexander & Van Knippenberg 2014). These factors are critical to the success of developing innovations (Gong et al. 2012; Sivasubramaniam et al. 2012). This dynamic view points to the importance of team leadership in guiding teams through these shifts in goal orientations. Therefore, team goal orientations are a key element in radical innovation because they influence both goal choice and behavioural strategies in goal pursuit (Alexander & Van Knippenberg 2014).

The literature here highlights that the theory revealing how inter-group dynamics support the development of innovations has deep ties to the strategic management-related concept of strategic alliances and partnerships, which we have previously discussed. Therefore, as we dive deeper into the literature we can consistently identify a relationship between strategy and innovation in the literature, further building a clearer picture of our theoretical framework. The next step in integrating product innovation into the theoretical framework is introducing how product innovations can create consumer value. This will be covered in the next section.

3.2.3 Creating new consumer value

This section will explore how product innovation can create new consumer value (Casadesus-Masanell & Zhu 2013; Euchner & Ganguly 2014). Innovations allow firms to create superior value for their target market segments through their products. As introduced earlier in this chapter, the direct effect of innovation on business strategy is that firms need to adapt their business models and strategies to increase competition and meet a growing need for differentiation (Eggert, Thiesbrummel & Deutscher 2014). Companies need to innovate to either neutralise a competitor’s superior market position or to obtain their own competitive edge. In either case, “innovation leads to the discovery, creation, or assembling of resources assortments that enable the innovating firm to efficiently and/or effectively produce value added market offerings" (Hunt & Morgan 1997, p. 79). As a result, innovating companies have the right to capture the market value with their superior offerings (Eggert, Thiesbrummel & Deutscher 2014).

The goal of innovation is to bring a product to market that has strong consumer appeal (Govindarajan et al. 2001; Veryzer 1998). At times, innovations emerge from individuals or organisations who are unable to develop and/or market the new product. Research conducted by Jones, Knotts and Udell (2011) evaluated how investors in new innovations appear to more favourably assess innovations with regard to both business risk and demand analysis. Business risk was found to be the most common factor considered by investors. Both buyers and investors are keenly aware that the health of the business that produces the good with which they are associating can have immediate effects on the success of their own investments. This raised the question of whether the stage of the innovation's development affects assessments of market attractiveness. The answer appeared to be that it did. Stepwise regression results indicated that stage of development and new venture likelihood was more critical than other factors in deciding the market feasibility of a product (Jones, Knotts & Udell 2011).

In the context of the automotive industry, specifically the e-mobility sector of the industry, investment in new technology innovation typically has been limited (comparatively to traditional product development and innovation investments). Recently, though, there has been a sharp progression in investing in e-mobility innovations (KPMG 2014). This comes at a point where there is a real-world acknowledgment that the technology occupies a market niche, as illustrated by the success of the Tesla Model S. Inherently, we can reflect on the above literature to establish its application in the automotive industry. As the majority of OEMs have a broad scope of investors, OEMs have only begun the heavy investment into e-mobility recently, as the technology's stage of development begins to grow beyond its infancy and the new venture likelihood becomes stronger.

The questions therefore begin to rise: why has one firm (Tesla) managed to bring a product innovation to market that has dictated value to consumers, yet all other attempts to bring an EV to market have failed? When analysing innovation as a mechanism to create consumer value, research and development investments have been extensively discussed, along with product innovation, as key drivers of sustained company performance (Biolos 1999; Blundell, Griffiths & Van Reenen 1999; D'Angelo 2010; Morbey 1988; Zucchella & Siano 2014;). Perhaps Tesla's sole focus on EVs has allowed the entire company to put all its resources in this one single product innovation. This raises the question, then: to what extent is the success of product innovation driven by strategy, and what role does the consumer play in the success of a product innovation?

Of particular interest is the role of pricing new product innovations that have no market competitor, and the role of the consumer in reacting to that pricing. The literature reveals that among the most significant success factors of innovation is careful price setting – which, however, remains more art than science (Hofstetter et al. 2013). The literature highlights that even highly successful innovators often stumble when setting the introductory price for a new product (Piercy, Cravens & Lane 2010). Therefore, we can begin to uncover that while there is a strong link between strategic management and product innovation in the literature, there is limited understanding of the relationship between strategic management, product innovation and consumer value in unison.

Ultimately, this section has highlighted that strategic management plays a large role in deciding on how to approach innovation: should firms invest in being a technological leader, or should they wait and follow? It clearly highlights the benefits and consequences of the different options, and has a primary focus on the strategic outcomes for the business as a result of a set strategy on product innovation. At the same time, other literature suggests that the consumer will ultimately react to new product innovations. The success of a product innovation is ultimately determined by its success in the market, which will be reflected in its consumer value. So, a gap begins to emerge. The literature shows an understanding of how product innovations can help execute and influence strategy; concurrently, it recognises that consumers are the end users of product innovations and determine the success of the product in the marketplace. However, there is no clear link in the literature between the flow of theory from strategic management to product innovation and finally through to consumer value. Therefore, we must critically explore the literature around consumer value in order to expand our understanding if there is a possible gap in the literature and round out the theoretical framework with extensive content on all three themes.

3.3 Consumer Value

As highlighted in the previous section, central to the positioning of this research is the consumer and the consumers' behavioural characteristics that shape value perception of new product innovations. The previous sections (3.1 and 3.2) highlighted an established flow of theory on the relationship between strategic initiatives and product innovation in ultimately delivering market success. This literature review has also identified that the consumer's ultimate acceptance of a product is central to the success of these initiatives. However, the literature highlighted no clear link or flow-on from the strategic and innovation elements through to the consumer value elements. Therefore, this section must provide a deeper view of the theory surrounding consumer value.

There has been longstanding literature on consumer relationships (Bendapudi & Berry 1997; Bhattacharya & Sen 2003; De Wulf et al. 2001; Dwyer, Shurr & Oh 1987; Kessous et al. 2015; Verhoef 2003; Winer 2001), consumer behaviour (Bagozzi, 1974; Hui, Bradlow & Fader 2009;; Lancaster 1971; Lin & Hsu 2015; Jovanović & Radojičić 2016; Ratchford 1975) and consumer value perception (Bishop 1984; Bowman & Ambrosini 2000; Sánchez-Fernández & Iniesta-Bonillo 2007; Sela et al. 2013; Sweeney & Soutar 2001; Zeithaml 1988). Among the literature is a predominant bias towards a view that 'the consumer' lies 'downstream' of businesses and their managers. The consumer by definition is identified as the party that consumes the final product:

> The term customer refers to the purchaser of a product or service. They may or may not be the ultimate consumer. **Whereas the term consumer refers to the end user of a product or service [emphasis added].** They may or may not be the customer. (Nair 2008, p. 3).

The product, however, emerges as a result of business and managerial decisions. The consumer comes across as a secondary consideration; contemporary business practice and literature seems to take a primary perspective predicated upon questions such as: 'How can we sell/position/explain/expose/direct our product to the consumer?' (Chilles & Meyer 2001; Porter 1991; Rosenkranz & Weitzel 2007) This top-down approach has long been at the forefront of managerial and academic perspectives. While this study clearly recognises that there is ample literature and ongoing managerial practice on consumer research, this research is predominantly focused on the question: 'What are the consumer expectations, reactions and perceptions in relation to EVs?'

> In a competitive economic system, therefore, the survival and growth of firms requires accurate knowledge about consumers: how they buy, why they buy and where they buy as well as just what they buy… (Foxall 2014, p. 29)

This section will begin by looking at the existing literature around the consumer's perception of value. It will then go on to review the effects of product positioning on consumer value perception; and finally, the section will review the relationship between product innovation and consumer value creation. We will look at these topics in order to identify if there is a link between strategic management, product innovation and consumer value covered in the literature, or if we have indeed established a gap in the literature.

3.3.1 Consumer's perception of value

From the consumer's perspective, the price of any product should reflect adequate value, which equates to greater gains for equal or lesser exchange (Lee & Min 2014). Ultimately, the pricing of a product will ultimately play the most significant part in determining its value; and judgement of the value comes in the form of consumers making a purchase decision (Mehta & Ma 2012). Potential purchasers have to judge how the product will satisfy their needs; and such judgements are made in advance of the consumption of the product, so consumers have to make inferences about the range of products on offer based on a variety of cues. The most pivotal of these are price, quality and value (Bishop 1984; Delkhah, Amouei & Moghadam 2014; Doyle 1984).

Consumer perceptions of the value of a good are based on their beliefs about the goods, their needs, unique experiences, wants, wishes and expectations (Bowman & Ambrosini 2000). In other words, consumers assess a product's overall value using their perceptions of what is given and what is received (Zeithaml 1988). Such an 'exchange paradigm' is driven by self-interest, whereby one party is looking to win at the expense of another party's apparent loss.

However, value should rather be interpreted using a 'value creation paradigm' (Grönroos 2011; Walter et al. 2001), which is inherently driven and succeeded by mutual interest whereby both parties 'win' (Sheth and Uslay, 2007). A value creation paradigm encourages marketers to think of other types of value by reaching beyond exchange value, as value creation depends on the quality and variety of experiences it enables for the consumer (Leavy & Moitra 2006). It is expected that the value creation paradigm will accelerate the innovation rate, variety, and experience quality of marketing. This more modern approach to value succeeds primarily by focusing on the creation and delivery of value through customer relationships, rather than simply creating satisfactory exchanges (Sheth & Uslay 2007). The importance of value is that the customer gains some sort of benefit from the transaction. Customers will only be willing to pay high prices or continue using a firm's product when they can create value from its use (Scherer, Wünderlich & von Wangenheim 2015).

As indicated above, value can come in many forms. A resource-based value can be considered valuable if it enables consumer needs to be better satisfied (Barney et al.

2001). Alternatively, if a resource exploits opportunities and/or neutralises threats a firm may face in its environment, it also finds a value not to the consumer but rather to the firm trying to deliver value to the consumer (Bowman & Ambrosini 2000). Therefore, a resource like a brand could be traded and, in the hands of the acquiring firm, it could be used to create greater levels of perceived use-value in the eyes of consumers. As a result, new use-value creation derives from the actions of people in the organisation working on, and with, procured use-values (Lado & Wilson 1994). The primary principle of the resulting value is that the use-value of products is assessed subjectively based on the buyers' perceptions of their needs and the extent to which alternative products might meet those needs (Bowman & Ambrosini 2000).

As such, many organisations have a high expenditure on developing products to fit a predefined segment of the market. For example, in the automotive industry, many OEMs work with third-party 'tuners' who tune production vehicles to higher performance credentials. We see this relationship with Mercedes-Benz and its AMG division, Volvo with Polestar, and Nissan with NISMO (Davoodi & Omran 2012). These cars are produced to fit a specific customer segment – those who want a car from an established brand but tuned to give higher levels of performance. These relationships in the automotive industry have been highly successful: many OEMs acquire their tuning companies in order to use the tuning brand in a greater capacity to create consumer value across the range.

However, there is an antithetical view on customisation in product innovation creating more consumer value. Research conducted by Sela, Simonson and Kivetz (2013) found that consumers can perceive offers that are explicitly presented as customised or designed to fit their preferences as less attractive than offers that they believe happen to fit them (and thereby provide them with value) without the marketer's intent. This effect reflects the consumer's intuition that customised offers already take into account the target consumer's willingness to pay. Sela and colleagues' (2013) analysis indicates that, contrary to the assumption that individual customisation creates a situation whereby customers receive more value and hence exhibit a higher willingness to pay, telling consumers that an offer is tailored for them can have the reverse effect, lowering the degree to which they perceive that offer as a bargain (Sela, Simonson & Kivetz 2013).

This initial section gives a brief overview of the literature of consumer perception of value, highlighting that consumers' perception of value is highly subjective. However, central to the consumer perspective is some sort of intrinsic cognitive justification of why each consumer holds that particular perspective. As part of the theoretical framework, we cannot categorise just one consumer; rather, there are various different consumers who define value in line with their various intrinsic justifications.

3.3.2 Product positioning and consumer value perception

While the previous section highlighted that the consumer has the power to pass judgement on a particular product, to what degree does the strategic approach of product positioning influence consumer value perception? This section will explore this paradigm as a contribution to the theoretical framework.

Although Sela and colleagues' (2013) research found that customers can see offers customised for them as less attractive, there appears to be a consensus in the literature that consumers' needs and wants must remain central in developing and delivering a valuable product (Cavalcante Chamie & Akemi Ikeda 2015; Kotler 1972; Schau, Muniz & Arnould; Stewart, Loane & Webster, 2014). From the modern management perspective, the key to surviving fierce competition lies in maximising the value for consumers (Chan & Ip 2011; Gallarza, Gil-Saura & Holbrook 2011).

When considering consumer value, there are key business strategies to effectively identify, conceptualise and deliver a valuable product to the consumer; these strategies can differentiate and target more profitable consumers over less profitable consumers, or focus on lifelong, rather than short-term, consumers (Nickerson, Hamilton & Wada 2001; Porter 1980;). Identifying these consumers, developing relationships with the right consumer segment(s) and loyalty to them are vital for survival in a competitive marketplace (Meyer-Waarden 2007). These business strategies around consumer value align strongly to the business strategies highlighted earlier in the strategic management section 3.1.

As suggested in section 3.1, different OEMs produce vehicles for different target markets. Each consumer segment places different values on certain elements of a vehicle, such as efficiency, performance, luxury, and so on. Some OEMs focus on – and compete in – just one consumer segment, giving all their resources and attention to the most valuable consumers, and aiming to develop longstanding relationships with them. Longstanding relationships are predicated on the concept that 'repeat business' is a key driver of profitability (Aflaki & Popescu 2013; Gupta & Zeithaml 2006). The logic is that keeping a consumer successfully integrated and committed to a brand is, practically speaking, far easier than acquiring a 'conquest' customer who has been loyal to another brand. Resources are thus allocated primarily to the product that keeps the existing customer base satisfied, rather than allocating resources to conventional marketing and advertising models to attract new buyers (Steiner et al. 2014). A practical example of this scenario would be Rolls-Royce, whose target market is a small yet loyal niche.

Concurrently, various OEMs offer a more diverse product portfolio across a range of segments. The diversity within each segment results in discrepancies in consumers' perceptions of value, challenging OEMs to develop varying, yet equally effective, business strategies in order to offer the most valuable product in each segment. A practical example here would be Mercedes-Benz, which competes across a variety of segments from entry-level hatchbacks right through to the Maybach limousine, which competes directly with Rolls-Royce.

Organisations that target diverse customer segments have a potentially different benefit of targeting only a specific area of the segment at different times (Cuadros & Domínguez 2014). Consumer value perceptions vary depending on the period of a consumer's life stage and other considerations (Payne & Holt 2001). Subsequently, OEMs that offer a diverse product portfolio can benefit from consumers whose needs and wants change over time. If the OEM offers a variety of products, consumers can move between product offerings at different points in their lives as their priorities and preferences change, thereby maintaining brand loyalty.

Focusing on consumer value to drive an organisation forward allows organisations a way to understand their markets and shift their marketing focus from creating and distributing outputs to co-creating value with consumers (Carrington & Neville 2014; Chen 2011). By considering consumer value, companies can envision opportunities beyond today's offerings; the concept emphasises the important role of the consumer in value creation (Bettencourt, Lusch & Vargo 2014). By adopting this approach, OEMs have recently incorporated the consumer's desires into future business strategies. Consumers want their cars to be safer, more connected and more efficient without compromising their expectations around driveability, functionality or convenience (Hawkins et al. 2013). Electric vehicles presently challenge this trend towards accommodating consumer expectation; although EVs perform strongly on consumer demand criteria including efficiency, safety and connectivity, they stumble on driving range and 'refuelling' times, which places a huge compromise equation in the purchase decision (Egbue & Long 2012). Consumers must forgo their current expectations of functionality and convenience; pairing this with a significantly higher purchase price means that EVs deliver value to only a minimal portion of consumers.

While the above literature highlights and recognises the conventional role of product positioning and the subsequent consumer value deviations as a result of market segmentation, the contemporary business environment is approaching the precipice of change in consumer behaviour – and subsequently, the consumer's value perception. The modern consumer has undergone significant behavioural change as a result of the revolution in communication technology (Lock 2010; Meso et al. 2005; Samil 2013): the modern consumer demands more choice, isn't very brand loyal and is willing to try competing products in order to practically determine which product delivers a higher value satisfaction (Nair 2008). As a result, firms must begin to transition to more diverse strategies that recognise the shifting priorities of the consumer. Ultimately, business strategy should give consumers more choice and turn its attention to providing consumers with a broader range of products that not only meet their explicit needs but also their implicit needs (Narver et al. 2004).

Importantly, it is often the implicit factors of a product that can determine the sway of a consumer's value perception of a product (Kumar & Shah 2011). Increasingly, the value of corporate sustainability and, in particular, environmental sustainability

(Biggemann, Williams & Kro 2014; Burnett, Skousen & Wright 2011; Kim, Lee & Yang 2015; Lourenço et al 2012) features in the consumer decision-making process far more prominently; if two products are alike in every way, yet one leverages an implicit value of environment sustainability (for instance, by being sourced primarily from recycled materials), that implicit product feature can be a crucial factor in the consumer's ultimate value perception and purchase decision – as long as this information is connected to the existing decision-making processes (O'Rourke & Ringer 2016).

As organisations move to understand the inherent value of adopting environmental sustainability as a strategic issue, we need to define what sustainability is. The World Commission on Environment and Development defines sustainable development as the ability to "meet the needs of the present without compromising the ability of future generations to meet their needs" (1987). The implications of adopting strategies that consider sustainable development or environmental sustainability are that ongoing environmental changes will require organisations to reshape value chains and use natural resources in innovative ways (Lampikoski et al. 2014).

Organisations can encapsulate environmental sustainability through two primary methods: 1) focus the product on becoming more environmentally sustainable (such as increasing energy efficiency); or 2) implement corporate initiatives to reduce the impact of an organisation on the environment (Lampikoski et al. 2014). In the modern era, there has been increased interest in environmental sustainability (Harris and Crane 2002; Hass 1996; Pane-Haden et al. 2009; Preus 2005; Purser et al. 1995), triggered by numerous ecological crises and stricter environmental regulations. This is forcing companies to view corporate sustainability as a strategic issue (Siegel 2014). A shift from compliance to proactive corporate sustainability is gaining ground as more companies are taking advantage of business opportunities rather than engaging in "green washing" (Chen & Chang 2013; Delmas & Burbano 2011; Peattie 1999; Saha & Darnton 2005) and other avoidance tactics (Lampikoski et al. 2014).

Outside of reshaping value chains, sustainable business strategies have intrinsic social value. This social value can be leveraged in a variety of contexts, but often managers do not uncover these values (Golob et al. 2008). Many business managers assume that investing in sustainability only represents a cost (Earl & Clift 1999). Therefore, they analyse the outcomes of clean technology investments in terms of traditional, short-term financial measures (Blackburn 2007). At the same time, they ignore the long-term, intangible benefits of sustainability, such as employee retention and engagement, talent attraction and brand enrichment. This inconsistency can lead to green washing (Chen & Chang 2013; Delmas & Burbano 2011; Peattie 1999; Saha & Darnton 2005), which gives a deceptive or misleading picture of the company's environmental friendliness. Although sustainability could be seen as a persistent work 'for good', managers often view it as an isolated set of activities pertaining to a corporate effort of 'being less bad' (Lampikoski et al. 2014) or being 'seen to be good' (Galbreath 2010). Importantly, social value creation must be contextualised within the environment where it has occurred. Some organisations may profit more fruitfully from sustainability-sourced social value due to either the market in which they operate or their target market segment and associated customer profiles (Kroeger & Weber 2014).

The above literature highlights that the needs, wants and values of the target consumer are central to product positioning. Whilst existing managerial practice, such as market research may help management somewhat with existing or stable products, there is little to suggest how firms should react to products that are developed more rapidly and have limited to no consumer exposure prior to launch. Therefore, in these cases, when firms are positioning a product innovation in a particular market, they must consider the known perspective of the consumer. However, they must also consider that a consumer's perception of value can vary, depending on the particular market segment they occupy and the rate of change in products within that or related segments. Importantly, we can also identify a link between consumer value and strategic management – in particular, by identifying the consumer value of sustainability and the strategic relationship to achieving it. Earlier in this section, we also saw how new product innovations can drive increases in consumer value. However, there is still an absence of literature that clearly considers strategic management, product innovation and consumer value concurrently. Therefore, becoming ever more prominent in the theoretical framework is the recognition of a multitude of relationships between each of the three themes individually; yet there continues to be a gap in the literature concerning the emergence of all three themes concurrently. The next section will explore product innovation and its role in value creation to round out the literature review of consumer value.

3.3.3 Product Innovation and Value creation

Product innovation has long been linked with increasing the value of certain products to consumers (Govindarajan et al. 2001; Jones, Knotts & Udell 2011; Veryzer 1998). While product innovation results from technological advancement, and as such will influence the future line-up of certain products, the consumer evaluation of those product innovations will play a crucial role in determining the success of the new product (Choi, Shin & Lee 2013). As a result of the evident ‘consumer power’ to determine the value of a product innovation and, ultimately the success of any particular product innovation, we can identify a direct correlation between value creation and the literature surrounding consumer behaviour and psychology. The consumer’s psychology must be considered as it shapes how factors such as attitude, motives and personality traits influence buying behaviour; couple this with social influences such as class and status and we can begin to recognise the importance of consumer value and value creation, given our understanding of the consumer’s decisionmaking (Foxall 2014).

While the psychological factors that affect consumer behaviour are widely recognised as key influences on consumer decisionmaking, there is often a misleading impression in the literature that these factors are easy to understand and explain – often to the extent where firms boldly believe they can influence and even predict consumer behaviour (Foxall 2014). As a result, firms and their managers must assess product innovation in an open manner and accept the variety of perceptions and position consumers can take on any product and the ultimate effect these positions and perceptions have on the consumer’s value perception of that product. Subsequently, different types of product innovation create consumer value in different ways. Fundamentally, this will identify inherent implications for firms who must draw on the effects of technological advancements, which influence product innovation from ‘push’ and ‘pull’ perspectives.

Core to the ‘pull’ value effect is the individual consumer’s perception of a certain product. In particular, among a maze of technically identical products, businesses use product design as a key method of differentiating their product from competitor products; aiming to make their product the most desirable from a design perspective

(Shao 2015). Achieving the right product design has long been a primary marketing method used by businesses to ensure that a specific product maximises its desirability to the consumer, which in turn drives an added value effect (Geraerdts 2012). Since different consumers have varying tastes, firms often invest large portions of resources into developing a diverse range of product designs (Martinez 2014; Ton & Raman 2010).

However, many industries are now bucking this trend and are opening up elements of the product design process to the consumer directly, by offering customers the opportunity to personalise and specifically design the look and feel of a product to meet their own individual and idiosyncratic taste (Moreau 2011). This voluntary shift of responsibility for product design from producer to consumer is dubbed "self-design" or "user-design" and is increasing both in practice and in marketing literature (Franke et al. 2009; Moreau, 2011; Moreau & Herd 2010).

The automotive sector has often been an industry open to incorporating varying consumer tastes. At its very core function, the automotive industry allows consumers to individualise their product by choosing exterior colours, interior leather, wood trims, and many other options. While this allows for a large degree of individualisation, the consumer is limited in exactly what they can individualise by what has been developed. While, for example, there maybe several leathers to choose from, a consumer can only choose from product features that have already been designed into so-called pre-defined 'options'. There is no possibility for an individual consumer to truly dictate the design of a vehicle. As a result, while there is an emerging trend of 'self-design' in other industries, the automotive sector is one where product design is still very much formulated along a 'push'-centric trajectory.

These conventional ‘push’ marketing strategies, upon which the automotive industry relies when it comes to its product, are common practice in many businesses (Chevalier & Curhan 1976; Levy et al. 1983; Rimlinger 2011). This position is central to the conventional view that the consumer plays a passive role in the product innovation process (von Hippel 1978). However, modern marketing is shifting to a more diverse view on the consumer’s role in product innovation (Rimlinger 2011). In a modern context, the consumer is seen as a valuable asset in the process of ‘co-creating value’ through an exchange of knowledge between consumers and firms (Vargo & Lusch 2004).

In order to move away from conventional ‘push’ marketing strategies, towards a more customer-centric ‘pull’ model, it is critical that companies engage in active dialogue with consumers during the development of new product innovations, rather than engaging them via one-way promotion after product development is complete (Payne, Storbacka & Frow 2008). As a result, the R&D departments responsible for product innovations need to work closely with the conventional marketing departments responsible for consumer research and engagement (Costa & Jongen 2006; Kemp 2013). The goal of this collaboration is to ensure the consumer’s voice is central in the product development process (Martinez 2014). However, incorporating such ‘pull’ strategies by putting the consumer’s voice at the centre is by no means a straightforward or simple process; it is highly complex, especially considering the consumer demand to develop products that cater to them and at a price they are willing to pay (Martinez 2014; Piller & Ihl 2009).

Here we can again identify a gap in the literature, which fails to highlight the role of strategic management in this process of integrating product innovation and consumer value. While the literature identifies inherent benefits of incorporating a collaborative approach to product innovation (via R&D) and consumer value creation (via Marketing), this complex process of ‘putting the consumer’s voice at the centre’ needs to be managed and integrated into a greater strategic context. As the literature highlights, the consumer demands a certain product at a certain price. In order to achieve this, strategic managers need to be involved in making decisions regarding what products to develop, at what cost and for what benefit to the business. Without the input of strategic managers, the concept of integrating product innovation and consumer value may pose risks to the business, such as rising development costs or reduced profit margins. This could in turn jeopardise the long-term profitability or competitive position of a firm. While it is not the role of strategic management to purely control or dismantle the processes of product innovation and consumer value, it is the role of strategic managers to constantly review and re-evaluate these processes to ensure the business is operating as efficiently and effectively as possible. However, the literature review has failed to identify a scholarly contribution that encompasses this three-factored approach: navigating between strategy, innovation and value.

We can gather from the review of the consumer value literature that the consumer value equation is highly relevant both to a firm’s strategy and to product innovation, since the success of new and innovative products is determined by the value the consumer places upon them. Consumer acceptance of product innovation is predicated on the consumer experiencing a derived value from a product innovation: a value that an existing product cannot replicate. Importantly, price has a central role in the consumer value equation; a product with inherent benefits can only be considered valuable in the context of an attainable price.

We can also identify a connection between consumer value and strategic management, since providing value is central to being competitive in the contemporary marketplace.

The role consumer value plays in the purchase decision can directly influence the success of a product innovation in the marketplace. In the most basic of strategies, consumers' positive purchase decisions will determine sales; sales determine revenue; revenue constitutes profit; and profit is the primary goal of the greater majority of businesses. Therefore, establishing a synergistic affinity between strategic management and consumer value when developing, launching and selling a product innovation is crucial to the success of corporate organisations. The literature review has highlighted that there is a gap in how these three themes tie together and we can arrive at the conclusion that the gap in the knowledge is the absence of a clear understanding of the concurrent relationship between strategic management, product innovation and consumer value. The next section will highlight the problem further and serve to justify the theoretical framework laid out above, in the context of this research.

3.4 The problem

The present literature review reveals that the three literature strands – strategic management, product innovation and consumer value – are each elaborated by a significant body of both theoretical and empirical work. However, these strands are primarily studied and analysed in isolation. On occasion, and as highlighted in the above literature review, the aforementioned strands are analysed in combination with one another. However, they are combined in a singular manner between two strands: strategic management and product innovation, product innovation and consumer value, or strategic management and consumer value. They are not represented in the literature in combination with all three strands examined concurrently.

Figure 4 provides an illustrative overview of the relationship between strategic management, product innovation and consumer value. The illustration provides some examples of the relationship; however, as observed in the above literature review, the level of detail in reality extends beyond these few listed examples.

Figure 4: Theoretical relationship overview

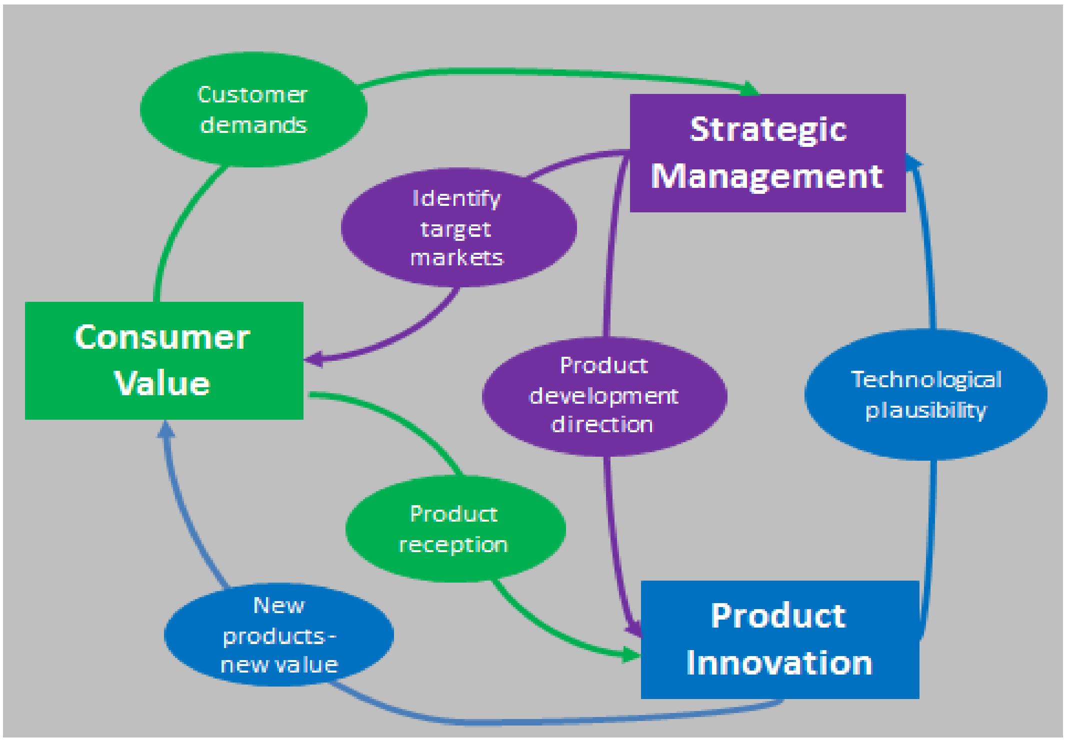


Figure 4 highlights that there are complex relationships across and between the strands of strategic management, product innovation and consumer value. The figure also reflects a gap in the literature by identifying that it does not highlight any clear knowledge or definite understanding of how all three strands of strategic management, product innovation and consumer value interrelate.

In the context of the increasing rate of technological change experienced in the Australian EV industry, there is a clear need for a better understanding of how the three strands of strategic management, product innovation and consumer value must work together in unison. Senior management shapes strategy by empowering and enabling the development of new, innovative products – which, in turn, the consumer should value. As such, a clear gap in our knowledge is present, neglecting the synergistic relationship between these elements. Therefore, in this research, the three strands are considered in concert in order to better understand the EV industry and how strategy and innovation work to deliver consumer value. In doing so, the present research seeks to extend our theoretical understanding of the interaction between strategy, innovation and value. As the influence of technological advancements and subsequent innovations continues to stretch to an increasing array of industries and businesses, it is becoming ever more critical to fill the gap in knowledge across many industries so that we better understand the relationship between strategic management, product innovation and consumer value.

The Australian electric vehicle market has been chosen as the subject matter of this research as it plays out the interactive dimension of the three key areas. As outlined earlier, the Australian electrical vehicle market makes up only a minor segment in the overall Australian passenger vehicle market. The EV market is only in its infancy and with the emergence of new technology comes the requirement to develop new strategies to accommodate the new technology. With a shift from conventional mobility to e-mobility, EV technology disrupts the market and offers a different form of mobility to the consumer. As it stands, EV technology requires compromise on the part of the traditional consumer psyche. However, it also encompasses a new set of consumer values. The challenge for senior managers in Australia lies in shifting their strategies in order to position these new products in the right market segment, target the right niche and establish a clear communication strategy to convey the value of these new products to the consumer.

As highlighted throughout the literature review, there is currently no theoretical understanding of how strategic management, product innovation and consumer value correlate in a theoretical context. The requirement then for this research is to address this gap in the literature and aim to deliver a contribution that provides a theoretical underpinning of how strategic managers can best work with product innovations to achieve their strategic goals in tandem with meeting consumer value principles. The next chapter will outline the methodology of how this research will aim to deliver this theoretical contribution.

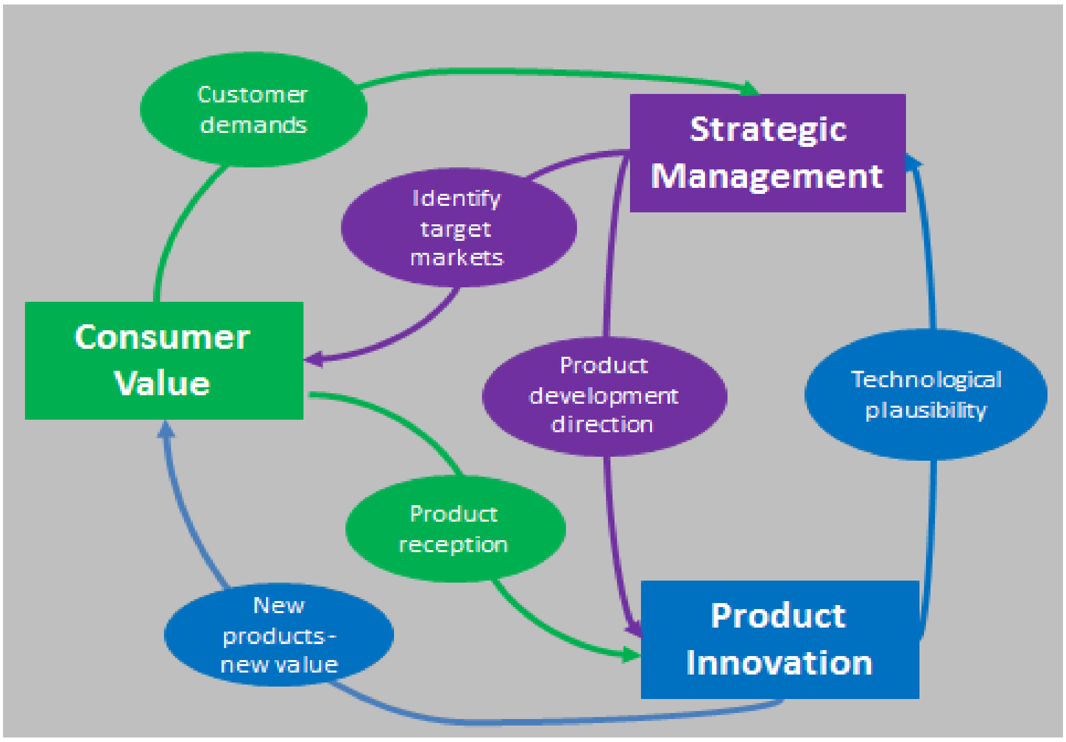
Chapter 4 Methodology and Design

Following on from the literature review, we can identify that the core gap in the literature we are trying to address is in the relationship between strategic management, product innovation and consumer value. Subsequently, the purpose of this research is twofold. First, it seeks to better understand the relationship between strategic management, product innovation and consumer value. Second, the research endeavours to contextualise and investigate the evolution of new market segments in an already established industry in order to illustrate how strategic management, product innovation and consumer value imperatives work together – particularly in the context of emerging technology. The present chapter outlines the methodology undertaken to collect and analyse relevant data in order to answer the stated research questions:

- *To understand how strategic management, product innovation and consumer value interact within a retail context to deliver upon strategic initiatives of OEMs and deliver value for their consumers.*
- *Can a deeper integration of strategic management, product innovation and consumer value principles better facilitate the uptake of emerging technology?*

As highlighted in section 2.5, figure 5 illustrates the fundamental triad relationship between strategic management, product innovation and consumer value. This relationship defines the purpose of the research presented here and forms its theoretical foundation. Subsequently, the same figure illustrates the fundamental conceptual design for this body of research.

Figure 5: Conceptual Design



The conceptual design illustrated above is intended to show the intersections between strategic, product and value-creation imperatives, thus demonstrating the conceptual linkages that construct this collectively reliant triad. The research design adopted here enables us to trace these conceptual linkages, showing how value, innovation and strategic issues inevitably drive and influence each other.

A qualitative methodology (Lincoln & Guba 1985; Maxwell 1992; Merriam 1998; Schwandt 1997) was selected for this research. While there has been some quantitative work undertaken on the global state of EVs, this research aims to specifically look at the EVs in an Australian context. Particularly, this research aims to uncover suggestions as to why certain Australian consumers may (or may not) feel resistance to this new technology, and where the implementation of a traditional value chain failed to deliver the desired outcomes for strategic managers and consumers alike. Subsequently, such a specified approach required qualitative feedback.

In order to respond to the research question posed in this thesis, further statistical data on the state of the Australian EV market would not yield the relevant insights. Rather, depth interviews with both Australian strategic managers and Australian consumers were needed to provide the rich kind of insights yielded through qualitative data.

4.1 Methodological validity, reliability and limitations

The basis of the method including the research design will be highlighted below. However, in order to ensure the validity of this method the researcher undertook certain steps to ensure the validity of research. Primarily, validity and reliability focus on ensuring that the researcher and others can be confident in the process of the research and the subsequent outcomes. In order to establish validity (whether the research is doing what it promises to do), the research problem along with the research question remained at the forefront of considerations whilst the research techniques highlighted below were investigated. Ultimately, this enabled the researcher to confirm that the data gathered is relevant to the research topic.

The focus on reliability emerged as certain elements became repeatable over time ultimately moving towards a broader concept of dependability (Bradley, 1993). The researcher focused on dependability by ensuring to be consistent in interviews whilst discussing certain themes, constantly reviewing interview audio data and transcripts and cross-checking industry reportage for consistency and accuracy.

The methodology had certain limitations. Importantly, since the focus of this research was on the Australian EV industry, the size of this industry had limitations in who could participate. The amount of industry experts in this field is far more limited than in other countries. Therefore the interviewees (from a management perspective) were selected from a relatively small pool. In some way, this hinders the diversity of respondents since the small industry pool is tightly knit and opinions are often openly shared and discussed. From a consumer perspective, the limitations of consumers wasn't as significant from a quantitative perspective but rather from an understanding perspective. Since EVs have not penetrated the Australian market (a focal point of this research) many consumer respondents were not as familiar with the technical specification of EVs. This naturally would have led to different assumptions among consumers being formed. This may have had an effect on their responses.

The final limitation to point out is the size of the interview data sets. Since the EV market is so significantly immature and small, the decision was made to focus less on increasing the number of interview participants, but rather at increasing the quality and depth of data collected in a more limited setting. This allowed for better data to be generated from the individual interviews, since they were conducted with individuals who were largely valid to provide responses to the subject matter. However, due to the low number of participants, the limitation remains that the research may not be conclusive to make a determination for the Australian EV market, rather an indicative suggestion of the state of the market.

4.2 Research Design

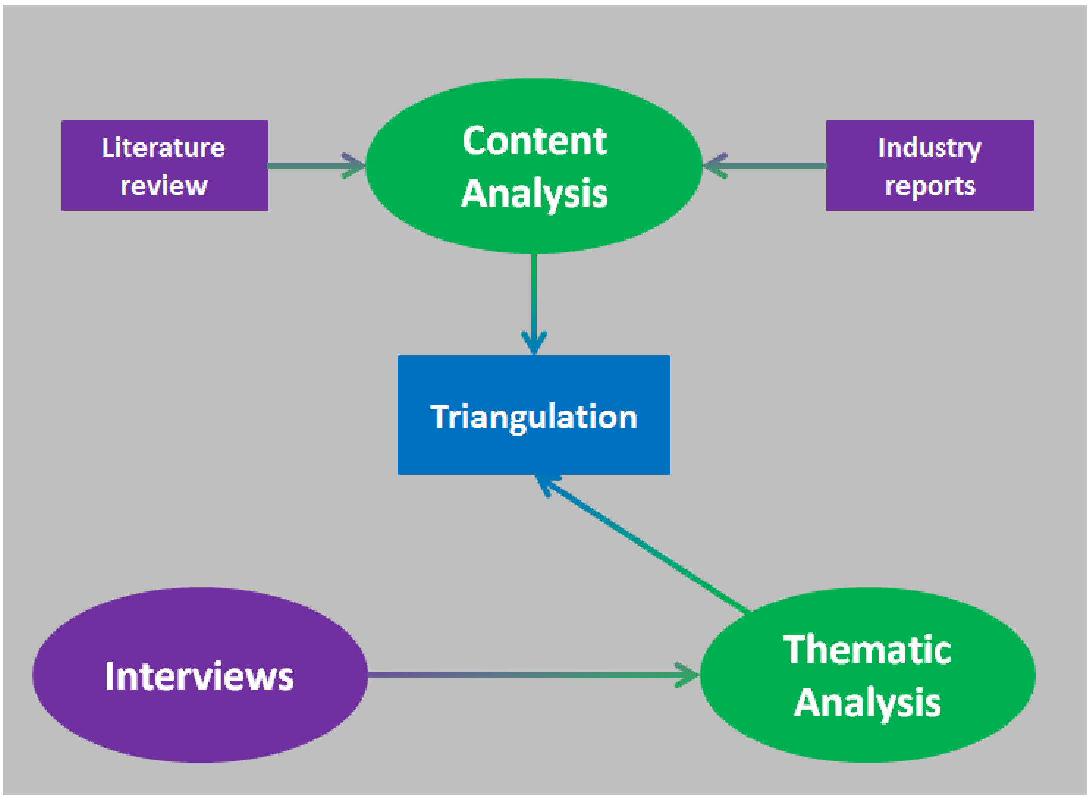
This research was designed in three phases, which involved secondary and primary data. The first phase included secondary data analysis of industry reports including annual reports, market reports, sustainability reports, and so on; the second phase involved depth interviews with industry leaders and consumers; and the final phase was a triangulation of the previous two phases. These data sources were selected in order to provide a broad foundation of information in the context of the Australian EV industry. This broad approach to data collection was particularly relevant since the specific influences and themes were not readily known. The data collection method of interviews was also selected in order to discuss the Australian EV industry with a variety of industry stakeholders and consumers of mixed backgrounds.

Fundamentally, the research design was conducted in a manner to use the subject manner of EVs in the Australian market as a technology reflective of the theoretical theme of product innovation. We would then use the management interviews to reflect the theories of strategic management and likewise the consumer interviews to reflect the theme of consumer value. As a result, the method in this manner would marry the themes of strategic management, product innovation and consumer value.

The analysis began with a content analysis of the industry reportage; when considered in the context of the underpinning theoretical framework, this allowed for the establishment of thematic patterns. Based on these thematic patterns, the depth interviews were conducted with key industry professionals and a broad selection of consumers. The specific questions were formulated on the basis of the thematic patterns uncovered in the content analysis of the industry reportage. The interviews were recorded and transcribed, before later being coded and categorised through themes. A thematic analysis of the interview data was conducted while triangulating the interview data against the already gathered secondary data sources. The triangulation method was used to justify the findings of both the industry reportage and interview data to ensure thematic consistency and validity of research.

A summary illustration of the research methodology structure is presented below in Figure 6:

Figure 6: Research Design



4.2.1 Data collection

The data chosen to form the basis of this research was selected for the primary purpose of providing the most relevant content to the subject matter. The literature review of academic sources was selected to establish a comprehensive understanding of the theoretical concepts surrounding strategic management, product innovation and consumer value. With a theoretical framework established, we could move our attention to gaining an understanding of the actual industry perspective from industry reportage, details of which are covered in the following section. Analysing this industry data, which comes from primarily automotive, energy and government sources, would allow for a greater understanding of the actual scenario currently facing the Australian electric vehicle industry and its consumers. From there the researcher could establish gaps in knowledge, which needed to be answered by the method of interviewing industry professionals and consumers. For this reason, managerial interviewees with accumulated industry experience were selected, to formally extract their opinions and find consistent themes in relation to the subject matter. The consumer interviewees were selected to provide a set of participants that accurately reflects the Australian EV buyer portfolio. This was largely based on demographic data gained from the aforementioned industry reportage. Choosing these data sets would allow for a smooth flow of logic, understand the academic principles, understand the industry position and address the existing gaps in knowledge by interviewing industry professionals and consumers.

4.2.2 Literature review and industry reports

This first data set is a combined review of industry reports and academic literature in the first instance. The amount of industry-based data on the evolution of the electric vehicle industry and the future of the technology is somewhat limited – for two key reasons. First, globally EV uptake and market penetration has been fairly limited. Second, EV technology constantly evolves, so that many reports quickly become less relevant due to the changes in the use case as the technology develops. However, the rate of publications surrounding EVs has been increasing as the technology develops and is becoming subject to more industry analysis. The industry reportage utilised in this research stems from publications from 2009 through to 2017.

The industry reportage was sourced primarily from automotive, energy and government contexts, since these three sectors are key stakeholders in the development of the EV industry. There is a general lack of EV industry reportage from any other sector that is deemed relevant in the context of this research. The publications selected were published in the last eight years (2009-2017), to ensure validity and relevance. The key industry data sources are listed below:

- Automotive industry publications
    - ABMARC 2012, *Electric and hybrid vehicles Australia: An automotive perspective*
    - Bernhart 2015, *e-mobility Index: Q3 2015*, Roland Berger GmbH and Forschungsgesellschaft Kraftfahrwesen mbH Aachen 2015
    - ClimateWorks 2017, *The state of electric vehicles in Australia*
    - Daimler AG 2014, *Life Cycle: Environmental certificate Mercedes-Benz B-Class Electric Drive*

- Green Car Congress 2009, *GM working with communities to develop roadmap for plugin infrastructure*
- KPMG 2014, KPMG's global automotive executive survey 2014
- Mader, T and Bräunl, T 2012 *Western Australian electric vehicle trial 2010–2012: final report*
- McKinsey and Company 2016, automotive revolution – perspective towards 2030
- Simon Kucher and Partners 2016, *Electronic vehicle (EV) short-study 2016: improving consumer perceptions on EVs*

- Energy industry publications
  - Energeia 2015, *Review of alternative fuel vehicle policy targets and settings for Australia*
  - Energy Supply Association of Australia 2013, *sparking an electric vehicle debate in Australia*
  - Energy Supply Association of Australia 2015, *Alternative fuel vehicles: Driving the uptake*
  - US Department of Energy 2012, *Plug-in electric vehicle handbook for public charging station hosts*
- Government reports and publications
  - AECOM 2011, *Forecast uptake and economic evaluation of electric vehicles in Victoria*
  - Dopita, M and Williamson, R 2009 *Australia's renewable energy future*, Australian Academy of Science, Canberra
  - European Commission 2012, *New public-private partnerships for research in the manufacturing, construction and automotive sectors*, Publications Office of the European Union, Luxembourg
  - Fraser Basin Council 2013, *Electric vehicle fleet modelling project*

- Mock, P and Yang, Z 2014 *Driving electrification: a global comparison of fiscal incentive policy for electric vehicles*, International Council on Clean Transportation
- State Government Victoria 2013, *Creating a market: Victorian EV trial mid-term report*

The academic literature was collated from a variety of quality academic sources including digital libraries, various journals, libraries, and so on. The literature was predominantly gathered to identify the key themes from the principles of strategic management, product innovation and consumer value. Once the key themes were identified, the researcher could evaluate which themes to review in more detail, which correlate with the specific research question.

As part of the research design, the first step was to analyse the industry reportage via a content analysis (Carley 1992). This would establish a foundation to gather knowledge on the information already deemed as 'known' and would allow the researcher to identify the specific issues and questions to raise in the interviews in order to dive deeper into the subject matter and extract data relevant to answer the research question.

4.2.3 Interviews

The second data set for this research comes from interviews with industry practitioners and consumers. Interviews were selected as a primary data collection method as they are considered a key tool in qualitative research and remain "one of the most powerful ways we have of understanding others" (Punch 2005, p. 168). Interviews can therefore be deemed key to the researcher's qualitative method approach. Determined by the type of research being conducted, interviews can be formed into three primary structures: structured, semi-structured or unstructured (Punch 2005). Structured interviews are utilised for their consistency across participants, while unstructured interviews allow for the establishment of tangents leading into discussions; they raise the ability for additional knowledge to be transferred but also risk over-complicating the response (Creswell & Plano Clark 2007; Punch 2005). Semi-structured interviews establish a middle ground between the aforementioned structures, drawing on the strengths of both. Although providing the best of both approaches, the semi-structured interview is notably difficult to execute and requires careful planning from the researcher to achieve the appropriate flow during the interview (Smith, Flowers & Larkin 2009).

To address the gaps in knowledge, the researcher conducted 16 interviews with key industry stakeholders and consumers in order to gain further insights into the subject matter. The primary research was conducted in the form of semi-structured face-to-face in-depth interviews (Cooper & Schindler 2008), undertaken with senior managers in the Australian car industry and with Australian consumers. All interviews lasted in excess of two hours, yielding 40 hours of recorded data.

Participants for the managerial interviews were purposively selected for their expert knowledge and experience of the Australian EV market and the industry structures supporting that market. Participants were drawn from strategic management and marketing positions, as well as product development and product management positions. All managerial interviewees were from the Australian electric vehicle industry with extensive experience in the field. At the time of the interviews, they were involved with representing a key company actively involved in the Australian electric vehicle market (such as a global car manufacturer) which has been actively engaged in the development of EVs and/or the services associated with EVs, such as recharging and energy; alternatively, they had explicit experience dealing with global car manufacturers, infrastructure operators or other key industry stakeholders. The full list of managerial interview participants is presented in Table 3 below.

Table 3: Managerial Interview Participant Information

Interviewee	Age & Gender	Industry	Position	Profile
M1	30-44 Male	Automotive	Product Manager	Premium European OEM with active EV portfolio
M2	45-59 Male	Infrastructure	General Manager	Importer and operator of charging hardware
M3	45-59 Male	Energy	Development Manager	Energy utility and EV specialists
M4	30-44 Male	Infrastructure	Director	Importer and operator of charging hardware
M5	30-44 Male	Automotive	Product Manager	Premium European OEM with active EV portfolio
M6	30-44 Female	Automotive	Product Manager	Mass European OEM with active EV portfolio
M7	30-44 Male	Automotive	Product Manager	Mass Asian OEM **without** active EV portfolio

The consumer interviewees were selected in order to reflect the wide spread of new automotive Australian consumers. Therefore, consumer interviewees were of different ages, occupations and socioeconomic backgrounds. However, since the research is centred on consumer attitudes towards buying vehicles, a prerequisite was that the consumer interview participants had purchased a new car in Australia in the past and also have the capacity to do so in the future. Naturally, this resulted in a skew of consumer participants from medium to high socioeconomic statuses.

Subsequently, all consumer interviewees who were selected were ‘first owners’: they have actively bought and owned some type of new vehicle across their lifetimes. This means that at some point in the past they have gone through the consumer decision making process – often on several occasions – and can be considered ‘experienced’ in buying a new vehicle. The interviewees were selected based on referral and researcher discretion was used in order to ensure a significant diversity between the interviewees to reflect the spread of the Australian new vehicle car market.

As a result, reflecting upon Lincon and Guba’s (1985) ‘evaluation criteria’, the consumer interviewee selection is valid to represent this research as they have the experience and means to purchase a new vehicle as and when it may be necessary. Since they have resided in Australia consistently for at least 10 years, their values and beliefs are formulated in a predominantly Australian context. They have had limited exposure to other markets where EV penetration and awareness is more prevalent. They have also been subject to continuous Australian marketing strategies and principles. Their buying habits, perceptions, desires, expectations and requirements are therefore reflective of the typical Australian passenger vehicle market consumer. As a result, the consumer interviewees are subject to the marketing of electric vehicles co-ordinated by the managers of the Australian electric vehicle market – represented by the managerial interviewees discussed above.

Participants classified as consumers were selected on the basis that the entire consumer data set met the demographic profile of the existing Australian automotive market.

That is, in terms of age and life stage, the mix of consumer interview participants in this research reflected the actual mix observed in the Australian automotive industry. Due to the limited size of the Australian EV market and the nature of the research, it was deemed more appropriate to seek participants with an age, gender and life stage mix reflective of the overall Australian passenger vehicle market, rather than specifically the immature Australian EV market. The full list of consumer interview participants is presented in Table 4.

Table 4: Consumer Interview Participant Information

Interviewee	**Age & Gender**	**Life stage**	**Socioeconomic status**	**Occupation**
C1	Over 60 Male	Older single and couple without children in household	Medium to High	Retired
C2	45-59 Male	Middle age single and couple without children in household	High	Director
C3	Under 30 Male	Young single and couples without children in household	Medium	IT professional
C4	Over 60 Male	Older single and couple without children in household	Medium to High	Engineer
C5	45-59 Female	Family of all age with children in household	High	Director
C6	45-59 Female	Middle age singles and couples without children in household	Medium to High	Academic

C7	45-59 Female	Families of all ages with children in household	High	Accountant
C8	30-44 Female	Families of all ages with children in household	High	Artist
C9	30-44 Male	Families of all ages with children in household	High	Barrister

Semi-structured interviews were utilised with both managerial and consumer interview participants to allow for the maximum focus to remain on the key issues at hand. The interviews facilitated the participants' ability to share their expertise from a managerial perspective, and their requirements and expectations from a consumer perspective. Given the high degree of expertise offered by each participant – and the scope of the research thesis itself – it was determined that 16 seminal interviews (seven managerial and nine consumer) would effectively support the industry reportage data sources and yield enough data to both validate the scope of the study and aid in answering the research questions. The purpose of the interviews was to compare the outcomes of industry data against the data of the interviewees and also to elaborate on the industry data in order to gain a rich insight into the issues of consumer value as well as the role of strategic management in the electric vehicle market – which by its nature is a child of product innovation. The interview schedules are presented in Appendix 1 for the managerial interview schedule and Appendix 2 for the consumer interview schedule.

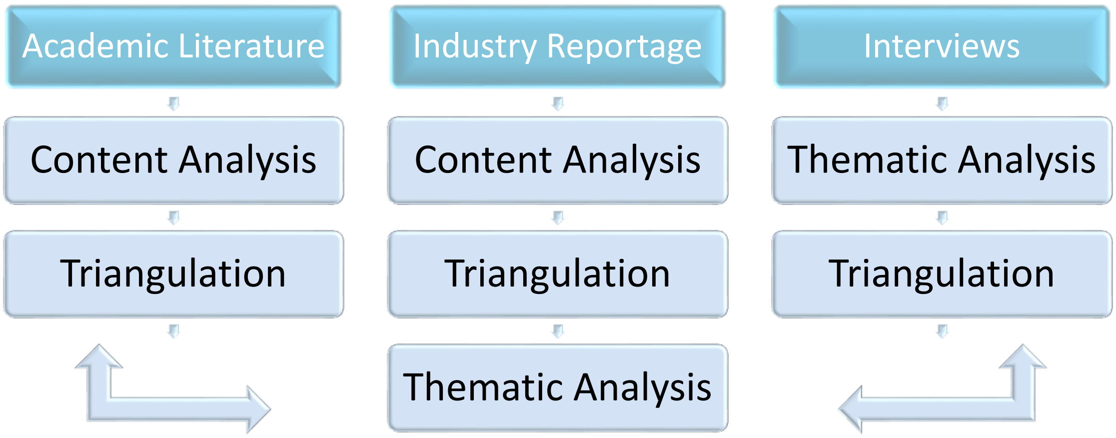
Managerial interviews were conducted in the business setting and lasted between two and two-and-a-half hours. Interviews were recorded, transcribed and then subjected to a thematic analysis. The managerial interviewees were presented with 20 guiding questions over the course of the interview, although discussion ranged well beyond question responses alone. The interview questions were derived from the current understanding of the Australian EV market, gathered from the industry reportage. The questions were designed to compare the results of the industry reportage, provide validity to consistent themes and expose new themes that did not emerge from the industry reportage. This information could then be triangulated against where the current electric vehicle market segment sits in the overall market landscape. The questions then went on to elaborate, in the context of the electric vehicle market: W*here are we now? Where do we want to be? How do we get there?* The interview data indicated common themes and provided a greater understanding of the aforementioned questions.

Consumer interviews were conducted in a close setting in line with the preferences of the individual consumer participant and lasted approximately two hours. Interviews were recorded, transcribed and then subjected to a thematic analysis. The consumer interviewees were presented with 15 guiding questions over the course of the interview. The questions were designed in a manner to establish first and foremost if the interviewees had any awareness of EVs and if so, what were their initial perceptions of an EV. In addition, they were asked what their considerations are when considering making a purchase decision on a vehicle. This information was triangulated against managerial perceptions of consumers and current marketing and product strategies. The questions then went on to elaborate: *Would you purchase an EV? What stops you from purchasing an EV? What would make you more likely to purchase an EV? When and under what circumstances do you think you will buy an EV?* The interview data indicated common themes and provided a greater understanding of the aforementioned questions.

4.3 Data Management and Analysis

The data analysis method undertaken for this research was a content analysis of the secondary data (literature review and industry reports) and a thematic analysis of the interview data. This established an understanding of each data source in its own right. Once an analysis of each individual data source was undertaken, the data was then triangulated via a thematic analysis in order to identify key themes across data sources. Figure 7 illustrates the sources, analytical approaches used and the flow of analysis process.

Figure 7: Data Analysis



Content and thematic analyses are rather similar in their application, but have distinct differences in their utilisation. Marks and Yardley (2004) draw the distinction in suggesting that content analysis is the accepted method of investigating texts, particularly in mass communications research. Most content analysis results in a numerical description of features of a given text, or series of images while a "thematic analysis is similar to content analysis, but pays greater attention to qualitative aspects of the material analysed" (Marks & Yardley 2004 p. 56). Since the industry reportage contained significant quantitative data, a content analysis was deemed more appropriate for analysing this data. However, the primary interviewee data was purely of a qualitative nature, making a thematic analysis the more appropriate analytical method.

4.3.1 Content Analysis

In this thesis, a content analysis was conducted for the industry reportage and academic literature sources. Content analysis (Carley 1992) can be defined as:

> A class of research methods at the intersection of the qualitative and quantitative traditions. It is promising for rigorous exploration of many important but difficult-to-study issues of interest to organizational researchers in areas as diverse as business policy and strategy, managerial and organizational cognition, organizational behavior, human resources, social-issues management, technology and innovation management, international management, and organizational theory. (Duriau, Reger & Pfarrer 2007, p. 5)

In accordance with the use of content analysis, data was coded and inferences then drawn to access the embedded concepts (McTavish & Pirro 1990). Single-word coding was used and the focus was on concept frequency. Once coded and analysed for concept frequency, the industry data and academic literature were triangulated against the interview data to identify common themes, which was subsequently analysed through thematic analysis.

This single-word coding was done manually. The manual approach was nominated over electronic software approaches in order to achieve greater control and allow a deeper cognitive evaluation of the data. This was executed via the use of conventional hard copy means such as highlighting, colour coding and manually taking notes on hard-copy paper transcripts of the interview data. This manual coding approach is supported by Graue and Walsh (1998):

> Touch the data … Handling the data gets additional data out of memory and into the record. It turns abstract information into concrete data (p. 145)

Saldana (2015) also supports this approach, highlighting that even users of electronic coding recommend the occasional use of hard-copy printouts in order to work with traditional writing materials such as red pens in order to allow the researcher to work with data from different perspectives.

4.3.2 Thematic analysis

For this research, a thematic analysis was conducted on the transcribed interview data. A further thematic analysis was undertaken during the triangulation of data in order to identify and interpret consistent themes across data sources. The function of a thematic analysis is to identify themes that emerge as important in the context of the particular area of research (Daly, Kellehear & Gliksman 1997). In order to complete the thematic analysis, there must be a stringent process of reading and rereading the data sets in order to enable pattern recognition within the data (Rice & Ezzy 1999). It is here that once themes emerge, they can be categorised for analysis (Fereday & Muir-Cochrane 2006).

As interviews are the subject matter of the thematic analysis, the first step in conducting the thematic analysis is to record and transcribe the interview. This set of transcriptions forms the data set for analysis. The transcribed conversations are to be used to identify patterns and experiences, which can come from direct quotes or paraphrasing common ideas (Aronson 1995). This was conducted manually in favour of the principles to engage with the data in a more stimulating way and ensure that abstract information was appropriately coded into a concrete data theme (Graue & Walsh 1998; Saldana 2015). The themes that emerged from this analysis were continuously grouped and regrouped until the final primary themes emerged as concrete.

A thematic analysis is further built on by splitting related patterns into sub-themes. These sub-themes may seem meaningless when viewed in isolation, but when grouped together they form a comprehensive picture of the subject matter being studied. As the sub-themes are established a pattern often emerges, which can be used to seek feedback from the respondent, which can be utilised to provide a more concrete perspective on the qualitative data (Leininger 1985). The sub-themes emerged from the data after the primary themes had been grouped and form a comprehensive element of this body of research.

The thematic analysis will be used in this body of research to understand what it is strategic managers must influence in order for new electric vehicles to have value for consumers. The themes that emerge from the thematic analysis will be further considered in the discussion chapter.

4.3.3 Triangulation

For this thesis, individual data sources were analysed individually and then triangulated for subsequent thematic analysis. By triangulating the data as part of the research design, the multiple data sources combine to strengthen the research (Jick 1979; Punch 2005). Ultimately, utilising triangulation promotes "a more complete, holistic and contextual portrayal of the unit(s) under study" (Jick 1979, p. 603).

As per Lincoln and Guba's (1985) 'Evaluation Criteria', triangulating the data validated and strengthened the analysis in terms of the credibility of the research data gathered from the interviews. By triangulating the interview data against what was derived from industry reports and the literature review, the researcher could draw on the opinions and perspectives of several investigators or researchers from different perspectives, times and locations (Golafshani 2003).

In the context of this research project, the interview data was triangulated against themes extracted from industry reportage and business documentation. This data was also triangulated against previous academic research covered in the literature review. This method of 'investigator triangulation' allowed consideration of the ideas generated by previous researchers studying the same subject matter (Johnson 1997). The literature strongly supports the use of triangulation as an analytical tool to strengthen a study, as triangulation enables the combination of different methods or data, including both quantitative and qualitative sets (Golafshani 2003; Johnson 1997; Mathison 1988; Patton 2002).

The analysis of the research data, as described in this methodology chapter, will be presented in the following four analysis chapters.

Chapter 5 Analysis – Overview

Due to the extent of content uncovered in this body of research we begin with an overview chapter of the overall analysis. This chapter aims to provide an overview of the outcomes of the analysis in order to clarify how the data relates in the scheme of both the subject matter of the research and the theoretical nuances of the relationship between strategic management, product innovation and consumer value.

The academic focus of this research is to better understand the correlation between the three domains of strategic management, product innovation and consumer value, which frame the findings of Chapters 6, 7 and 8 respectively. The research aims to better understand the correlation between these three themes by focusing on their application in the context of the Australian electric vehicle market. As outlined in the methodology, the research will take the form of analysing data sourced primarily through interviews with both strategic managers and consumers. A thematic analysis (Aronson 1995; Daly, Kellehear & Gliksman 1997; Fereday & Muir-Cochrane 2006; Marks & Yardley 2004; Rice & Ezzy 1999) is implemented in this study. However, in order to justify the depth of certain themes and strands of thought, some of the industry literature presented in Chapter 2 will be triangulated (Jick 1979; Punch 2005) against the interview data to provide further depth and aid in achieving research validity (Lincoln & Guba 1985).

The findings from the face-to-face interviews will be presented in three separate chapters, each one of which will focus on one of the three overarching academic strands of strategic management, product innovation and consumer value. Each academic strand is then split to present the primary themes that emerged from a thematic analysis of the interview data. Each academic strand presents two primary themes, resulting in the presentation of a total of six primary themes. These six primary themes are: 1) Government support and policy; 2) Awareness and communication; 3) Product compromise; 4) Total cost of ownership; 5) Consumer perception of new technology; 6) New value and image. These themes were consistent between the managerial and consumer interview data.

The managerial interview data consistently highlighted the sub-themes of range, charging and price across all the primary themes. This highlighted that managers generally linked the issues of EVs specifically to product-related issues (range, charging and price). Table 5 illustrates the core themes and sub-themes applicable to the managerial interview data.

Table 5: Managerial interview data

Academic themes	Primary themes	Managerial Sub-themes		
		Range	Charging	Price
Strategic Management	Government support and policy	– Policy to support the development and implementation of longer range EVs	– Investment into public charging infrastructure – Policy to support rollout of charging infrastructure – Policy to support research in technological development of charging	– Fiscal policy to support the purchase and use of EVs – Fiscal policy to penalise the purchase and use of ICEVs – Non-fiscal policy to create additional value in EV ownership
	Awareness and Communication	– EV range limitations and the actual implications and potential benefits compared to ICEVs	– EV charging options (at home, at work or public) – Refuelling time and frequency (EVs v ICEVs)	– Higher purchase price for EVs v ICEVs – Additional value of EVs v ICEVs

Consumer Value	Customer perception of new technology	– The limitations of EVs in range compared to ICEVs. – Range anxiety and its implications on consumer behaviour – Consumer range expectations	– EV charging options v conventional petrol station locations – EV charging time v ICEV refuelling time – Charging at home and its value	– Perceptions that shape the value equation if an EV is more or less valuable – EV price premium and consumer expectations
	New Value and Image	– New EV products with more range can enhance the scope of value	– Choice of refuelling time, day and location – Control over fuel expenses	– EVs deliver functionality and capability that cannot be purchased on ICEVs – EVs can deliver contemporary consumer values that an ICEV cannot
Product Innovation	Total Cost of Ownership	– If the range requirements meet the use case, government and business can focus on cost benefits	– Charging: a reduction in operating costs	– Purchase price is the predominant influencer on the TCO equation – The role TCO plays in driving a logical consumer purchase decision
	Product Compromise	– EV range limitations and comparative compromise	– EV charging duration and locations versus ICEVs	– The established compromises and the EV price premium

The consumer interview data provided sub-themes that were far more varied than those presented in the managerial data; various unique sub-themes emerged from each primary theme. These were generally less product-related, and highlighted more diverse concerns and reasons for certain consumer actions. Table 6 illustrates the same construct but in relation to the consumer interview data. The tabulations provide an overview of the key points raised in the analysis chapters.

Table 6: Consumer interview data

Academic themes	Primary themes	Consumer Sub-themes	
Strategic Management	Government support and policy	Economic influences on consumer choice	Convenience and non-fiscal influences on consumer choice
		– Government policy increasing the economics of EVs has an advantageous effect – Government policy increasing the cost of ICEVs can entice consumers towards EVs	– Consumers value policy that gives exclusive benefits to EVs – Convenience features often valued and preferred above fiscal advantages
	Awareness and Communication	Low consumer awareness due to lack of communication	The role of information in the consumer product evaluation
		– Low overall awareness of EVs among consumers – Lack of knowledge due to no communication or education from OEMs, government or other channels	– Consumers require information on products to make a decision, especially with new products – Consumers will avoid products that they cannot understand
Consumer Value	Customer perception of new technology	A promising consumer technology for the future	Current state of the technology has too many limitations for consumers
		– Consumers see EVs as a product of the future – Consumers can see themselves driving an EV in the future and do not oppose the technology	– Consumers are not convinced by the current EV product – Consumers would opt to wait for the technology to mature before deciding to adopt it
	New Value and Image	Environmental consciousness: a contemporary consumer value	Public image - a limited consumer value
		– Consumers have genuine concern for the environment and take value from products with a low environmental impact	– Consumers hold little to no regard for their public image and how an EV may affect their public image

<table>
<tr><td rowspan="3">Product Innovation</td><td>Total Cost of Ownership</td><td colspan="3">– TCO is a critical factor considered by consumers in their purchase decision

– Consumers are open to EVs if they can reduce their TCO while still meeting all their other ownership requirements</td></tr>
<tr><td rowspan="2">Product Compromise</td><td>Range</td><td>Charging</td><td>Price</td></tr>
<tr><td>– Consumers expect an EV to travel the same distance as what they are used to in an ICEV</td><td>– Consumers have concerns with the lack of public charging stations in comparison to petrol stations

– Consumers are uncertain about long charging times</td><td>– Consumers are unwilling to spend more on an EV than an ICEV

– Consumers expect the same from an EV as they get from an ICEV</td></tr>
</table>

The findings elucidate that EVs are limited by *range* and cannot travel as far as ICEVs, they take significantly longer to *charge* (or refuel) than ICEVs and are hindered by the lack of *charging* locations in comparison to conventional service stations. The EVs also have a significantly higher *price* when contrasted to comparable ICEV models, thereby introducing issues of value. These key and repeated factors are reasons why EVs have a limited consumer appeal and in turn minimal market penetration.

While these product-related issues are central to the analysis as they consistently emerge throughout the data, the analysis will uncover key differences in how managers and consumers will overcome these issues. The analysis will showcase how some managerial approaches do not reflect consumer expectation. This will ultimately suggest and support the principles of this research: that a more integrated approach is required between strategic management and consumer value, in the context of product innovation. Chapters 6 through to 8 will dive deeply into the detailed analysis of the data before the outcomes are discussed in Chapter 9.

Chapter 6 Analysis – Strategic Management

The thematic analysis of interview data uncovered several themes that relate to the core theoretical field of strategic management. Primarily these are government support and policy; along with awareness and communication. These themes emerged from both the managerial and consumer data sets. However, as the analysis will uncover, the perspectives of managers and consumers varied. In particular, what managers deemed to be the consumer's opinions and positions on certain topics did not reflect the actual consumer positions and opinions. This chapter will explore these perspectives along with the relevant sub-themes.

6.1 Theme 1: Government Support and Policy (Managerial data)

A key theme that emerged from interviews with managers was the impact that government had on the take-up of electric vehicles, particularly, via government policy and both financial and non-financial support measures. We consider Government support and policy as a strategic management theme because it is a significant part of the external environment of managers that influences their corporate decisions.

The managerial interview data identified several levels of government support and policy as having an influence on the take-up of EVs. These included: emissions controls, financial incentives, various non-financial incentives, education and placing restrictions on ICEVs.

In the current market situation, managerial participants discussed how emissions controls from the government are forcing OEMs to develop their products to be more efficient. For example, M1 stated:

> With emissions standards across the world, not just in Australia, emissions are getting a lot stricter. There's more emphasis from the government on 'green' vehicles, and basically how vehicles affect the local environment and/or the emissions standards within the Australian market. We envisage that platforms such as 'our EVs' [undisclosed] and electric mobility will increase over time.

Governments are also looking at new ways to further enhance sustainability and promote better living to their citizens. M2 identified this trend in nominating:

> Clean air initiatives and noise initiatives around urban and city areas. Local and state governments will say, "We want cleaner air, we want quieter cities," and that will force alternative transport in the cities.

It is further highlighted that, as we move into the future, policy must evolve to facilitate future mobility in the major urban centres of tomorrow:

> There's a lot of change around major cities; there's a lot of change in populations in major city hubs. Moving those people around, not just on public transport but in their own private transportation, is going to be a challenge. That's a challenge that needs to be taken on by not just governments but also vehicle manufacturers to develop a product that suits their particular requirements around these larger city hubs with quite a large population in such a dense and small area. (M1)

The industry literature also accurately reflects consistencies in the managerial interview data:

> Penetration of electric powertrains would most likely be led in dense high-income cities, which have a well-established car base, increasing regulatory pressure against vehicle emissions, and where the cost of technology features represents a lower proportion of income. (McKinsey and Company 2016)

Recognising that government does have a role to play in helping the adoption of EVs in Australia, and in light of the limited action in Australia from government, we must also look at the effects of overseas government policy on EV uptake.

> When you see government support, particularly in the USA and in Europe, and they're focused on looking after the environment and promoting the development of new technology – there's not that drive here in Australia at the moment. (M3)

> If we look at Europe we see that EV adoption is far higher in countries that have significant tax benefits. In those markets, people are buying EVs for the tax breaks because it makes that car cheaper for them than a normal car. (M6)

Several respondents further highlighted the comparisons drawn between overseas policy and Australian policy:

> It's interesting, when you start looking at policies from government and so forth, and lack of subsidies when we see what's going on overseas, there could be a lot more support for new technology coming in; and there's opportunities, as we see it, going forward to help work with governments to help them decide which way they should be going around all this new innovation. (M3)

> As we can see from other markets, government support and policy is very important [in driving the take-up of EVs]. Unfortunately, in Australia there is not a lot of initiative happening at this point in time. You could also see, if you look at general CO2 emission targets, obviously Australia is very far behind there as well, and that might just be the reason why they are not going in the direction of supporting EVs at this point in time. (M5)

> A big factor behind governments offering EV tax benefits are CO2 emission standards. In Australia, we don't have any reduced CO2 standards or goals [comparatively to Europe and America], so there's no need to offer incentives. (M6)

> Australia compares very poorly, compared to other first-world countries, and especially other OECD nations that are serious about reducing their dependencies on fossil fuels and reducing vehicle emissions … the Netherlands are planning to ban the sale of new petrol and diesel cars from 2025 and France currently has the ban of petrol cars coming into the city [e.g. Paris] that are built or registered before a certain date and they'll go into more bans into the future. That kind of support from the government guarantees the success of EV introductions going into the future. (M7)

The lack of Australian policy to support the uptake of EVs, by comparison to some overseas markets, can be attributed to a lack of strategic vision:

> The lack of incentives is one thing but it's actually more than that. The reason EVs have been so successful in California, Norway and China is because the government actually has a vision over there of what they want their transport system to be. They actually say to their constitutions and voters, "We want to

> move towards a zero vehicle emissions future and these are the reasons we are giving you these incentives." By outlying the vision, it makes people more willing to adopt EVs. (M4)
>
> The Australian Government needs to take a leadership role. The Australian Government really hasn't done anything to back up the introduction of new technologies with educational campaigns, industry support and especially financial support for infrastructure that's required for the future. We don't have in Australia – whether it be for EVs or FCEVs [Fuel Cell Electric Vehicles] – a roadmap. We don't know where we need to allocate stations, dependent on the demographics and the people that buy these vehicles and the future of the companies that run these vehicles. We don't have anything set in stone that says, "This is where the mass take-up is going to be and this is the infrastructure that's required in those inner city and outer metro areas, whether that be for EVs or FCEVs," and most other countries have got that! (M7)

Industry data addresses the correlation between a lack of government initiative and a lack of consumer uptake. A study conducted by Simon Kucher and Partners (2016) found:

- Only 20 per cent of Australians had driven an EV compared to 35 per cent in Germany, 35 per cent in France and almost 60 per cent in the USA
- Less than 50 per cent of Australians would consider purchasing an EV in the near future compared to 60 per cent in Germany, 60 per cent in France, 75 per cent in the UK and 80 per cent in the USA.

The challenges of EV adoption in Australia are recognised as extremely difficult, yet these challenges open the door to establish an achievable global benchmark in government policy surrounding EVs:

> What we do has to be tailored to our unique population and geography. This is a very hard market, probably one of the hardest markets in the world, Australia, to make this work [EV adoption]; with our small population and huge distances … if it can work here, it can work anywhere in the world! (M2)

Globally, emission controls are becoming stricter for OEMs as a result of government policy. Subsequently, it is natural for OEMs to start allocating resources to develop more efficient technologies such as EVs in response to these policies. However, M1 highlights that it will take more than stricter emissions controls to help stimulate the take-up of EVs in Australia:

> We definitely see the electric vehicle market growing….[but to support the growth] it will really take local initiatives from government, public enterprises and private businesses.

This highlights the need for appropriately flexible and forward-looking government policy, but simultaneous collaboration between government and EV businesses:

> OEMs need to promote awareness – not just on the consumer side but also on the government side as well – to create incentives and really make the consumers feel that this is the next biggest thing in mobility and really start to adopt the technology and embrace what EVs offer. (M1)

The industry literature also supports the benefit of successfully engaging with government around the emergence of EV technology. If government were to support EV technology in some capacity there could be inherent economic and social benefits:

> Electric vehicles … delivered increased economic growth and employment in Australia by substituting away from imported energy supply towards domestic energy supply. The net result of this was to increase growth and domestic employment. This also increased Australian energy security by reducing reliance on imported fuel supplies (Energia 2015).

At the same time, adopting a 'do nothing' approach could have adverse implications, whereby:

> Over the 20 year study period, the 'do nothing' policy scenario for EVs would result in:
>
> - A net economic cost of $368 million over 20 years to the Australian economy
> - The loss of a potential additional $878 million Gross Value Added (GVA)
> - An additional 17,407 TJ of imported fuel
> - An additional 2,299 kt CO_2e valued at $42 million
> - An additional $16.3 million in health related costs as a result of local air pollution… (Energia 2015)

Thereby, this section of the analysis has begun to uncover the managerial perception that government support and policy is critical to the take-up of EVs. In particular, it is identified that the current lack of government involvement, compared to other regions such as the US and Europe, has resulted in significantly lower EV uptake in Australia than in those regions.

The latter part of this section will dive deeply in the recurring sub-themes of range, charging and price. These sub-themes emerged in relation to the primary theme of government support and policy.

6.1.1 Sub-theme 1: Range

Government support and policy play a role in increasing the driveable range of EVs. As outlined above, government policy is already in place to drive OEMs to develop more efficient vehicles:

> With emissions control standards in Europe, becoming stricter, it's really positioned manufacturers to really develop their vehicles … Government regulations [are in place] to try and get some control over emissions, pollution and climate change [and these policies] are driving the development of vehicles. (M3)

The major technological product development that EVs require is the improvement of the vehicle range. This is dependent primarily on improvements in battery technology:

> Battery chemistry is a moving thing; when we can have denser cells that can store more energy and deliver more range that will help the value proposition. (M2)

So in the quest to aid the adoption of EVs, governments need to shape policy and outlay their support to help drive these product innovations. Interviewee M3 accounts for this proposition by recounting a direct Australian example:

> In Queensland, there's work going on with nanotechnology and the development of the anodes for EV batteries, to the point that they're saying within the next 12 months we could see a battery that will charge 20 times faster, have higher density, travel further and last three times as long as the standard lithium ion battery – now that's Queensland doing some work! So, it doesn't take much to realise that a bit more support behind these guys could see them on the cutting edge of being able to export this kind of technology to the major manufacturers.

When asked if this technology would be more successful in going to market if it had government support, interviewee M3 responded:

> Absolutely, because that gives more momentum! If they have more dollars to spend on hiring smart people to accelerate the testing and development of these technologies, then it can come to market faster; it's self-perpetuating!

Thereby we can identify the relevance of government in driving improvements such as vehicle range.

6.1.2 Sub-theme 2: Charging

Government support around rolling out charging hardware in public places was widely recognised as a key support strategy to help promote the Australian EV industry:

> Government is probably the key driver to implement public awareness. Once governments start getting on board with EV technology, by mainly putting in charging stations around local residential areas and public places, the general public and actual consumer sees this infrastructure and questions come out of this: “What is this?” and “What is this new technology and how do I learn about it?” That, I think, is really influential in the adoption of this technology within the mainstream passenger vehicle market. (M1)

Government support for EV charging infrastructure is not such a foreign concept in Australia:

> We see governments such as the Victorian state government implementing certain charging facilities in universities, shopping centres and public places to really support the growth of electric mobility within Australia. (M1)

However, this one small example is not enough to stimulate any significant change on its own, in particularly when comparing to activities being undertaken overseas. When asked to compare EV charging infrastructure in Australia to the rest of the world, M1 responded:

> Europe as a whole is very much on board with EV mobility, down to the fact that they have public charging stations in public streets around residential areas, close to city hubs. They also have charging points in public places such as shopping centres … that could be influential to the Australian market…

This comparison is also further supported by M3, who commented:

> Looking at the Norway test case: the government and local governments are focusing on building EV highway corridors; that’s supported with DC fast

> charging. So people who need to do a longer trip, they know within 50 kilometres they can pull into a roadside stop and do a quick charge-up and get another couple hundred kilometres worth of charging. (M3)

Although overseas examples are provided to illustrate the success of government support around EV charging infrastructure, the interviews also highlighted that, in the Australian market, such a project is a lot more difficult to execute:

> California and the Netherlands are dense populations. California has twice the population of Australia, in something the size of Victoria. A dense population in a small geographic makes infrastructure relatively easy to roll out, and as such makes it very prevalent. (M2)

Australia, on the other hand, is geographically far larger than these overseas markets, with a smaller population, making the rollout of EV infrastructure more problematic. As such, we can again see the relevance of industry working with government in order to shape policy to support EVs. Ultimately, these forms of collaboration can foster the success of the technology in the market, serving the desired outcomes of both OEMs (that is, vehicle sales) and government ($CO2$ reduction). The interviews highlighted that a functional strategy needs to be implemented to

> [s]ee how we [industry] can help support them [government] to get new policies going around the take-up of these new technology vehicles and infrastructure support. (M3)

One such way is to spread the responsibility across various industries beyond conventional automotive and government industries, via clever policy:

> Developing building codes can assist and help address the infrastructure question … At planning levels, new building designs must incorporate EV charging into the building codes or car park design codes. (M2)

> Let's offer incentives to employers to install charging infrastructure for employees. Let's remove congestion levies for parking spots that have access to a charging station. Let's develop policies that encourage third parties to offer charging infrastructure. (M4)

The industry reportage supports the relevance of charging, recognising that:

> Higher levels of charging infrastructure significantly increase the take up of plug-in electric vehicles and hence increase the viability of the market. (AECOM 2011)

This section has again highlighted the relevance of government support and policy to tackle product-related issues such as charging.

6.1.3 Sub-theme3: Price

Pricing of EVs is another relevant theme that emerged from the interviews with managers, because EVs demand a far higher purchase price than ICEVs. The large majority of managers suggested that government needs to provide support to reduce the price of EVs compared to ICEVs, to help improve the value equation for customers in owning an EV.

> The most effective form of support usually would be *dollars* – that's usually very helpful – so, monetary incentives. (M5)

> There's no tax incentives, there's no free parking, there's no reduced registration. Unfortunately, most of the vehicles that have the best technology fall within the luxury car tax as well. So people get penalised for buying green technology because it's perceived to be luxury technology. (M7)

> There needs to be push and pull incentives – cash incentives to discount the cars or give the buyer a grant. (M2)

> Subsidies in the form of direct cash incentive would obviously go a long way to help accelerate the take-up of EV; but let's also focus on reducing other costs via stamp duty reductions and registration costs. (M4)

> Subsidies! That's what you see in markets where the uptake [of EVs] is pretty high – there are a lot of other monetary advantages – and the higher those are, to possibly even fill the gap for the price premium compared to ICEVs, that's very important. (M5)

While the data identifies cash incentives as an effective way to tackle the high price of EVs, there are other ways governments can increase value beyond direct financial incentives. These are initiatives that focus on providing additional entitlements to EV owners to which conventional ICEV owners would not be privy.

> Privileged stuff like parking, usage of bus lanes, et cetera, for EV drivers … just imagine you can use the bus lane on the way to the airport when there's a traffic jam; I think a lot of people will really value this as an additional benefit. (M5)

> There's no government support in our country whatsoever, so we're not getting the mum-and-dad buyers that drive from Sydney to Dural, or Sydney to Penrith

> or Campbelltown, that can use bus lanes. So there's no priority lane access like there is in California. (M7)

> Also give them [EV drivers] non-cash incentives such as preferential city parking. (M2)

> Take the UK: using bus lanes and taxi lanes, there's advantages there; parking as well. There's additional value for all those things when you own an EV in that market. (M5)

While these non-cash incentives do not lower the price of an EV, they do generate additional benefits for the consumer. This in turn creates additional value and to some degree offsets an element of the higher purchase price, reducing the price burden of an EV upon the consumer in exchange for additional value.

The actions of government in increasing value for EVs by other direct cash incentives or non-fiscal incentives have shown much success overseas:

> Successful EV markets such as California and the Netherlands were both stimulated in part by grants to the purchaser. (M2)

> We have seen evidence in the USA from their support to transition to more efficient and lower emission vehicles, with the federal government throwing in a $7,500 subsidy for EVs … and you get other state governments, like California, that will offer another $2,500 if you buy one of these vehicles. So, government support will help the introduction and take-up of these vehicles. (M3)

The industry data equally highlights the benefit of government support in stimulating the take-up of EV technology:

> Norway's fiscal incentive of about 11,500 EUR per BEV (equivalent to about 55% of vehicle base price) is associated with a 6% market share for BEV in 2013, and a 90% market share increase from 2012 to 2013. Similarly, the fiscal incentive in the Netherlands of about 38,000 EUR for PHEV (equivalent to about 75% of vehicle base price) in 2013 is associated with a 5% market share for PHEV in 2013, and a 1,900% market share increase from 2012 to 2013. (Mock & Yang 2014)

Subsequently, we can identify that the existence of government policy, in particular policies that incentivise EV ownership, is a key part in accelerating the take-up of EVs. However, interviewee M2 points out the non-existence of similar policies in Australia:

> We see other parts of the world where there are incentives: push incentives, pull incentives and also non-cash incentives such as transit lane access. There's none of that here [Australia] … there won't be any incentives in the foreseeable future.

When asked if penalising ICEV owners will have an effect on EV uptake, in lieu of direct EV incentives, M2 responded:

> Incentivising is a better model than penalising; policy makers should observe the effects of incentives before considering penalising ICEVs. (M2)

Ultimately, the best strategy to overcome the price gap is to provide more benefits to consumers in owning an EV than an ICEV:

> Governments, with green vehicle incentives and various consumer incentives for the purchase of these particular cars within a market, are one of those things that can influence a customer's purchase decision, to purchase an EV … in the

> USA they subsidise the purchase of the initial vehicle but also the ongoing use [costs] of the vehicle, such as registration, insurance costs, et cetera. So customers are benefiting from not only the benefits that come from an EV, such as the efficiencies and cost savings in mobility, but also the mandatory costs, such as registration and insurance. So governments have a role to play in incentivising this particular technology, to ensure customers are aware and approve of this particular technology. (M1)

The influence of government is uncovering strategic imperatives for OEMs to work with governments and other firms to help drive the integration of new products into market:

> With the industry evolving from competition among individual players towards new competitive interactions, but also partnerships and open, scalable ecosystems, OEMs, suppliers, and service providers need to form partnerships across and beyond the industry. They need to benefit jointly from sharing the costs of electric and autonomous vehicle technology and the necessary infrastructure. Those partnerships should also engage governments to develop regulation and architectures for new mobility solutions together. This also extends to joint efforts in public outreach for consumer education on the benefits and challenges of new technologies. However, despite collaborative efforts, OEMs in particular need to maintain control over their individual value creation and success in the emerging ecosystems. (McKinsey and Company 2016)

> Partnering is especially important in the current economic crisis as the squeeze on public and private investment in research and innovation means that Europe

> must use existing resources even more effectively. (European Commission 2012)

Ultimately, in terms of the strategic management perspective, the theme of government support and policy is largely dictated by a consensus that in order to facilitate the take-up of EVs, government involvement must be present. The relationship between OEMs and government is highlighted as critical where the success of EVs in Australia is predicated on building a platform which is supported by an open collaboration between OEMs and government.

6.2 Theme 1: Government Support and Policy (Consumer Data)

The above managerial data has highlighted the importance of government support and policy to promote EVs: it creates additional value for the consumer; and helps overcome key barriers. Pairing this managerial perspective with the consumer data below, we see that there is a correlation between the management and consumer perspective. However, while both identify government support and policy as relevant, there are less product-related concerns for consumers. Rather, they see the role of government support and policy is to accelerate consumer choice (with an economic consciousness); they highlight the importance of convenience and suggest how non-fiscal incentives from government can create additional value in favour of EV ownership. Therefore, this section will discuss the consumer perspective on Government support and policy by exploring the two sub-themes of:

1. Economic influences on consumer choice; and
2. The role of ‘convenience’ and non-fiscal influences on consumer choice

6.2.1 Sub-theme 1: Economic influences on consumer choice

The consumer data highlighted that when considering the purchase or ownership of a vehicle, economics (such as pricing) is a primary consideration in the overall purchase decision.

> Pricing is always a factor, yes of course… (C1)

When asked what effect fiscal incentives would have on the likelihood to purchase an EV, there was a broad acknowledgment that such incentives would increase the interest and consideration of an EV in the overall vehicle purchase decision:

> Yes, sure. It would improve the economics, wouldn't it? If there were government incentives, if there were financial incentives, for owning an EV as opposed to an ICEV… (C4)

> If there was government incentive it would certainly increase my interest… (C1)

> Government support would be another reason to go for an EV. At home, we went and got solar panels because the government put in rebates and incentives to get the solar panels. If those rebates weren't in place, we wouldn't have even considered it because at the time it was quite expensive. The same with electric cars: I guess if there were incentives or rebates from the government, that would help in the decisionmaking process. (C3)

> If there was no ongoing running cost like rego it would probably make it easier [owning one]. It would make it more attractive over a normal car, yes, definitely. (C2)

> It [government incentives] would definitely affect my decision, absolutely. (C7)

> Oh definitely, great idea [government incentives] … if that brought it down to being competitive … if you bought it, with tax concessions, down to being similar (priced), I'd consider it! (C8)

The consumer data highlights the positive effect fiscal incentives would have on increasing consumer interest and consideration to purchase an EV. However, the degree to which it would positively influence the consumer purchase decision varies. One such response highlighted that fiscal incentives do influence their decision somewhat, but would not be the most important variable in the vehicle purchase decision:

> Government grants to reduce the price would be a factor in my consideration, but it wouldn't be a primary factor. (C2)

While there is strong support across the consumer and managerial data for the view that government incentives would increase the consumer desire of owning an EV, elements of the consumer data highlight that this perspective is not unanimous, and that not all consumers can, or will, be influenced by fiscal government incentives:

> No, it [fiscal government support] means nothing to me … I think a lot of us these days are a bit over the nanny state, the nanny country we live in, and I'm fed up with governments trying to force us into behaviour changes because they think it's a good idea. (C5)

> No, because I don't trust them [the government] at all … I don't want to be forced into doing something I don't want to do! (C6)

Therefore, while the large majority of consumer participants agree with the management perspective that government support is relevant and beneficial, there are consumers who disagree with this notion. This begins to highlight a rift in the data between managerial and consumer perceptions.

One side of government support and policy that increases the economic viability of an EV comes in the form of fiscal incentives for EVs. However, there is also the possibility for government to impose fiscal penalties on ICEV models in order to increase the economic desirability of EVs; this could come in the form of additional taxation for ICEVs. This method of stimulating EV uptake received mixed reactions. The data suggests that taxation penalties on ICEVs would not be well received by the broader majority of the population, as an ICEV is currently the most predominant new vehicle technology:

> I would want to see incentive [for EVs] and not penalties on ICEV. It's unfair. If you want to introduce new technology, you got to make it palatable; but you can't make it palatable by punishing the existing system. (C1)

While the data highlights resistance to taxation penalties, the data does fundamentally highlight that any additional taxation penalties on ICEVs would sway desirability to EVs that were not subject to that tax. Primarily, this sway in consumer preference is associated with economic advantages:

> Taxation penalties making a normal car more expensive would sway my interest towards an EV. (C3)

> That [taxation penalties] would definitely affect my decision, absolutely; getting penalised for not having an EV would push me to get an EV. (C7)

This section therefore highlights that the economics of vehicle ownership can sway consumer preference in the acceptance of a particular technology or product. However, this position is not as unanimous as the managerial data and perspective led us to believe.

6.2.2 Sub-theme 2: Convenience and non-fiscal influences on consumer choice

The consumer data also highlighted the role and positive effect non-fiscal incentives would have on the consumer purchase consideration of EVs. The consumer participants positively received the concept of government policy which would allow EV owners to access ‘special privileges’, such as preferential parking and access to transit lanes. The data suggests that these ‘convenience’ features provide consumers with a value that they would otherwise not be able to attain while owning an ICEV.

When asking consumers about the effect of non-monetary government policy, such as EVs gaining access to bus/transit lanes or preferential city parking, there was a positive reception:

> That would influence me more than taxes, absolutely! Absolutely, because it’s a freaking nightmare to get anywhere in this city! The CBD is an absolute nightmare, parking in the CBD is a nightmare, traffic is a nightmare, it’s horribly diabolical! And if the purchase of a car would allow me an easier transition, I would be there in a flash! (C5)
>
> If there were special privileges to own an EV compared to an ICEV then I would consider purchasing one. (C3)

> It would be an excellent idea to have reserved lanes on major arteries, like bus lanes, for peak hour. (C4)

The above data identified that among the interviewed participants, special privileges would significantly increase the practicality and usability of EVs for each individual. Since these special privileges result in an increase in convenience, the data suggests that among the interview participants, convenience is a core value in vehicle ownership and usability:

> I would prefer this to monetary incentives. Convenience, at my age, is a little bit higher rated than a few dollars in the pocket more. Quite often I take a taxi to get to town even if it costs me more but I know I'm there in 10 minutes, I'm not sitting in traffic for half an hour. Again, that's convenience versus money; that convenience is very valuable to me, very much so! (C1)

> I would only consider purchasing an EV over an ICEV if it was more convenient … and as practical! (C2)

> That would be a plus. That's the very reason I ride a scooter: just because it's easier with bus lanes and parking. It's just time; time is just so critical! With my scooter I save an hour coming home at night; that's a huge thing because that's family time, that's important, it's critical … if I could have that in a car, I'd value that. (C9)

These special privileges, which are exclusive to EV drivers, appear to be so valuable to consumers that some participants stated they would even pay more for an EV if it came with these additional convenience features:

> If there was any benefit, I would take it; regardless if it’s money or a non-financial benefit. I would even pay more for the car – but it depends on how much more. If the price was five thousand more compared to an ICEV, then possibly yes, but if the price was double or triple, then most likely no. (C3)

> To be honest, I don’t drive anymore in the city. I very seldom use the car unless I’m going long distances, because I can’t stand the traffic and I can’t stand the parking and it drives me nuts! So I prefer to walk and take public transport; it’s just easier. If an EV would be exempt from all those horrible things, I’d be there! I’d get it! That would be a huge significant driver for purchase for me! Convenience, absolutely, convenience! I would pay a price premium for that, particularly if that came with tax cuts, but I wouldn’t do it for tax cuts on its own. I’d do it for tax cuts plus the set of criteria for convenience, so the two of them would have to be coupled. I’d put a heavier weighting on the convenience; I couldn’t care less about the tax cuts, really. (C5)

Not only would these participants be willing to pay more for an EV if such convenience features existed, but the data also suggests that these participants would accept some compromises with the EV product to access those convenience features:

> Would I consider one [an EV] under those circumstances? Yeah, I would. Life would be a lot more convenient; it’s the convenience. If I had bus lanes and unmetered parking, it’s kind of like flying business class on the road. I would certainly consider that and I’d even consider that in light of the fact that it being underpowered and it would have some hassles with recharging but I’d probably put that convenience factor, I would probably say that would balance the scales. (C2)

> If that charging [in public places] was free, that would be a big factor, wouldn't it? That would be a big positive! (C4)

While there is evidence to suggest these convenience features will generate additional value for EVs, some consumers who aren't able to leverage these advantages would naturally not be affected by such policies.

> It doesn't really interest me; I'm more financial. I don't really need the extra lanes: they don't really affect me; I catch the train to work. (C7)

While a large majority of participants had highlighted the benefit of non-cash incentives, the above highlights again that this position is not unanimous among consumers.

The analysis of both the managerial and consumer data in reference to government support and policy uncovers some interesting data. Ultimately, both consumers and managers identify government support and policy as a highly relevant influence on the appeal of EVs. However, the sub-themes begin to identify key differences. In particular, while managers identify product-related issues as a key barrier which government should try to help overcome, the consumers instead highlight a willingness to overlook the product issues in light of preferential treatment and new value-adding services such as preferential parking and traffic lanes. Ultimately this section has highlighted that while managers and consumers do share similar perspectives on the role of government, the exact initiatives that are required become an element of conjecture between managers and consumers. Subsequently, we can observe a separation between manager and consumer perspectives that must be considered in the broader scheme of this research. Whilst we have identified a top line interrelation between manager and consumer perspectives (that is that government support is important in the take up of EVs) there is a separation in this detail when exploring the theme in more depth. Subsequently, this element eludes that there must be a far deeper consideration of a particular theme, rather than just observing the overarching interrelation.

6.3 Theme 2: Awareness and communication (Managerial data)

The second theme that emerged from the analysis of the interview data is the relevance of awareness and communication around EV technology. EVs are increasingly arriving in Australian showrooms, yet consumers do not appear to be aware of their presence (Climate Works 2017). From a managerial perspective it is flagged that consumers have a general lack of awareness on EV technology, as interviewee M7 highlights:

> I believe that 95 per cent of the public are unaware that there are practical EVs options out there.

This raises the issue that OEMs and industry partners need to start communicating this technology – and its potential benefit – to consumers. The requirement for such communication has been previously highlighted and recommended in the Australian EV industry literature, as exemplified by AECOM (2011):

> Public awareness campaigns for consumers can be used to address informational barriers about energy efficient technologies. Consumer willingness to change behaviours and accept different types of vehicles (and

> perhaps driving patterns) will be an area of uncertainty and one that industry can play a significant role in assisting to address.

Recognising that the industry needs to take action to generate awareness, we can again see that an inter-industry approach is required and that OEMs must collaborate on these industry-wide issues with other firms:

> There’s a great opportunity for many advanced drivetrains like EVs, but there needs to be a co-ordinated industry and government approach to highlight the advantages. (M7)

While there is a lack of a co-ordinated industry approach, we can observe in the industry literature that gradually there is an increasing number of people becoming aware of EVs in Australia and considering purchasing them.

> 50 per cent (of people) said they would consider buying an electric vehicle and 19 per cent of respondents had spent time researching the options for buying an electric vehicle. (Climate Works 2017)

However, these consumers face hindrances to a final purchase decision in favour of an EV:

> More and more people are aware of them [EVs]. More and more people approve them [EVs] and will aspire to getting into one someday, once a whole lot of things meet their criteria: number one being price, the second one being the prevalence of recharging infrastructure, and the third being battery chemistry and range. Once those things fall into place, I can see a place for EVs once all those things line up and get a mass-market appeal. At the moment, without that, we are going to be looking at some very ad hoc sales. (M2)

For many who are interested in the technology, there is a well-recognised resistance to adopting it, as

> [t]here are customers that see the technology as a bit scary at the moment thinking: this is brand new technology on the market and it hasn't had time to prove itself… (M1)

This mindset exists, but it is slowly changing as the technology evolves and begins to slowly saturate the market:

> It's [EVs] credible technology: people understand we are beyond golf carts and they understand these are real vehicles, credible vehicles and it's the way it's going to be in the future. (M2)

However, while EVs are slowly becoming more credible as a technology, many consumers still lack a general understanding of this technology. This flags the need for the industry to educate these other consumers who do not understand the technology, as highlighted by M6:

> Some people understand it and others don't get it. You have to educate people on it [EV technology]

To help drive awareness of EV technology, OEMs and the broader EV industry must develop comprehensive communication strategies:

> Marketing strategies are great to speak to a broader audience and then to really narrow it down to a customer that's a target audience for this particular vehicle. So we certainly see the strategy for marketing really drilling down and focusing on customers that maybe have a few challenges to overcome to purchase an EV, and really talking to these people on how these vehicles can overcome

> those challenges to really ensure the consumer is really happy with their purchase decision. (M1)

> Obviously OEMs do their part to promote their EVs. For example, from our perspective, we did billboards and we did an e-mobility campaign. So if those cars are more in the market and OEMs are running campaigns like that, then the general public will eventually be educated. (M5)

At the same time, the interviewees recognised challenges in promoting EVs, especially in maintaining consistent communication in the market. It was noted that:

> OEMs have brilliant EVs but because it's usually only one model in amongst the entire range of vehicles, it initially gets a nice burst of promotion and then it kind of gets lost in the message of all their other products … EVs need to be constantly out there and being promoted. (M3)

That said, one interviewee took a more negative view of the current marketing of EVs by OEMs, suggesting:

> We have good products coming to this market, but they are not being marketed well. (M2)

The importance of marketing EVs well is reinforced by M4:

> OEMs need to invest in marketing EVs. People are driven by marketing and without it EVs will struggle.

The interviewees recognised challenges in marketing EVs. Although the product has certain strengths and consumer appeal – such as efficiency – often, the challenge is overcoming the perceived concerns over range, charging and price:

> The number one challenge is getting this technology across to customers in a way that isn't daunting and is somewhat normal. What we'd like to do is communicate to customers that they can actually use these vehicles in their daily lives and that this is going to be the future of mobility around city hubs and areas of dense population. (M1)

As a lot of the communication around EVs involves overcoming concerns about the application of this new technology – such as range, charging and price – incorporating this technology into public spaces will provide consumers with real-world application and subsequently, awareness:

> Japan was probably the first country to implement an electric-type vehicle successfully within a market; it was a hybrid vehicle, the Toyota Prius. They used the vehicle initially for public mobility such as taxis and government vehicles, to really get the public aware and government officials aware of this future technology. (M1)

The benefit of exposing the public to EVs can likewise be identified via the application of utilising EVs as fleet vehicles:

> The drivers of fleet cars will experience the benefit of EVs along with ordinary people riding in the cars – such as taxis and limousines – as a matter of course, and they begin to ask questions, which naturally inform them of the technology. This leads them to consider the next time they go to buy a car: "Actually I wouldn't mind looking at an EV, because I travel with an EV limo company." (M4)

The effectiveness of real-world application of EVs will increase as they become more mainstream and the model availability increases:

> A lot of OEMs have announced EVs for the end of this decade. If you see more and more cars on the road and the word of mouth is, “It’s actually pretty good,” people are more likely to take up that technology. (M5)

> There are more OEMs coming out with EVs; seeing more of these cars on the road, will increase awareness in the future, especially in CBD areas or metropolitan areas, where there’s a whole lot more cars than in rural areas. (M6)

These examples indicate that communicating with the public about the emergence of EV technology is not as simple as running conventional advertising. Rather, the awareness must be regularly seen in application, thus accounting for why OEMs and EV industry partners are trying to make this technology as visible as possible. Both M1 and M3 highlighted this need for visibility:

> We’ve been doing some work with manufacturers for quite a number of years to start to integrate plug-in vehicles into our fleet and promote them around the country. (M3)

> it’s relatively new technology at this point in time. It’s about informing customers and informing the market of what the benefits are to do with new platforms, new drivetrains, and so on. (M1)

As a result of these early strategies in promoting EVs,

> we’re seeing quite a few people transitioning over to plug-in vehicles, as more information gets out there – particularly when there’s new models coming in … that sparks new interest. (M3)

The key to successfully communicating with the public and generating ongoing awareness of EVs would appear to be consistency:

> As long as manufacturers understand that they need to keep promoting the new technology and not just let it do itself, I think it will be highly successful. (M3)

Precedents for the required EV awareness and communication strategies can potentially be sought from past strategies used to convey the benefits of diesel-fuelled passenger cars:

> The more EVs we have in the market, the more understanding people will have. We had the same situation with diesel, which, once people understood the benefits, we had a steep incline [in sales]. Once people understand EVs, we should see a steep incline [in sales of EVs]. (M6)

The industry data does highlight an issue with the type of consumers OEMs have been targeting with EVs in the past:

> OEMs are persisting in their search for a small, affordable e-vehicle, believing that only scale can bring down production costs and raise margins. With the exception of a few idealistic, green drivers, however, most mass-market consumers are very price-sensitive and remain uncertain about the impact of battery life, driving range and recharging facilities upon these vehicles' dependability.
>
> The typical premium/luxury car buyer, on the other hand, is far less concerned about cost and more motivated by the desire to be a pioneer of the latest technology. Many of these customers already own one or more other cars so

> are happy to use their e-mobile for shorter journeys, where charging is not an issue.
>
> Rather than targeting the lower end of the market, e-vehicle manufacturers should instead shift their attention to the first movers in the upper segments. Once the price and convenience of owning an electric car has improved sufficiently, the rest of the driving population should follow suit in classic, trickle-down fashion. (Ulrik Andersen cited in KPMG 2014 p.19)

In addition to the problem of targeting the wrong consumers, there is an additional hindrance currently displayed in the Australian electric vehicle market: a lack of understanding, education and interest in EVs at the point of sale, that is, at the dealership. As OEMs and industry partners implement marketing strategies to promote EVs, it is critical that the communication channel flows right through to the final step of the customer journey – the point of sale at the dealership. Unfortunately, the managerial participants highlight that the point of sale is a major hindrance to selling EVs:

> Car salesmen are trying to sell ICEVs because it’s easier. We need to educate those selling the vehicles. There is a big gap in education between the buyers and the sellers … EVs are not easy to sell because of the price, range and infrastructure. (M2)
>
> [EVs] play no role due to a lack of consumer education and dealer support. (M4)

M3 further consolidates this issue by elaborating on why the point of sale awareness is, firstly, so critical, and secondly, why it is proving to be a challenge at the current point in time:

> Vehicle salespeople always gravitate to the easiest sale because obviously it's their pay packet. If they have to explain too much to a potential buyer about the innovation of this new technology, I don't think they're focused on that, I think they're focused on their own hip pocket … they must be coached not to fall back onto the easier sell. (M3)

The point of sale, by test-driving the EV, is also where many customers can instantly appreciate the product:

> Anyone that's tested an EV says one thing: electric torque is fun and it's exhilarating. (M2)

Therefore, capturing a complete communication strategy that takes in both internal and external stakeholders is emerging as a key aspect of promoting EVs in Australia. The industry data supports this proposition, highlighting that a collaborative effort in promoting EVs may carry more influence and security than individual OEMs' efforts:

> Another suggestion for stimulating take-up [of EVs] is joint ventures and alliances among e-car technology stakeholders, which could reduce the risk associated with this new technology. (KPMG 2014)

> The Chevy Volt is truly coming to life, but preparing the market for electric vehicles also requires capable partners from outside the auto industry. Momentum is building as governments, technology companies, communities and universities are increasingly working together to prepare the market for electric vehicles. (Ed Peper, then General Motors North America Vice-President for Chevrolet, cited in Green Car Congress 2009)

This section has thus far highlighted that managers believe there needs to be a more centralised communication approach from the industry in order to ensure consumers understand the technology. Concurrently, it is flagged that an inter-firm and inter-industry approach is required. As the literature review has already highlighted, this data identifies the need for collaborative firm effort to deliver a successful introduction of EVs into the industry. The next section will again discuss the topic of awareness and communication in the context of the sub-themes of range, charging and price.

6.3.1 Sub-theme 1: Range

The awareness of EVs is slowly becoming more evident, particularly as more OEMs begin to bring them to market. However, leveraging that awareness to combat perceptions of limited range and usability is key:

> EVs are something every single OEM is now planning or have already brought into the market. I guess that whole mentality around customers and range anxiety and being too complicated in terms of understanding the whole system has kind of made it something you really love and want to understand and learn what the new technology is all about; or it's something that's too complicated and customers just stick to the normal petrol or diesel. (M6)

Despite the known range limitations of EVs, M4 highlights that the issue around range can be addressed with more diverse options than simply increasing the total range of EVs:

> Like EVs, ICEVs also have a limited range. Where EVs are limited by their battery capacity, ICEVs are limited by their fuel tank capacity. However,

> unlike ICEVs, EVs can be refuelled to maximum capacity overnight at your home each day. ICEVs require trips to petrol stations to refuel. So while the range of EVs is currently lower than ICEVs, we need to change the way we are communicating with customers to tell them, “Yes, the overall range is lower than an ICEV but you have the maximum range available to you every day.” So ultimately, we need to be telling people that you don’t need to have 500 kilometres of range every day and that a range of about 200 kilometres is more than enough for the vast majority of trips you will take. (M4)

This leads us to explore how to communicate to consumers regarding charging habits.

6.3.2 Sub-theme 2: Charging

EVs have significantly longer refuelling times than ICEVs. Communicating this change in habit to consumers is difficult, yet it must be addressed:

> The best thing we can do is hit the reset button on how we do things and say to people, “In EVs you charge wherever your car’s parked.” Cars are stationary 21 to 23 hours a day … we get to our destination and park it and we get home and we park it; so that’s when we have to be doing all that charging … if consumers are comfortable with that notion, it overcomes a lot of the issues relating to charging. (M2)

The notion of communicating the change in refuelling habits to consumers is supported by M4:

> What we need to do is tell people, “You charge at home; you charge at work.” It’s not a petrol station, mentally. You don’t need thousands and thousands of charging stations; in fact, I would say it’s a giant waste of money to do that. (M4)

In order to facilitate this transition, it is important to keep the driver informed:

> We assist the driver using technology to keep them informed, using apps so they can find where to park and charge and also allowing the customer to keep an eye on the charging cycle to see their state of charge remotely. (M2)

Central to adjusting this mindset around refuelling are energy companies who are slowly starting to recognise a major benefit in incorporating EV charging into balancing the electrical grid. M2 highlights the importance of these kinds of external actors in communicating benefits:

> Energy networks are now making noise about it, so people are starting to gain awareness of the technology via the energy networks. (M2)

The potential to integrate EVs into the Australian electrical grid is prominent in the Australian energy industry literature:

> Significant additional electricity infrastructure will be needed when a significant number of electric cars are on the road. For an average daily driving distance of 40 km (14,000 km per year) an electric car would require 2.85 MWh per year. A national fleet of one million cars would require at least 2.85 terawatt hours (TWh) of electricity.
>
> This energy infrastructure issue can be offset. Charging the electrical car fleet at night (using smart meters and the smart grid) would allow the current

> electrical generation system to run continuously at full efficiency and allow a displacement of perhaps 50% of petrol usage and associated emissions, with little additional emissions. These can be reduced by the use of renewables. Given that it would require less than 20% of national electricity to run the car fleet, household efficiency savings could in principle supply this. These measures would reduce our petroleum dependence. (Dopita & Williamson 2009)

Although most EV customers will charge their cars at home, customers still have concerns about alternative charging locations. The data suggests that car manufacturers clearly understand this concern and its impact on potential sales:

> If I run out of charge, where would I charge it other than the home? This could be a potential barrier that customers come up against. These are the questions that consumers need answers for before they make the purchase decision. (M1)

Some manufacturers, most notably Tesla, have readily addressed the issue customers have around alternative charging locations. Tesla continues to roll out comprehensive public charging infrastructure. This not only addresses the direct concerns around charging for potential EV customers but it also serves as an excellent promotion tool to build public awareness:

> Tesla is doing some fantastic work. We all know about Tesla's brilliant vehicles and their technology; Musk is the next Steve Jobs. The way they market their product, getting people to pay dollars upfront before the car is even starting to roll off the production line, is absolutely sensational … they're starting to build their supercharger network up and down the east coast of

> Australia, so a lot of the hype around that vehicle will transition people's understanding of how efficient EVs are in Australia. (M3)

This section has highlighted the managerial perspective of the importance of communicating how and where to charge a vehicle to the consumer. It is a central philosophy that managers believe needs to be addressed in order to raise the awareness and understanding of EVs among consumers.

6.3.3 Sub-theme 3: Price

The managerial participants see the role OEMs have to play in communicating pricing around EVs as a critical one. It is also arguably the most critical facet of the business at which OEMs have failed:

> OEMs must be clever with how they handle EVs. They are very different to what we are used to, and to ask customers to simply pay a higher price for something that to them appears to be a lesser product will never work. Yes, EVs are expensive, but there are strategies which OEMs can use to tell customers they are in fact getting a better product. OEMs should team up with other stakeholders – like energy retailers, solar companies, infrastructure operators – and offer a valuable package. OEMs can also look at reducing the price of EVs by removing the most costly part of an EV, the battery, via battery leasing programs. This will reduce the upfront price of EVs and increase their appeal! (M4)

Due to the infancy of EVs as a technology and the variety of businesses EVs affect – such as OEMs, energy retailers, infrastructure operators, and so on – there is a clear indication from the interviewees that there would be value in businesses opting in to a collaborative strategy. However, such a strategy requires more than one – or a select few – firms operating in and focusing on the EV industry. Competition across all the above industries needs to be encouraged to create positive-sum competition (Porter & Teisberg 1991):

> The EV charging industry in Australia needs to grow. We need more competition between companies looking to roll out, install or partner up with OEMs when it comes to rolling out EV chargers. They need to become more affordable! (M7)

Again, we can identify that across the sub-themes, managers clearly recognise that a deeper relationship is required among firms operating in the industry. In order to overcome many of the challenges present in the industry, OEMs need to work with many other firms. Partnerships are therefore again flagged as a critical component of overcoming the product related issues and to drive consumer value.

6.4 Theme 2: Awareness and communication (Consumer data)

In respect to the consumer interview data, awareness and communication was an evident theme with two clear and related sub-themes. These are: first, that consumers have a low awareness of EVs that stems from a lack of communication; and second, the role of information is critical for the consumer in influencing their purchase decisions. These elements will be discussed below and ultimately highlight the need for deeper management consideration of consumer perspectives I the context of bringing new product innovations to market.

6.4.1 Sub-theme 1: Low consumer awareness due to lack of communication

Fundamentally, there is an issue with consumer awareness when it comes to EVs. While the managerial interview data above illustrates that there are practical solutions for some of the product issues associated with EVs that can be overcome (for instance, via partnerships), these are not being communicated effectively, if at all, to the consumer. This results in the consumer taking a skewed or often negative perspective on EVs:

> My initial impressions are that they are underpowered. (C2)
>
> My initial impressions are that they are probably slow cars, but I don’t know what the options are. (C9)
>
> It’s probably a misconception because I don’t know much about them, but I’ve just assumed that they must be a bit sluggish, like, your ability to accelerate quickly. I think of EVs like ‘dodgem cars’: you put your foot down on the accelerator and it just slowly starts to go. (C9)

While a lack of communication has meant some consumers build a negative perspective on this new technology, some consumers don’t even know elementary details about EVs, such as model availability or pricing. As such, they have never even considered purchasing one.

> No, I haven't considered buying an EV. I haven't really seen them promoted, so I don't know fully what's on the market or what the pricing is. (C4)

> I haven't considered purchasing an EV, mostly because I didn't know enough about it. (C6)

> I think they [EVs] are a great idea but I don't know anything about them. (C7)

> It [an EV] would interest me as a second car … the main family car would need to be a 'seven-seater' because we have four children … I imagine that there could be one [a seven-seater] out there but I haven't seen anything or heard anything. (C8)

> Me? No, I've never considered one [an EV]. (C9)

This lack of consumer awareness is a key hindrance to consumer inquiry. Since consumers are not overly aware that EVs have a market presence in Australia, there is no catalyst to begin researching or evaluating the options of an EV as a potential future purchase.

> I am not well educated (on EV technology). On principle it's up to us individuals to gather the information if I'm interested … I might wish that there was more (information) from the industry. There's more a push to the awareness of the options. If I see more Teslas and hear more about it, I get interested and then I will go and start asking people, doing research and gathering information on my own. You've got to create that interest! (C1)

> I do read and listen to mainstream media, and online stuff, daily as part of my job and the fact that those brands [brands other than Tesla] have electric cars

in Australia has never crossed my radar … if I knew of them, I'd probably take a test drive and have a look. (C5)

If I knew what was available I'd be very interested. (C7)

Even for those consumers with a genuine interest in cars, there is little to no information on EVs across the conventional communication channels:

I do read a lot about cars; I just don't read a lot about EVs. (C2)

Ultimately, it is the role of OEMs as businesses to ensure they are communicating with consumers about their products. Both the managerial and consumer data has identified a gap in communication, which is leading to low consumer awareness of EVs as a product. The gap in communication is not only top-down, but also bottom-up: OEMs do not listen to consumer feedback on the EV product.

No, I'm not fully aware of EV technology but after hearing from friends and reading on the internet, sometimes there's new articles released of what new cars are being released on the market, that's where I get my knowledge from … maybe if OEMs were to start releasing ads on TV or social media: "Look, this is what we're doing, these are the new cars we're planning on releasing," and getting maybe input from consumers that way, that would be an avenue to get some feedback. If the business doesn't take into consideration the consumers' feedback, they're just trying to guess what the consumer wants and when they do that, they don't always get it right. If they go direct to the consumer, they'd get a more direct answer. (C3)

6.4.2 Sub-theme 2: The role of information in the consumer product evaluation

As indicated above, there is a lack of communication about EVs, which is leading to low consumer awareness. Critical to this premise is the role of information in the consumer product evaluation. If OEMs or other industry parties can provide the consumer with more information on EVs, it will allow the consumer to evaluate the product with clarity and perhaps form a different perception of the product.

> No, I wouldn't choose an EV over an ICEV. But I'm okay either way. I suppose I'd still go ICEV because I understand those vehicles, whereas I don't understand an EV … and it's not just the technology, it's more the behaviour of the vehicle, because you're driving it and I understand how an ICEV drives and I don't know if an EV drives the same way. (C2)

> What would make me more likely to consider purchasing an EV? More knowledge of an EV, which is easier to obtain … more knowledge on what's available and easy access to more knowledge on EVs. I wouldn't even know outside of Tesla, is there another EV in the country? (C5)

The role of information is critical, as this new technology encompasses so many new product features never before featured in an ICEV, such as recharging. Information on these new concepts must be effectively communicated to the consumer so they can evaluate the product with clarity:

> I don't know what's available, but charging stations, for instance. I don't know if it's possible, but I'd be hoping you can use the car for your daily use and then charge it on off-peak rates and get advantages on the lower cost of electricity. Or alternatively, to have a trickle charge with solar cells attached to

> the car as an option with the car. They may be available, I don't know, I really don't know what is available. (C4)

> If my general understanding on electric power was that it was more powerful, the vehicles were more powerful, and there wasn't a requirement to recharge them as often, I would be more interested in them. (C2)

If a consumer lacks information about a product, they will maintain their initial perception. Fundamentally, with this new technology, the perception is one of product compromise and inferiority. These issues cannot be resolved without the consumer being given some sort of information, which convinces them that these compromises and inferiorities are either nonexistent or nullified in some way. The more information that is put into the market, the more confidence this will inspire in the market:

> I see the occasional article on Tesla and that's it, so I'm not really receiving much information to review … if I were to receive more information I would become more enthusiastic about things and as I see things becoming more viable I would be more interested. (C4)

> Where do I get information? Predominantly from the media and from the internet and that. So if there was promotions being done via the internet and the internet media, that would seem to be one way to get to the mass of people. (C4)

The key drivers of this communication, the consumer data suggests, should be the OEMs. As the developers of this new technology, the consumer participants expect the OEMs to champion the technology and inform them about it:

> I expect to get more information from the OEMs, the same as the OEMs have done the job on safety. For example, airbags: side, front, back, roof, whatever. Exactly the same. And I would expect it to be driven, I suppose, by prestige cars downwards, because Mercedes, BMW, Audi, Volvo, all those prestige cars in that mid-level prestige – I'm not talking about Lamborghini, I'm talking mid-level prestige – they've done a really good job of educating the market on new technology, so I would expect them to lead it. I think in a way they've been left behind. I wouldn't mind betting that when asking people on this topic [EVs] the predominant brand that comes up is Tesla. Because everyone's heard of it, everyone knows what it is, and nobody has a clue where all the other prestige brands are in the promotion of this technology… (C5)

> Who do I expect information to come from? OEMs! And maybe the government but predominantly the OEMs. I don't expect marketing with promotional stuff. Just sort of what it is and how it works and the benefits to everybody, and a little bit more background information on that. A bit more objective – take the spin out. (C6)

> I'd expect to hear from the OEMs … advertising in some form or another, whether it's social media, mainstream media or traditional media. But I want facts! (C9)

While there is strong evidence to suggest that top-down communication is a requirement to promote an initial awareness and interest in EVs, the data does show that consumers will go and do their own research rather than depending on being fed information through a single above-the-line channel:

> I did a bit more research in terms of my car before I purchased it, so I've got more knowledge in terms of the Toyota Prius range but in terms of the other brands and models, I wouldn't know in depth. (C3)

> Right now I'm very happy with my setup; I have a car that's perfectly okay. Once I decide to change over my car, probably in two years' time, I have a look at it [EVs]. That will be interesting as it will be the first time I consider or look at the options of EVs, ever. (C1)

> I'd just get my information from the internet … I tend to go looking for information rather than being presented with it. (C2)

Overall the consumer participants highlight that the role of information is critical in shaping the consumer's evaluation and perception of a product. While the data doesn't definitively identify how consumers expect information to be served to them (either top-down or bottom-up), fundamentally the data highlights that these particular interview participants depend on information in order to make a decision. Information is critical in allowing them to make a perception on a product and have confidence they are making the right choice in their purchase decision.

> I would like to know, "How does it really work out with the carbon footprint?" I mean, it goes back to: how do we produce these batteries? How do we dispose of batteries? So I need a detailed, honest comparison of my car right now, which I'm driving, to the electric car. That I would be really interested in! An in-depth report, including of all the energy used in production, longevity, replacement parts and so on. (C1)

> That's where EVs can be promoted, because my perception is the battery is going to last five years or so and will need to be replaced; but maybe there's

> bugger-all maintenance over five years? … That's one way you can promote it: it's five years maintenance-free and then you pay $10,000 for a battery. Spread over five years that's $2000 a year – that's what you pay, anyway. Or there are all sorts of different maintenance plans they can offer. You pay like insurance: you pay so much every year on a service agreement and all your servicing is free for ten years. You don't need to worry if the battery dies, we'll put a new one in for no charge. (C4)

The theme of awareness and communication highlights a discrepancy between consumer expectation and managerial practice. While the managerial data identifies that there is a need to increase communication to the consumer, the analysis uncovers that current strategies are not penetrating through to the consumer. This suggests that either the managerial communication channels are insignificant or are not delivering the right message. Since the analysis identifies how critical information is for the consumer in their decision making process, management needs to revaluate how they communicate EVs, and their benefits, to the consumer.

Ultimately, this chapter has identified that there are gaps in how the product innovation of EVs are being strategically managed in the market. OEMs are continuing to bring EVs into the market; however, the consumer awareness and acceptance is limited. The data suggests that while both managers and consumers identify a problem with EVs, the specific problems and issues are somewhat different from both perspectives. In terms of the themes of government support and policy and awareness and communication, both consumers and managers alike identify an issue. However the actual constructs of these issues and subsequent solutions vary. This suggests that there is a divide between managers' and consumers' perceptions and approaches to the subject matter.

This chapter has identified that a significant challenge of managing and marketing EVs comes down to overcoming inherent issues with the product itself, such as range, charging and price. As a result, the next chapter will focus on the role of product innovation. It will identify how EVs currently place inherent compromises upon the consumer, and explore the resulting implications.

Chapter 7 Analysis – Product Innovation

The previous chapter began to identify some of the core issues with EVs in the Australian market in the context of strategic management. These were issues surrounding government support and policy, along with communication and awareness. However, we began to identify a consistent undertone that the EV product innovation also had several of its own issues underpinning the more strategic issues. Therefore, we can continue to identify the relevance of this research in terms of developing a more cohesive understanding of how strategic management, product innovation and consumer value relate.

This chapter will explore the themes emerging specifically from the field of product innovation from the perspectives of managers and consumers. The two primary themes that will be explored in this chapter are product compromise and the role of total cost of ownership. In particular, this section will take a closer look at the recurring sub-themes of range, charging and price – this time from a product perspective.

EVs are one of the most significant and disruptive product innovations to hit the Australian new vehicle market in a considerable time. However, while EVs are still very much intended to be used as a normal alternative to ICEVs, they do have some radically different user implications. As identified in the previous chapter, these are that EVs have a lower range compared to ICEVs and they also have issues with recharging (refuelling), as it takes significantly longer in comparison to an ICEV and the existing charging infrastructure is limited. Couple this with a higher purchase price, and a picture begins to emerge that EVs provide the consumer with an unrealistic product alternative to an ICEV.

The analysis in this chapter will highlight how managers have a good account of the product compromise of EVs, particularly in terms of range, charging and price. The managers perceive these compromises as a major issue for consumers and hence correlate this with a lack of market penetration. However, the consumer interviews highlighted far less consistency of knowledge in reference to these product compromises. The consumer data will highlight a deep correlation with the strategic management view of the consumer's lack of awareness about EV technology. This chapter will therefore begin to expand the picture formulated in the last chapter, showing that the managerial perspective and consumer perspective are indeed different in reference to the subject matter.

7.1 Theme 1: Product Compromise (Managerial data)

One of the key issues identified by managers in the Australian EV market was the need for the consumer to compromise on one or more of the key product issues highlighted so far – range, charging and price. The interview data clearly identifies this:

> EVs need the price barrier to go down, the range needs to improve and [we need] more charging infrastructure. (M3)
>
> EVs do tick the majority of the boxes for the majority of consumers; however there are some barriers such as range, price and charging times. (M1)
>
> There's a lack of infrastructure and when you couple that with a limited range and a higher price, there are challenges that need to be overcome. (M4)

The suggestion of the managers interviewed is that by addressing these product compromises of range, charging and price – and ultimately delivering a superior product – the EV product is increasingly likely to succeed in the marketplace:

> The key things that need to be improved to make up the right [EV] product in this market – beyond, obviously, price – are: design, day-to-day usability, range, charging infrastructure and safety (M5).

When coupling the amount of compromise a customer has to undergo, in comparison to what they are already accustomed to in an ICEV, we uncover one of the key reasons why EVs have no substantial presence in Australia:

> The general populist thinks: we've always done it this way [ICEVs]. Battery technology: they'll find reasons not to take it on because of price, range and charging. There are too many points at the moment that make it easy for people to say, "It's all too hard." (M3)

The data highlights that these compromises need to be negotiated as best as possible, we need to reach impasse tipping point where an EV brings the consumer more benefits than compromises in comparison to an ICEV:

> It's up to vehicle manufacturers to develop the technology further to overcome these barriers and promote consumer adoption of the technology … to overcome these core challenges, it would require manufacturers to further research and develop the product. (M1)

When discussing future markets for EVs – who the buyers are and what the product should be able to do – M1 responded:

> Young families that would like an EV that doesn't suffer range anxiety, and that doesn't cut into their personal time to maintain or charge, and that is affordable. We really do see electric vehicles being implemented into their personal lives.

Gauging from the responses of the managerial participants, addressing the three issues of range, charging and price will be a major step in influencing the success of the future EV market in Australia. These product related issues will need to be addressed by product innovation. Subsequently, this is where the strategic, consumer value and product innovation elements will need to combine:

> I believe that EVs will make up a portion of the market. How large that segment is will depend on time, technology and what challenges are overcome within that technology. The three core challenges that need to be overcome are: range, charging and price. Once manufacturers overcome these challenges, it will make the consumer feel more confident in purchasing an EV. So certainly, those three core areas will be a key focus for vehicle manufacturers in the future. (M1)

> I think that EVs will make up a substantial market segment one day. They won't replace ICEVs totally but I think by about 2021, EVs will make up 15 per cent to 20 per cent of new car sales [in Australia] and by 2030 we will see that number rise to 30 per cent to 40 per cent. (M4)

The managerial data therefore highlights the inherent issues with the product innovation of EVs that are forcing customers into compromises, by comparison to ICEV alternatives to which they have long been accustomed. The particular compromises that an EV requires consumers to make are those of range, charging and price. Therefore, the next sections will look into those topics in more detail.

7.1.1 Sub-theme 1: Range

When asking managers their opinion on consumer preferences, the responses indicated that the majority of consumers are not willing to compromise on range. When asked "Are there any specific requirements in product innovation for electric vehicles to be successful in Australia?" managers provided the following responses:

> Cell density! Pack more range into the vehicle… (M2)
>
> Battery range! (M3)
>
> There are people out there that would be happy to pay more for an EV, but there are not many [EVs] out there that offer an acceptable range… (M4)
>
> Range is always a big factor! (M5)

Furthermore, the industry data from the Western Australian EV trial (2012) and Victorian EV trial (2013) similarly highlighted that an increase in the vehicle range of EVs was required:

> Range was seen as a serious barrier to EV uptake, with almost half of the respondents indicating the need for significant trip planning, particularly for trips greater than 30km… (Mader & Bräunl 2012).
>
> Larger vehicle batteries – this would increase range. (State Government Victoria 2013)

The potential for EVs to take off in Australia is so heavily dependent on range since "geographic density is a key in range-limited transport" (M2). As we have limited control over geographic density in Australia, "range has to go up and there has to be infrastructure where you need it" (M2).

As the underpinning EV technology is still in its infancy, there is a strongly held belief that the issue regarding range will improve in the future:

> Right now, we are just seeing the youth stage of this potential product. Maybe in 10 to 15 years' time we will see great improvements in technology and range within the products themselves… (M1)

> There's a lot of research around the world about battery chemistry … we'll see better and better cell chemistries [in the future] which will provide better densities, which will answer that question about range… (M2)

Currently, only Tesla offers a truly comparable 'all-electric' range to an ICEV for Australians:

> Tesla is offering customers a future vehicle that basically has a range very similar to that of a hybrid car or ICEV car, without really changing a customer's daily life or lifestyle, with their vehicle. (M1)

The managerial interviewees commonly mentioned that the desired range, identified as the required range for EVs in Australia, is around the 500-kilometre mark, so that it closely resembles what consumers are already accustomed to in an ICEV vehicle:

> When we can get cell density to such that it mimics the patterns we're used to now, such as 500 kilometres of range out of a single refuelling … people will start saying this (technology) is useful. At the moment when we see things that

> are sub 100-kilometre range, people say, “That’s nice, but we want 500 kilometres.” Tesla is close to that now but it’s an awfully expensive vehicle. (M2)

> 500 kilometres is the magic mark. (M3)

> For premium EVs, we need to hit, *real world*, 450 kilometres of range. (M4)

The issues around limited range are also echoed in industry literature:

> EVs are still underperforming on key customer criteria, especially range. (Bernhart 2015)

This section has highlighted that managers see range as a key barrier to consumer adoption of EVs. Managerial suggestions are largely consistent with the view that an increased range of about 500 kilometres is required for consumers, so that EVs perform similarly to ICEVs in terms of range.

7.1.2 Sub-theme 2: Charging

The managerial data has raised the point that there are serious product compromises involved in charging EVs; they are limited by both a lack of available infrastructure to recharge, and also the extended time it takes to recharge in comparison to refuelling an ICEV. The availability of charging infrastructure directly correlates with the topic of ‘range’ covered earlier:

> We see a petrol station every couple of kilometres, whereas we don’t really see a charge point outside of some places like a CBD, where there are public

> charging stations. But in that sense you can kind of look at it with [the perspective that] if an EV had a massive range, you don't need to worry about the next charging point, you can pretty much do it as soon as you get home. (M6)

Until such a time arrives where the product has come so far as to deliver an extensive enough range not to be dependent on public recharging infrastructure, the issue of charging time must be seriously considered. A conventional ICEV can be refuelled for a circa 500-kilometre range in less than five minutes; EVs, on the other hand, take far longer to refuel.

> The holy grail would be to be able to recharge a thousand kilometres of range in five minutes … it may be doable but not any time soon. So what can we do [now]? Tesla has shown the way with DC charging; they can deliver enough range for 400 to 500 kilometres in about an hour or so. That's way better than AC charging: a seven-kilowatt charger delivers about 40 kilometres of range an hour; a 50-kilowatt charger delivers about 360 kilometres of range an hour. Those are the sort of numbers we are at now. If we wanted to get to 500 kilometres in five minutes, we would need an incredibly powerful DC charger … we have a very long way to go before we can get to that … So what has to change, the driver's going to have change their expectations and behaviours; they're going to have to understand that there's some wait time while this occurs, so they're going to have to combine it with other activities … it's not going to be a five-minute thing any time soon. (M2)

The requirement for a reduction in EV charge time is also highlighted by M4:

> If we want to get serious with EVs, we need to improve the way we can charge them on long-range trips. The aim would be to have an EV that can charge about 300 kilometres worth of range in 15 minutes. If we can get to that stage, customers will see less inconvenience in owning an EV as it can be functionally almost identical to an ICEV. So DC charging technology will be critical for EVs in the future … AC charging not so much … so long as you can achieve a full charge in an eight-hour period, while you sleep, people will be satisfied with that. (M4)

Not only is the requirement of reduced charging times flagged as a key issue, but there is also the issue around increasing the convenience of charging:

> Charging times are an issue, so if you can reduce charging times by using high-power chargers that is very helpful. Make it possibly easier [to charge, such as using] inductive charging … from a convenience point of view you don't actually have to do anything, you just have to position your car at the right point. (M5)

In the industry reportage, the Victorian EV trial (2010–15) highlighted that participants required:

> [a p]ublic charging network – including specifically quick charging and/or battery swap, would greatly increase the effective range of the vehicles, or possibly even support reduced battery size/vehicle cost for highly predictable vehicle applications that align with the charging network. (State Government Victoria 2013)

The interview data supports the evidence that a charging network helps address the issues of usable range:

> Compromises [of EVs] come in with the range of the car. You have it somehow with ICEVs as well, but the petrol stations network is much more established. So obviously, every main street you have a petrol station. Whereas with EVs you have to plan if you want to travel, let's say from Melbourne to Sydney, you have to make sure you are not taking the wrong road because otherwise you are running out of capacity in your battery … Nowadays if I buy an ICEV car, I don't really have to worry; I have to make sure I don't run out of petrol but it's pretty easy because petrol stations are everywhere. With an EV, that's probably one of the biggest compromises to deal with. (M5)

Although refuelling times are significantly longer in an EV compared to an ICEV, the method of refuelling is different. A hidden advantage for an EV over an ICEV is that an EV can conveniently be refuelled at home and autonomously; an ICEV, on the other hand, requires the driver to travel to refuel and spend time refilling the car and complete a transaction.

> They [the customer] basically drive it [the car] from A to B, maybe from home to the office and from the office to home and plug the car in, in the garage – which really is a lot faster than pulling into a petrol station and spending five to ten minutes filling up your car and paying for the fuel and driving away. It's actually quite an easy process these vehicle manufacturers are implementing, with charging stations at residential properties for customers to: pull up at home, charge the vehicle and then not think about it until the next morning when the car is fully charged and ready to drive away and start their day. (M1)

Reflecting the above, The Western Australian EV trial (2010–12) confirmed that

> 82% of all charging events happen at only two different places per vehicle (Mader & Bräunl, 2012)

We can assume, in most cases, those to be each point of the regular commute: home and work. The ability to charge at home requires no major development in technology and is achievable today:

> For households, the technology will work now. During the trial most households used the electric vehicles as their main transport choice, without having to change anything about how or where they travelled. Most Melburnians can drive during the day and charge overnight, when it's cheapest and while they sleep. (State Government Victoria 2013)

While the evidence highlights that most charging will be done at home, there are also positive-sum commercial opportunities when it comes to offering EV charging infrastructure:

> At the moment you don't go to many places and see – compared to Europe or North America – and see EV charging spots; whether that be the first 10 spots near the front door of the Westfield supermarket or quick chargers at service stations like we start to see in New Zealand. A company [unnamed for confidentiality] has a had a great idea and they bought the assets [off another confidential petroleum company] in New Zealand and put quick charger stations at every service station. They still want those customers to come in and buy the milk and bread. They weren't making money on the forecourt anyway. They're not going to lose a whole lot of money by having a quick charger onsite but they still want to make their profits via other transactions. (M7)

Subsequently, the managerial data highlights that a lack of charging infrastructure is a hindrance to consumer adoption. Further, from a product innovation perspective, it is important to consider the feasibility and state of the technologies with the subsequent implications. Charging technology itself is not at a stage where the speed of charging is acceptable to the consumer. However, it is raised that there are ample strategies for businesses to address both of these issue by either creating new business models which incorporate EV chargers, investing in higher charger saturation and/or educating consumers on new user habits.

7.1.3 Sub-theme 3: Price

We have covered key product compromise issues in the above analysis. However, from a management perspective, price appears to be the crucial factor in EV adoption:

> Price is the biggest deciding factor when considering a new vehicle. (M4)

> Price is the main factor; price needs to come down or at least be more competitive. (M5)

> With PHEVs, I don't think there is a compromise from a product perspective; it's more the initial purchase decision, in terms of affordability. But in terms of the product itself and doing the things that you need to do for a day-to-day commute, I don't think you are compromised in any way. You kind of have the best of both worlds in the sense of you can choose to use EV [mode] if you wanted to not use your petrol or diesel engine. (M6)

> What kind of price premium are customers paying for EVs? Are they paying 20, 30, 40 per cent more? Is the car 10 or 20 per cent more expensive than the equivalent ICEV and what features doesn't that car [EV] have [compared to an ICEV]? (M7)

If people can save money in their transportation, they are often open to adopting new technologies and products that enable a cost saving. Inevitably the cost of fossil fuels will rise and that will force people to investigate alternative options for transportation, given that:

> The cost of oil-based fuels will become very expensive, forcing people to find alternatives. (M2)

However, in the current market environment, it's hard to justify saving money on operating costs with such a high upfront capital cost.

> So with PHEV, usually what happens is that it's the same car [body/shape] as an ICEV [just with a different drivetrain] … but if it then comes with a 50 per cent price increase, then obviously, it's not happening [the PHEV purchase]. (M5)

Therefore, the managers believe the mass market consumer's attitude towards EVs can be characterised by price-sensitive curiosity, where consumers understand EVs to be cheaper to run and maintain. However, consumers are not willing to spend more initially to achieve an ongoing operating cost saving.

> Customers do see some disadvantages in purchase price [of an EV] versus their equivalent in an ICEV vehicle. (M1)

Equally, consumers consistently consider the purchase of an EV, and the associated value of an EV, in comparison to a conventional ICEV. The lack of uptake of EVs can be associated with their inflated price in comparison to ICEVs:

> EVs have no market share due to a lack of appropriate pricing because they are too expensive compared to their ICEV counterparts. (M4)

Ultimately, the managerial data highlights that a reduction in the price of EVs will be associated with higher desirability from consumers.

> When the price comes down, consumers might have a look at it [EVs]. (M2)

> If we can get EVs down to that $35,000 mark, it's general populace.(M3)

The reason EVs have such a high purchase price simply comes down to the cost of the technology:

> An electric vehicle, the technology is actually quite expensive to manufacture. The base of which the technology comes from – the most expensive component of that – is the battery. To manufacture a battery to have a range for these EVs that's comparable to an ICEV is very expensive; and for engineers to research and develop these next steps in battery technology, it is a lot of money that's required for research. This in turn plays a role in the retail price of the vehicle. (M1)

Not only does the cost of the EV battery play a large role in influencing the upfront price of an EV, it also influences a consumer's decision when considering the long-term costs of an EV:

> People think EVs are really expensive: not only do they cost more than an ICEV now, but what happens when I need to replace the battery? People don't want to pay for that! (M6)

However, a high retail price is commonly found in new technologies and there are consumers out there who do not wait for the price to come down; they want the latest technology at all times and they are willing to pay a premium for it.

> The retail value is made up of certain aspects: manufacturing, marketing, research, sales volume, profitability, et cetera. There are a lot of certain elements rolled into that retail price and EVs at the moment are expensive versus their ICEV counterparts; but it's like that in any industry, if you have a brand new computer and it's the latest technology, it's going to be a lot more expensive because it's new technology, in comparison to the outgoing technology. We foresee with volume growth there will be savings and with more learning on the manufacturer's side, there will be savings over time, which would inevitably affect, in a positive way, the manufacturer's list price of these particular vehicles. (M1)

Once the cost of EV technology comes down as a result of increased volumes and increased efficiencies, there is strong evidence to suggest that EV technology can overcome its compromises and become the car of the future:

> I think EV will be the car of the future. Let's say by 2025, I would say half of new car sales will be EVs; obviously under a few assumptions that costs are at least on par, if not lower. By that time, synergies will come into effect and the technology will be rolled out over all derivatives and costs will come down. Let's call that the base case scenario 50 per cent. Worst case scenario by 2025

> will be 10 to 15 per cent. I would be very surprised if we wouldn't get there. (M5)

This section has highlighted the relevance of price in the success of EVs as a product innovation. Currently, the managerial perspective dictates that consumers are unwilling to accept the high purchase price of EVs. However, the managerial data also highlights that this cost is expected to fall as the product moves into a more mature phase of its lifecycle, at which point market uptake is expected to accelerate. This belief is clearly identified across the above interview data and industry literature. However, pairing the advancements in price with the previously covered future advancements in EV range and charging will result in EVs overcoming their various compromises that exist at this point in time. This perspective is best summarised by McKinsey and Company's (2016) report on 'Automotive revolution – perspective towards 2030':

> With battery costs potentially decreasing to USD 150 to 200 per kWh over the next decade, electrified vehicles will achieve cost competitiveness with conventional vehicles, creating the most significant catalyst for market penetration. Advances in charging technology, range, and awareness will further improve the customer value proposition.

7.2 Theme 1: Product Compromise (Consumer data)

The analysis of the managerial data in Chapters 6 and 7 highlighted three consistent sub-themes across the core themes. They were: range, charging and price. Until now, the consumer data analysis section has not shown the prevalence of these themes in the data. The managerial data highlighted, and the consumer data has proven, that consumer awareness of EV technology is low. Subsequently, the transcribed consumer data was unable to reveal as much depth in the sub-themes of range, charging and price, across the core themes. However, the core theme of ‘product compromise’ highlights that there is a real concern with the consumer usability of the EV product; and that the consumer would not accept a product compromise without any inherent product ‘gains’. In particular, while consumers weren’t able to recall the compromises in as much depth as managers, there was an underlying consistency: these concerns were generally categorised around the sub-themes of range, charging and price. These sub-themes are therefore going to be analysed separately in detail to cover the consumer perspective on these three particular topics.

Before covering the three topics of range, charging and price; it is important to establish that the consumer data highlights an unwillingness to accept compromise from a vehicle.

> Compromises: well, I really don’t know what the compromises might be [in an EV]; why would there be a compromise? There shouldn’t be a compromise! (C4)

> I would expect not to compromise, nor would I compromise. I wouldn’t compromise to own an EV on those things that are important to me … an EV would need to offer me exactly the same facilities and reliability before I would consider it, I wouldn’t compromise at all! (C5)

7.2.1 Sub-theme 1: Range

The range of an EV is evidently important to consumers. While there is a fundamental perception in the manager data that a lack of range is of concern to consumers, the consumer data shows limited knowledge or awareness of what the actual range of an EV is.

> If I had a fully electric car, what would be the travel distance I could get from it? On the weekend if I want to zip here or zip there and zip back again, will it always be ready to go? Or after two trips would the battery need to be recharged? (C4)

As a result, we come back to the role of communication in order to educate the consumer on the new technology. When asked what would make the consumer more likely to purchase an EV, C1 responded:

> The range of the vehicle – how far can I go with one battery?

There is an underlying perception in the consumer data that an EV has suitable functionality for city driving. However, consumers raise concerns about the long-distance capability of an EV.

> Initial impression as well is that it's predominately good for commuting but not necessarily good for long-distance travelling because each charge of the batteries is only good for a limited number of kilometres. So for daily commuting it seems like a good solution but for family holidays or longer road trips, whether or not that's possible, I don't know. (C4)

> I see practicality issues with distance and speed. (C9)

Consistent with the concerns over long-distance capability is the element of 'range anxiety'. The idea of running out of 'fuel' is a concept that does not sit well with consumers and raises doubt that an EV is not suitable for their needs.

> Running out of battery concerns me, especially if you're just stuck in the middle of nowhere and stuck with no options. Many people know how to repair an ICEV but there are not too many options of mechanics that know how to fix an EV. (C3)

> The thing of the EV running out of electricity somewhere and stopping is something that puzzles me … it's an annoyance, it would drive me nuts! But behaviourally it's the same as petrol, so I don't know why it drives me nuts, because it's the same deal: you can run out of petrol and you can run out of electricity. I don't why; it just feels weird, that's all. I wouldn't be frightened of it, it doesn't bother me; it's just really annoying! (C5)

> Before I can buy an EV I need that feeling of security: that you're not going to stop on the Harbour Bridge or in between country towns! (C9)

This 'range anxiety' is coupled with the premise of the unknown: what to do next? As the interviewees recognise, both an ICEV and EV can run out of onboard fuel; however, there are established behavioural processes and commercial services set up to deal with the case of an ICEV running out of fuel – simply find petrol and fill the tank. In the context of an EV, there is not yet a behaviour process akin to this for the lay consumer, due to the nature of the new technology. Accordingly, due to the low volume of EVs, there are no services available to assist these EV consumers if they do run out of range.

> Not having a backup system if the electric system was to fail or run out [is a concern] – what do I have to do? What's the next step? (C3)

The managerial assumption in the previous section was that consumers needed more range from EVs to find them practical. However, the actual consumer data presented here suggests that the issue surrounding range is more educational than product-related. Consumers genuinely lack knowledge of how far EVs can travel and how they will be recharged if and when they are out of electricity. Therefore, we can begin to identify a deeper discrepancy between the managerial perspective and consumer perspectives. Further analysis will be conducted in the next section exploring the issue of charging. This highlights than in the context of product innovation, that a sole managerial focus on product optimisation is not the only option in overcoming product related issues.

7.2.2 Sub-theme 2: Charging

The topic of charging directly correlates with range. As highlighted above, there are consumer concerns with running out of electrical range in an EV because they do not know what the next step might be. In the event of an ICEV running out of fuel, that next step would be to find petrol or diesel. In an EV, it's more complex, as there are essentially no places to charge an EV – this is a core issue:

> Petrol cars you can just refuel and electric cars that's not the case, so that concerns me. (C2)

The fundamental premise of a lack of charging infrastructure provokes a significant lack of confidence among consumers. Consumers do not know any options of how to recharge their vehicles, particularly on long trips. This inability to refuel an EV on long trips limits the use case of the vehicle. Therefore, the inability to utilise an EV on long-distance trips is a significant consumer compromise.

> I would be worried about how to recharge it. It won't be hard to plug it in but it's the availability I'm worried about. If I drive to Dubbo, will I be able to recharge the thing to get home on Monday? Being stuck away from home is a concern for anybody! (C1)

> If I were to go visit friends in Nowra, it will just be inconvenient to go, " All right, where am I going to recharge this?" if in fact it needs recharging … that gives a normal car an advantage in my opinion, absolutely. (C2)

> I have considered purchasing a full electric car but because I wanted the car for work as well as personal reasons, I was thinking if I was to take a long trip, I just wanted to consider the options in terms of recharging. Where would I have to recharge the car? If I would be stuck halfway on the road and if I would need to call in for roadside assistance, how would that come into effect? And those are some of the concerns with just fully electric. It's always in the back of my mind; it's kind of reassuring to know if the electric fails there's always a backup where either petrol or diesel kicks in, that's kind of reassuring knowing that there is a failsafe. (C3)

> Where am I going to plug in if I'm going to drive 200 kilometres? (C6)

The consumer has come to expect ubiquitous mobility and to be able to refuel their vehicle as and when required. The reality is that, given a lack of public charging infrastructure, EVs simply do not possess the refuelling usability features comparable with an ICEV. The consumer's expectation in terms of refuelling is one of convenience, and is predicated on a lifetime's worth of behaviour according to a simple refuelling model – refuel the car at a nearby petrol station when the tank indicates the fuel level is low.

> A car means independence; otherwise I take public transport. And in order to be independent I need to, and I'm used to, the last 50 years driving from A to B and having petrol stations on the road, on the go … if there were no charging stations that would put my decision to buy an EV on the backburner … I want to be able to drive down to the south coast and when I've arrived on my long weekend, I want to be able to drive around as much as I want and have the possibility to charge it up down there somewhere. If I wasn't able to charge up down there, it would be a very big problem. (C1)

> My concern is that these vehicles require recharging. You've got to be able to garage them and you can't seem to take them away unless you know you have a recharging place you take them to … the inconvenience of charging would adversely affect my purchase decision. (C2)

> The other thing is the time it takes to charge. Because I believe the time it takes to charge is between 15 minutes and 30 minutes. So that's a period of time a lot of us don't have in our schedules and that would annoy me. At least at a petrol station you can pull up, fill up and be on your way. (C5)

As the passages above illustrate, a lack of public charging infrastructure will deter people from considering an EV. However, the promise of an increased abundance of public charging infrastructure has a favourable effect on the likelihood of considering purchasing an EV. Without a heavy abundance of public charging infrastructure, the compromise of an EV would simply be too great.

> I just came back from a trip to Europe and I saw these little electric cars parked in the cities, which you can hire to go around the city, like you have the pushbikes. I just thought that is a very interesting concept. Obviously that told me that – up until now I thought the long range wasn't yet there, and to recharge these electric cars seemed to be a little bit complicated – but now coming back from Europe, I see all these electric cars sitting around there; so they obviously have a network and I'm sure we will build in Australia the same network. Only if the network exists can I start seriously thinking about purchasing an EV. (C1)

> Compromises would probably be access to charging stations and stuff like that. If we were to plan a trip and we were to take an EV there might be places or destinations which we would probably say we can't travel there because the car would probably run out of battery before we got close enough to a charging station. So if we were to use the car for leisure purposes, travelling to different places on the weekend, then we would have to take that into consideration. You have the car there and because you have made this investment and you don't have an alternative you're kind of stuck in the choices you can make in terms of where you can go. So it does have a negative impact on the final decision. If there would be lots of charging stations everywhere it would put you at ease because there would be nothing to worry about: there's heaps of places to recharge if we were to run out of battery. (C3)

> I would be more likely to purchase an EV if the country was littered with charging stations like petrol stations that were conveniently located … when I need to charge the battery, I just need to drive half a kilometre. Like a petrol station, I can find a petrol station when I need petrol; I need to be able to find a charging station when I need to charge the battery. (C6)

> If there were good options available for charging the car, I'd be more likely to consider buying one. I would expect to find chargers in parking stations, at workplaces, even at meters on the street. If there was a higher abundance of these charging stations that would influence positively my potential ownership of an EV. If I knew I was driving across town and was going to park for two hours and could plug it in and charge while I'm there, how much that would cost? I don't know. Like a parking meter: swipe your credit card and plug it in and get $10 worth of charge that will get you back home again. (C4)

> I know at the moment it's a bit of a pain with the charging. I have friends that take their Tesla up to Byron Bay and they have to stop at a particular spot in Port Macquarie or Coffs Harbour or wherever it is that has a charging station. But I guess that will all change when electric cars become more common and there's charging stations everywhere. (C7)

As a result, in order for EVs to become a successful product innovation, and achieve significant market share, there must be a significant development in the abundance and saturation of public charging infrastructure:

> To be frank, I think before the EV can really become mainstream in this country, we need more charging stations. I don't think there is enough of them around. It's a real issue for Tesla people who drive outside Sydney. (C5)

> I suppose being fairly assured that there are plenty of power stations around will make me more likely to consider an EV, so there's not going to be an issue about that. (C9)

In close alignment with the availability of charging stations – or the current lack thereof – the time it takes to charge is another major consumer compromise.

> There's more convenience in owning a petrol car because I know I can refuel almost everywhere. As well as the quickness, you can pull up in a petrol station and put the petrol in and in five minutes you're back on the road; electric it's going to take five hours, probably. (C4)

This notion of having to wait to recharge an EV is simply not accepted by consumers. The expectation from the consumer is that they can refuel an EV in the same manner as an ICEV. They are not willing to compromise on this without any additional value in exchange:

> Currently, me filling up my car with petrol probably takes me between five and ten minutes. I'd expect the same from an EV, unless the cost is halved! So it's a trade-off … for half the cost I'd probably wait twice as long. (C6)

Therefore we can identify that the lack of charging stations and the time it takes to recharge an EV are huge compromises the consumer is currently unwilling to accept. While the management data highlighted an understanding of this consumer position, the biggest oversight from managers is consumers' lack of awareness in terms of alternative solutions for EVs. Education therefore comes to the forefront as a priority for managers to address, in order to convey the benefits and solutions to overcome issues surrounding charging.

7.2.3 Sub-theme 3: Price

The price point of any vehicle is a core consideration factor for a consumer.

> I obviously don't want to spend too much on a car; I think it's just a bit of a waste of money after a certain point. (C7)

As noted in the managerial data, the price point of EVs is historically very high in comparison to conventional ICEV models. Combining this high purchase price with inherent limitations, such as a lack of range and a lack of charging infrastructure, has a negative effect on the consumer perception of the technology. The role of price clearly influences the consumer purchase decision:

> Why haven't I considered purchasing an EV? Price point, probably. I think Tesla is beautiful – I've test-driven a Tesla and I really liked it – but it's so expensive! The price point is incredibly expensive, coupled with the fact that it's different technology … what stops me from purchasing an EV? Price! Price, absolutely price! (C5)

> What stops me purchasing an EV? Cost! (C6)

> In an ideal world I would buy one … but I still feel in my head that they are overpriced or they haven't worked out how to make them competitive. As much as I'd like to [buy an EV], I know that the cost of them prevents me to consider them. (C8)

While it is apparent that the high price of an EV has a negative effect on the consumer's perception of new EV technology; consumers expect the price point to eventually come down as the technology matures. The consumer participants have developed a perception that new technology often attracts a significantly high price point when it first comes on the market. However, historically, the consumer participants have observed that these products become far more attainable as time passes.

> Of course in my lifespan, I'm jaded by having lived too long. You know, when microwave ovens first came out they cost a fortune, and now they're cheap as chips. Mobile phones were the same: they were big as a brick and they cost you a month's pay, but now they're small as your wallet and they do a lot more now. And of course everyone has them; they are very affordable. So I guess the point is I imagine in the future EVs will do the same … as they become more mainstream, they become more economical. The inverse of that also applies of course: as they become more economical, they'll become more mainstream. (C4)

If the price of an EV were to come down, this would have a positive impact on the desirability of the EV product for the consumer. Ultimately, the consumer expectation remains that an EV should be comparable to an ICEV in almost every way. Not only should they have the same product functionality, such as range and refueling characteristics; but they should also be priced on par. If this were the case, the likelihood of a consumer purchasing an EV over an ICEV is increased.

> A lower price point would make me more likely to purchase an EV. (C5)

> I would of course do my numbers on value for money … value for money is that the existing car industry, I believe, is super competitive. Today I can buy a very good car for actually very little money, I think … and value for money means that an EV needs to compete with the existing ICEV cars. (C1)

Ultimately the data identifies that consumers are price-sensitive, particularly when it comes to a vehicle. Therefore they are unwilling to spend more on an EV simply because it may carry some inherent environmental benefit. The data clearly outlines a trend where consumers would only consider an EV once EVs reach a comparable price point to current ICEVs.

In summarising the effect of all the product compromises covered under this theme – range, charging and price – we can observe from the consumer data that these consumer interview participants are not willing to compromise. These consumers expect an EV to deliver the same functionality and user experience to which they have become accustomed with an ICEV. From the perspective of the interviewed consumers, only once this is the case do EVs stand a chance of becoming a realistic product alternative to an ICEV. When asked if all the product compromises are removed and EVs and ICEVs perform comparably on all levels (price, range, safety, performance, and so on), would they choose an EV over an ICEV? The following response were received largely indicated a preference for an EV over an ICEV:

> Yes! (C1)
>
> It would certainly be in the options, yes. If it’s equivalent, meets all the needs, meets all the requirements. (C4)
>
> Yes! … I would have to know which one [EV or ICEV] was more eco=friendly. So if they’re similar on levels and they offer me the same advantage, I would choose the more eco-friendly one. (C6)
>
> Yes! Because of the environment; environment all the way. (C8)
>
> Yes, it’s for the environment, less pollution. (C9)

What we can evaluate from this theme of product compromise is that both managers and consumers can identify that EVs are currently a compromised product. We can further identify the need for OEMs to either remove these product compromises through increased product development and product innovation, or to manage these compromises in the market through new and innovative strategies to reduce their effects upon the consumer. The consumer data shows that once these compromises are reduced or removed, the consumer appeal of the EV product is likely to drastically increase. However, both the managerial and consumer data highlights a discrepancy between the possible methods to address these product compromises and which approach would work best in the marketplace. Therefore we can identify that this discrepancy and conjecture between managers and consumers, in relation to product innovation, must be addressed through new theorisation.

7.3 Theme 2: Total Cost of Ownership (Managerial data)

The Total Cost of Ownership (TCO), which is the total cost a consumer will bear by owning the vehicle (such as purchase price, servicing, insurance, registration, fuel, and so on), is a topic often considered by consumers when purchasing a vehicle, and comes into effect in the 'EV versus ICEV' ownership debate. EVs have a higher upfront cost but lower running costs over time in comparison to ICEVs (McKinsey 2016). However, to what degree do managers see the TCO debate being relevant to consumer adoption of EVs? Industry literature highlights the importance of TCO as a driver for the adoption of EVs, in conjunction with the already established themes around range, charging and price:

> Stricter emission regulations, lower battery costs, widely available charging stations, and increasing consumer acceptance will create new and strong momentum for penetration of electrified vehicles (hybrid, plug-in, battery electric, and fuel cell) in the coming years. The speed of adoption will be determined by the interaction of consumer pull (partially driven by total cost of ownership) and regulatory push, which will vary strongly at the regional and local level… (McKinsey and Company 2016)

The TCO equation is heavily affected by the upfront purchase price of a vehicle, which has consistently been flagged as an issue with EVs:

> The business case for electric vehicle acquisition is strongly dependent upon upfront purchase price and the residual value at the time of disposal… (State Government Victoria 2013).

A more predictable influence on the TCO equation is running costs – specifically ‘fuel’ (petrol/diesel or electricity). Running an EV with electricity is cheaper than running an ICEV with petrol or diesel, as was highlighted in the Victorian EV trial:

> The average cost for a trial household participant to run their electric vehicle on renewable energy was between $7 and $10 per week. This is about half of what it would cost to run an equivalent petrol vehicle, with none of the emissions. (State Government Victoria 2013)

From a management perspective, the awareness TCO receives from the consumer can vary, depending on the consumer segment:

> Among EV enthusiasts, TCO is a massive influencer on the consumer purchase decision. Among the mass market, there’s not a lot of consideration. At mass

> market, the upfront capital cost is all that matters: that's all the consumer looks at and for them, it must match an ICEV. Only EV enthusiasts will actually sit down and do the numbers and work out how much an EV will save them over the life of the car. (M4).

The role management believes TCO plays in the Australian EV market is not just dependent on a financial cost. However, managers also consider the suitability of an EV in terms of financial and practicality costs. Therefore we briefly explore the impact of the consistent managerial sub-themes of range, charging and price on TCO, below.

7.3.1 Sub-theme 1: Range

Crucial to the execution of a TCO advantage is balancing that financial advantage against the actual practical premise of a particular vehicle. In essence, although an EV may have a financial advantage over an ICEV, that advantage becomes redundant if it cannot perform the duty required. This becomes highly relevant for fleet buyers in particular. If the TCO equation can be applied positively for EVs over ICEVs, government fleet buyers would become a serious potential market, depending on the use cases as determined by the range requirements. Currently there is immense interest from government fleet buyers to take on sustainable transport solutions. However there are obvious cost considerations that must be accounted for as well as the use case of EVs. For some use cases the current EV range is sufficient; however, for many other use cases the limited range serves as a barrier to adoption.

> There are use cases in local government where the technology is perfect, in councils with city rangers; EVs tiptoeing around the city is magic. Take a

> council that's out in the regional areas, use case is very limited and that comes back to range. (M2)

Industry literature which investigated the benefits and limitations of deploying an EV fleet in the USA found that

> Only 6% of the duty cycles would have not been range capable for the all-electric vehicles assessed in the models. These results helped fleet managers in the program determine how to mitigate risks of range issues by knowing where to deploy EVs where they would be range capable and ensuring that they deploy electric vehicles in applications that allowed sufficient time to fully charge. (Fraser Basin Council 2013)

The industry data therefore highlights EVs as a practical alternative for certain government applications. However, for the cases where EVs are not practical due to limited range, what impact does this ultimately have on the feasibility of integrating EVs into a government fleet? Again, we must consider the differences in perspectives between managers and consumers – who, in this case, are government buyers. Their divergent views need a deeper integration to find a practical solution to facilitate a sustainable EV application for these consumers.

7.3.2 Sub-theme 2: Charging

As highlighted above, government fleet buyers may have some issues with the range of EVs and this may result in a negative cost. However, for local government, charging can be easily utilised and be more practical than having to visit petrol stations.

Refuelling a government fleet with petrol has an opportunity cost, while recharging an EV simply takes place at the location where the vehicles are usually parked:

> Most of these guys [local government] see charging as depot charging or back-to-base charging. (M2)

The industry literature equally found that this method of charging was largely feasible for a large majority of fleets:

> Across all the fleet operators in the program, 81% of their duty cycles where found to have sufficient time to fully charge the best-matched EV every night with a Level 2 (240 volt, 30 amp) charging station. (Fraser Basin Council 2013)

Although there are inherent issues with charging times and charging locations for some consumers, for other consumers this isn’t an issue; charging can be done at the place a vehicle is parked (for instance, at a depot, for government customers, or at home, for private customers). Not only is it more convenient but it is also significantly cheaper, increasing the TCO with financial savings and opportunity cost savings.

> We can get around the charging issue, with people plugging in at home; they need to understand that it’s cheaper to do that than pulling into a petrol station and filling up with petrol. (M3)

Consumers can find varying scales of value in EV ownership as they are in greater control of their fuel costs; electricity prices are more transparent and consistent than fuel prices, which are volatile at times. M2 found EV owners to be

> [g]etting quite some value in the refuelling cost, and they have control of their refuelling costs – by utilising time-of-use metering – and, subsequently, how

> much their fuel costs. They get some sense of satisfaction in choosing the price for their fuel. (M2)

The variable nature of electricity pricing meant managers observed that if utility companies were to establish specialised EV electricity tariffs, this would further reduce the TCO for consumers:

> If there were favourable tariffs for EV charging, that would reduce the cost of fuel, and some energy retailers are now investigating this. (M2)

This highlights the opportunity for managers – not only at OEMs, but also other industry stakeholders – to play a role in driving down costs for consumers, increasing the TCO equation and subsequently increasing the value of an EV for consumers. Therefore we can identify that the relevance of EV uptake extends beyond simply vehicle manufacturers and vehicle buyers.

7.3.3 Sub-theme 3: Price

The low operating costs of EVs make them an attractive proposition for individuals and businesses who are trying to reduce their operating costs; however, lower operating costs are only desirable as part of a broader TCO advantage. When managers were asked which buyers would want to buy an EV but don't – and why they don't – M2 outlined:

> For fleet and government, it's mostly TCO … Fleet managers talk about TCO; that's the only number they care about. Whilst maintenance costs and fuelling

> costs are really cheap with EVs, it's the capital upfront which doesn't offset itself. When you amortise the cost of a three-year lease, it doesn't work. (M2)

The benefits of achieving a TCO advantage can significantly increase the adoption of EVs in Australia, due to the significance of fleet volumes in Australia and the importance fleet managers place on TCO:

> The key to EV adoption is fleets, because fifty per cent of car sales go to fleets in this country … fleets are not wedded to any brand; they do not have the same emotional attachment as [private] consumers do. They are driven purely by economics and a little bit by marketing; they like the idea of saying they drive a zero-emissions fleet – that's good for the brand – but they are not going to pay a lot extra for that. However, if they can see over the lifetime of the fleet – say, three to five years – their fuel savings means that the cost of ownership of an EV is the equivalent or maybe two per cent more than an ICEV, they'll do it. (M4)

The importance fleet managers place on TCO is reflected in the Victorian EV trial, where a fleet operator commented:

> They've said they can do an EV for the same total package cost over three years as one of my current vehicles – but if I'm not going to save anything, why would I bother? (State Government Victoria 2013)

This highlights that EVs need to be cheaper than ICEVs to operate – not merely equivalent. The industry literature, however, highlights that in the USA, achieving financial savings by using EVs in vehicle fleets is achievable:

> Although the results varied considerably from one application to the next, the modelling indicated that the financial benefit of electrifying their fleet applications would be approximately $15,968/vehicle over a seven year service life, while potential reductions in fuel usage and life-cycle GHG emissions by 94% and 95%, respectively. Across all fleets, the pilot program estimates an opportunity for $1,964,148 in financial savings and 3,526,915 kg of CO2 savings by selecting the optimal powertrain and EV model for each duty cycle. (Fraser Basin Council 2013)

Therefore we can identify the importance of TCO for fleets and also find evidence that in some cases, a TCO reduction is possible. In particular, the interview data identified that a rise in operating costs of ICEVs results in an opportunity for EVs to deliver better value to consumers over the total life of the car:

> The sudden drop in the price of oil is taking the urgency out of the need to find alternative drivetrain technologies, such as electric drivetrains. With oil prices plummeting people have no urgency to get off petrol or diesel. When petrol was up around $1.70 per litre we were getting lots of enquiries about our technology because people were fearing this psychological $2 a litre number and that was motivating people to find alternatives. Now it’s $1.30 to $1.40, and people are saying it’s not such a big deal. (M2)

> With the oil crisis, if that at least would go the other way and petrol prices would go up, then obviously at some point you could argue: “Okay, over a few years’ time [I will recoup the price premium of an EV] with the savings on electricity over petrol.” (M5)

The industry literature supports the effect oil price has on EV adoption, highlighting that transitioning to EVs will be dependent on

> [t]he effect of world oil prices upon fuel prices for ICEV vehicles. (AECOM 2011)

A study conducted by ABMARC (2012) highlights that Australia, in comparison to other markets like Germany, Japan, USA and UK, currently has a lower margin of economic benefit in terms of electricity against petrol:

> The higher the comparative electricity to petrol percentage, the lower the financial incentive for motorists to change from liquid fuelled vehicles as the payback period for electric and plug-in electric cars increases. Whilst Australia does not have the highest electricity prices in the world, it does have the longest payback period for electric and plug-in electric vehicles due to Australia's relatively low cost of petrol.

The interview data further emphasised this correlation between purchase price and running costs that makes up the TCO of a car:

> I think price is one of the main factors; the running costs in the mid-term are lower, if electricity prices are staying where they are. But the offset at the moment is the relative high starting price … If the price of EVs were to drop, the TCO equation will definitely be in favour of EV cars. (M5)

> EVs are expensive! … I think making it [EVs] affordable is going to be the big key in the future, or a couple of years' time! (M6)

Industry literature backs up the interview data and identifies that TCO parity of EVs in comparison with ICEVs can be achieved in the future and will result in a shift towards EVs:

> The net cost of … [EVs] … compared to conventional petrol and diesel vehicles depends on the rate at which the costs of these vehicles fall over time … modelling shows … [EVs] … will deliver passenger transport more efficiently across the community than conventional petrol vehicles by 2025. This analysis includes all the direct costs faced by drivers including purchase, refuelling and maintenance costs. (Energeia 2015)

While reducing the upfront purchase price is identified as one method to promote the total cost of ownership equation, it is highlighted that even while an EV may be a cheaper vehicle over the total lifecycle of the car, the upfront purchase price highlights a perceived cost to consumers that is higher than an ICEV:

> The high purchase price of an EV is seen as a roadblock as that is the perceived cost [to the consumer]. Whether they're looking at the whole of life cost, they're not taking into account how much it costs to service a modern diesel or petrol. They're not taking into account the average monthly or yearly fuel costs and that's probably where a lot of the marketing should change, around the whole of life cost of an EV against an ICEV. (M7)

This further identifies the role awareness and communication play in ensuring the consumer understands the additional value an EV can deliver throughout the ownership lifecycle. However, in order to best understand the consumer perspective, the next section will explore the consumer perception of TCO.

7.4 Theme 2: Total Cost of Ownership (Consumer data)

The analysis of the consumer data shows that the TCO equation is relevant, in some sort of capacity, for the majority of consumers. Fundamentally, the consumer is familiar with the ‘total cost of ownership equation’. The consumer does not assess the economic impact of a vehicle purely based on the upfront purchase price; the price of fuel, service, maintenance, parts, and so on are all formulated into the consumer purchase decision.

> Okay, TCO is: the cost of the vehicle in the first instance, change of registration, ongoing registration, insurance, petrol, minor mechanical issues [servicing], major mechanical issues and depreciation value. (C6)

> For me it’s the initial price as well as the long-term investment price, factors like servicing costs and spare parts. And that’s the reason I went with Toyota because it’s just cheap to service and parts are easily available… (C3)

The analysis has highlighted that consumers continuously perceive EVs as expensive technology. From a TCO perspective, the consumer is not willing to bear the financial burden of this new technology without any inherent benefit.

> I think financially it’s, what it all comes down to – it’s the world economy, isn’t it? … Would I put myself out? Not financially! (C4)

The data also suggests that some consumers don’t see electricity as a more economical fuel in comparison to petrol or diesel, due to the ever-rising cost of electricity:

> A few years ago, the price of electricity was more reasonable. With the price of electricity going up, it’s unreasonable – not interested! (C6)

This perspective on electricity cost in comparison to petrol highlights again that the perspective of managers and consumers are different because some consumers do not see electricity as a cheaper alternative.

The relevance of TCO is highly variable depending on the individual consumer, their priorities, stage of life and socioeconomic situation. The younger consumer demographic sees a vehicle as an enabler of mobility and is far more methodical with their decision to invest in a vehicle.

> At my current age TCO is quite important because there's other things to take into consideration. I'm saving up for a place, putting money aside for starting a family. So having another expense, like a car expense, needs to be calculated so I know exactly how much, overall, it's going to cost me. I see a car as not an investment to make you rich, but an investment to get you where you want to go. It's not a luxury expense; it's a necessity expense. I'm willing to spend a little bit of money – I want to get value for money – but I just don't want to spend the money and not get a product that matches that amount of money. (C3)

> The problem with cars is, the moment you drive them out of the dealership, they go down [in value]. If you put your money into your house, it seems to just go up [in value] … We'd like to put a second storey on the house, we'd like to do this to the house, we'd like to do that. The car is important, we spend a lot of time in it, it needs to be safe; but we don't really just want to put a whole chunk of money into it at our stage in life with kids beginning school and that. (C8)

> I don’t want to invest too much in a car because of the damage kids do to a car. Are you going to pay $120k and tear your hair out every time you see your children kicking the back of the seat or doing whatever? Or are you going to get something that’s cheaper, where you don’t sweat it as much when they leave lollies in the car and all that rubbish? (C9)

For the wider consumer demographic, the TCO equation still has a high relevance, but it is not the primary consideration factor in the vehicle purchase decision.

> It [TCO] is reasonably relevant but things like size and power sit above that. (C2)

> To me, TCO is a consideration but not a major consideration. I think comfort and safety becomes the most crucial issue. (C5)

The wider consumer demographic assesses TCO second to other preferences and purchase influences. In the context of a vehicle, these could be: design, size, practicality, safety, performance, and so on The analysis found that in these circumstances TCO plays less of a role and that the consumer would be willing to pay more in order to get what they want:

> The TCO equation is probably a 7/10, it’s not first but yes, of course, it’s considered. Double the price [of an EV] is too much; probably 20 to 30 per cent [more expensive] is what I’ll be willing to pay. (C1)

> How relevant is the total cost? Well, it’s very relevant, but it’s a matter of the scale! If you’re talking about 10 or 20 per cent higher then it’s not really a major factor, but if you’re talking double the cost, then it is! If you pay double the cost for everything you had, well that adds up! (C4)

> If I was going to buy a second vehicle, I would balance that [TCO] with convenience. If I could get more convenience, I would be willing to spend more. (C2)

The TCO of ownership of an EV must also be weighed in the context of the usability of an EV. If the EV had limitations in its usability, the consumer would only accept these limitations if the TCO was significantly lower in comparison to a more convenient ICEV.

> I would consider an EV if the TCO was 50 per cent less than an ICEV … because it's going to be inconvenient: charge time, availability of charge station, range of the vehicle, battery replacement … there's no relative advantage over the status quo, and in fact it increase the cost to me, the consumer. (C6)

As the above highlights, the consumer places emphasis on the TCO of a vehicle. Subsequently, they believe an EV should offer a similar TCO equation to an ICEV. Due to the nature of the new EV technology, there are concerns from the consumer regarding the longevity of the EV product. In particular, there is a concern with the longevity of the new components in an EV: specifically, the battery:

> In terms of value for money, EVs need to compete with ICEVs on running costs. What is the purchase price, what the running cost is and what's the longevity? If I have to buy a new battery every two years, I don't know, I'll look into that; but it's got to be comparable [to an ICEV]. (C1)

If OEMs were to guarantee their EV products longevity, offer reduced cost of servicing or capped price servicing in EV ownership; this would instil confidence in the consumer purchase decision. If the running costs of an EV could be easily compared to those of an ICEV and the result was favourable to an EV, this could have a positive effect on consumer adoption of EV technology.

> What would make me more likely to purchase an EV? I guess if the OEM offered a reduced cost in the servicing, if it was the same price or even cheaper to service an EV compared to an ICEV then yeah, it would make sense. You could compare the two and say it's cheaper to actually get an EV, and the long-term investment as well would be cheaper because the servicing cost is lower as well. (C3)

Ultimately, that consumer data shows if EVs were to offer similar or identical TCO benefits to the consumer when compared to an ICEV, this would have a positive effect on the consumer's assessment of the technology.

> I know that EVs perform very well; they drive well. If you get the same car for a lesser price, it's a no-brainer! (C1)

> Because we keep the car for more than five years, spending more upfront to save more in the long run would be something we would consider … if an EV were cheaper [to operate] I'd consider it. From an investment point of view, it would be more feasible to get an EV because the running cost would be lower and overall serving cost would be lower and more money in my pocket makes me happy! (C3)

Both industry managers and consumers alike identify the TCO equation as crucial. However, the data does identify that while consumers would consider an EV more favourably if it had a lower TCO in comparison to an ICEV, they are less methodical in their calculation of TCO than industry managers may think. Consumers are also not inherently educated on the key differences in running costs between EVs and ICEVs, highlighting the need for additional strategies to bring this topic to the fore. This further extends the emerging issue in this research: that in the context of new product innovations, there is a clear separation between managerial and consumer perspectives. This highlights the need for a deeper integration between managers and consumers in the context of new product innovations.

The product innovation analysis chapter has identified a largely consistent view between managers and consumers that EVs carry compromises for the consumer when compared to ICEVs. However, the exact extent of these compromises, the implications and possible solutions are subject to a large degree of conjecture when contrasting the managerial and consumer perspectives. The data identifies that the consumer expects an EV to deliver the same user experience and product experience that they have become accustomed to with ICEVs. As it stands, EVs are a compromised product and as a result offer the consumer a negative benefit in comparison to an ICEV. From a managerial perspective, while managers observe these issues somewhat, there seems to be an overall lack of understanding of how deep these product compromise concerns run with consumers, and managers also underestimate consumers' general lack of understanding of what practical solutions may exist now and into the future.

The management data highlights a perspective that in order to rectify these compromises, managers must continue to innovate the product and/or develop strategies to reduce the implications of the inherent compromises. Once these compromises can be removed, an EV can offer its unique advantages, such as lower running costs and environmental benefits. In turn, these benefits can begin to make an EV more valuable to a consumer in comparison to an ICEV.

However, from a consumer perspective, it is questionable if such management strategies will truly address the problem. The analysis has continued to extend the key finding that in the context of product innovations, managerial and consumer perspectives are not aligned. This continues to support the need for new theories to integrate managers and consumers more closely in the context of product innovations.

The role of consumer value in the context of this research will be addressed in the next chapter.

Chapter 8 Analysis – Consumer Value

Central to the positioning of this research is the consumer and the role the consumer plays in the success or failure of a particular product innovation; which in the context of this research are EVs. This chapter will evaluate how, in the context of the Australian EV market, the consumer value equation is positioned in response to new technology. The chapters above have highlighted issues with the EV product and this in turn results in a negative consumer value for such a product. The analysis thus far has also clearly identified a rift between the managerial perspectives against the actual consumer perspective. This highlights immense relevance in this particular chapter to explore how both managers and consumers themselves interpret how EVs create value for consumers and possible methods in order to extend the value of EVs.

This chapter will take the following structure by focussing on the primary themes of 'consumer perception of new technology' and 'new value and image'. The themes will be explored from both the managerial and consumer perspectives individually and broken down by the various sub-themes. For the management perspective, this will continue to be the consistent sub-themes of range, charging and price. The sections highlighting the consumer data will look at the primary theme of 'consumer perception of new technology' and break it down into the two sub-themes of 'a promising consumer technology' and 'current state of the technology'. The second primary theme of 'new value and image' will be broken down into the sub-themes of 'environmental consciousness: a contemporary value' and 'public image: a limited consumer value'.

8.1 Theme 1: Consumer perception of new technology (Managerial data)

From the data analysis of the managerial interviews, it has emerged that managers believe that the consumer's perception of EV technology plays a large role in its desirability as a product. For those consumers who positively perceive EV technology and enter that market segment at such an early stage in the product lifecycle are identified by strategic managers as 'early adopters'. For instance, M1 view that

> Currently we are seeing early adopters or technology focused customers adopting this EV mobility. Not just for the benefits in efficiency, but they are really interested in the technology and how this technology can be implemented into their daily lives and make it easier upon them to drive from A to B (M1).

These 'early adopter' consumers are committed to acquiring the latest and most technologically advanced products as soon as they come to market. Early adopters, who appreciate new technology, are willing and wanting to implement as much new technology into their lives as possible. As the development of EVs continues, this desire for EV technology has the potential to filter through to more people as the technology becomes more widely recognised and accepted

> OEMs have invested millions, tens and hundreds of millions of dollars in developing EVs and they're trusted brands, respected brands; so people understand that if it's good for the OEMs to invest that sort of money, it must be credible technology and must be worth a look (M2).

However, the current status remains that while there are these 'early adopter' consumers out there who do find value in these new products; the majority of consumers are still wary of EV technology and have a poor perception of the technology due to the issues surrounding the product e.g. range, charging and price. However, as the product begins to mature and is starting to be shaped into a product that is valued by consumers, the perception of some consumers seems to be changing

> Consumer perception of EVs is also very low! But manufacturers like Tesla are making inroads as they're producing sporty eye catching models and positioning their brand outside the normal mass market methods. They're not doing TV, they're not doing radio and print. They're using next generation marketing methods, which is appealing to the market that buys those cars. So all of the social media has driven their marketing and interest and you have people lining up for the next model, which is great to see! (M7)

> You have a few people who are very technology savvy and they actually probably like it. But a lot of people are still [thinking] … "How reliable is the technology?" (M5)

> It's very hard to put general statement on the overall perception of EVs in Australia. I think if you are an EV fan, you in most cases love them. If you are more conservative and in this corner of range anxiety and "is it really that green if you look at the whole production process", you're probably not too supportive … overall if you look at where the numbers lie, I would say it's a 90/10 split on the conservative; but I think over the next few years this will significantly change! Once more EVs are brought to market, once the [Tesla] Model 3 comes, I think that will pretty much be a mainstream car and that will be very successful with volume numbers (M5).

The industry data around the emergence of EVs and this new technology takes positive look at future potential. KPMG's Global Automotive Executive Survey 2014 highlights that

> 47% (of surveyed industry executives) consider use of alternative fuel technologies as <u>critical</u> to consumers' purchase decisions" (KPMG, 2014).

Therefore we can identify that managers believe that the consumer perception of EVs as a new technology is varied. Early adopters are already embracing the technology, but the majority of consumers are hesitant to embrace the technological change due to lingering concerns, in particular with range, charging and price. Therefore, we will continue to explore the managerial perspective of the consumers' perception of new technology following these three sub-themes of range charging and price.

8.1.1 Sub-theme 1: Range

Many early adopters of new technology are also interested in EV technology. Many of these consumers are willing to pay a price premium for new technology, however other product related issues become a barrier to purchase. In terms of EVs the managerial data highlighted that one such barrier is the consumer perception of EVs having limited range

> It's the range anxiety … with a Nissan Leaf you have 130-170 (kilometres of range), which really, for a daily commute is more than enough. People seem to think they need to have 400-kilometre range available to them at a drop of a hat, but most people only drive less than 70 kilometres a day; so the Nissan

> Leaf's got twice as much available to do that … it's a change of mindset [that is required] but the old range anxiety is an issue [for interested consumers] (M3).

> People's perception of EVs is that they have limited range. There not overly aware of how limited the range is, they just know it's less than an ICEV and that's enough for them not to consider an EV (M4)

The WA EV trial (2012) found that the range of current EVs is more than capable of the average commute

> 25km [was the] average distance driven between charges; 22km [was the] average daily driven distance, which is lower than the average daily distance for petrol cars [32km]. (Mader & Bräunl, 2012)

This comes back to theme of awareness and communication from OEMs around this new technology; questions need to be answered to shape consumer perception of EV technology in order to dispel doubts regarding the core issue of

> Why would I buy something that has limited range when I can buy something much cheaper that has superior range?" (M2)

Therefore the managerial data highlights that managers believe the consumer perception of limited range must be addressed in order to remove this as a barrier to purchase.

8.1.2 Sub-theme 2: Charging

Another issue managers believe is clouded by misconstrued consumer perceptions is the issue of charging. Customers, naturally, don't have all the answers to their questions, it is significant to note that the data presented here demonstrates that managers believe they are aware of these issues. M2 highlights that consumers perceive EV recharging with questions such as:

> Where on earth do I fill these things up? Where can I recharge and why does it take so long to recharge? Why can't I recharge anywhere I want ubiquitously and fast (M2).

Managers believe that there is a clear consumer perception that charging a vehicle as opposed to filling it with liquid fuels implies some sort of extra effort

> Having to charge a vehicle seems to be a big hassle (for some consumers) … the perception there is that they may have to do something above and beyond just parking up a petrol car when they get back to the office. Having to pop the boot open and plug a vehicle in, just seemed to be inconvenient and time that could be spent buying a latte or something else! … it may take them two minutes but that's two minutes out of their lives that they can't afford (M7).

Therefore a key to shaping consumer perception, again, comes back to communication and giving the consumer information as to the options available to them so they can work around new user habits and be informed

> Charging is a hassle. The best thing we can do is make it as easy as possible for the drivers … EV drivers are a very savvy lot and they crave information,

> so as long as we give them information, they'll take control of their own situations (M2).

The WA EV trial (2012) reflects this issue around extended charging times, highlighting the requirement for faster charging stations and connecting drivers to the charging process by providing them with plenty of information

> The collected data confirms that EV charging bays tend to be occupied for most of the day by the same vehicle, so EVs continue to park when the charging operation has finished. This prevents charging stations from being used in an optimal way, because they get a lower vehicle throughput and a lower than optimal utilisation.
>
> These results indicate that a smaller Level 3 (fast-DC) charging station network could be more important than a larger Level 2 network. Level 3 stations typically allow an 80% charge in 20 minutes (compared to Level 2 chargers which take 3-4 hours for a full charge). As this is much closer to a petrol/diesel fill-up time, an EV driver could be expected to stay with the vehicle (or in an adjacent station store or coffee shop) and immediately move the EV after completion of charging, making space for the next EV.
>
> Web-based statistics as well as smartphone apps have been developed to assist EV drivers with information about their driving behaviour and charging status. This can be extremely helpful when waiting for the completion of a charge cycle before taking the EV for a drive, as well as for monthly statistical evaluations.
>
> The trial reinforced the view that the availability of basic EV charging infrastructure will be an essential factor in the uptake of EVs. While not

> required on a daily basis by most EV drivers, it is a matter of reassurance to know the infrastructure is in place when needed. (Mader & Bräunl 2012)

While managers highlight the consumer perception being negative in reference to the long charging times, there is also the issue of the amount of charging stations available. However, increasing the amount of charging stations is an expensive exercise and one which is uneconomical with a small fleet of EVs which would utilise these chargers, as observed in the Australian market. This stops many private enterprises in entering this space to supply charging stations since for any commercial entity it is uneconomical to run an EV charging station network due to the

> Cost of Capital equipment to run such a small amount of vehicles out there. So charging stations, charging highways and infrastructure in city areas and outer metro areas; it's not really at the point where it is in Europe (M7).

Therefore we can identify that managers believe that due to the long charging times and a lack of charging infrastructure, consumers have a poor perception of EVs and their usability. Possible strategies to rectify these consumer concerns are also identified as uneconomical since the small market share of EVs makes an infrastructure network implausible to operate without attracting significant financial losses.

8.1.3 Sub-theme 3: Price

The pricing of EVs is another element the managerial data identified as having a high influence on the consumer perception of EVs. The collected data consistently suggests that managers believe that high price perception of EVs by consumers is as a major barrier to entry for consumers.

> People perceive EVs as very expensive for what contains a lot of unknowns for them. It’s a leap of faith and a lot of money. People are saying: Why would I pay a premium for a vehicle I don’t fully understand yet? It’s cool, it’s a look at me kind of thing but it might not be practical yet and it might not be value for money (M2).

> [Initial EVs offered in Australia] were not very successful at all … the perception in the market here with EVs is still very conservative … EVs are usually coming with a massive premium in price and then to convince customers or prospects to go for that alternative over an ICEV is very very hard. (M5)

In support of this high price perception of the consumer, managers reaffirm that consumers are unwilling to pay more for an EV over an ICEV. When asked why EVs are not being heavily adopted in Australia, M3 highlighted that

> Pricing is the number one factor. If they [consumers] can buy an ICEV vehicle for $20,000 less than an EV, they tend to gravitate towards that. The people who are really keen on this technology will step up and pay more for that vehicle. Once we get to an equilibrium where the plug in vehicle might be a slight premium over an ICEV vehicle, that’s when we are going to see a huge transition (M3).

The high list price of EVs is one pricing factor which managers believe influences the consumers’ price decision. However with prices trending downwards, managers believe consumers have not yet become aware of this in their pricing consideration.

The pricing consideration is identified by managers as paramount to the consumer decision making process.

> The perception is that the EVs are much more expensive than the standard vehicle; whether customers actually realise it or not, the prices have come down quite a lot … the big question [for consumers] is, “What are they going to lose by buying this technology? What’s the depreciation they’re going to cop compared to an ICEV?” … to the mum and dad buyers, that’s the biggest consideration. They want to be seen as green but what’s it going to cost them to do that? (M7)

This feedback confirms that the Australian consumer has a strong perception that, although the technology may be suitable to them (where range or charging are not an issue for a particular consumer), the significant price premium may not justify a purchase.

> Currently the EV market is in its infancy, where it’s an early adopters market; people understand that there’s a price premium as someone has to pay for the R&D that goes into the product. Many people are not prepared to pay the premium and will wait for others to pay the premium before jumping in at a later stage in the product lifecycle (M2).

There is evidence to suggest that this point of the product lifecycle is slowly approaching with the next generation of EVs that promise to be more attainable due to a lower price position.

> Price is a big barrier, there are a lot of people who would like to get into an EV but the ones that appeal to them, are out of their price range … we need the right product at the right price in the market place. If you look at Tesla now

> with the Model 3, I personally think that will be very successful if they get the product substance right and the quality; because it's at a price point where so many more people who want to drive an EV will be able to afford it (M5).

The management perspective on EV pricing highlighted in the interview data conforms to the industry data which highlights that

> 77% [of surveyed industry executives] believe EVs will only go mainstream if prices come down (KPMG, 2014).

This supports M3's claim that once we reach

> an equilibrium [in price] … that's when we are going to see a huge transition.

The claim is also supported by M5 and M6:

> If EVs are pricing wise on par, or at least a good alternative to ICEVs then that would defiantly increase the uptake; if the product is the right! … If you have the right design, the right car at the right price, then people wouldn't be that adverse to an EV. (M5)

> The cost of the [EV] technology is the first thing that needs to be addressed. The key challenge [for EVs] is to be competitive against the diesel version of a car (M6).

Furthermore, the industry data again highlights the point of transitioning away from ICEVs towards EVs lies in the key variable as to when there is a switch in

> the capital costs associated with (EV) vehicle purchase, in relation to the costs for conventional ICEV vehicles (AECOM, 2011).

Therefore, the management perspective is critical in flagging price as a major driver behind consumer EV uptake. Managers believe that the consumer perception around pricing, among range and charging, is currently restricting EV uptake. Therefore, addressing these issues is seen as the managerial approach to increasing EV uptake. In order to validate this perspective, or provide an alternative viewpoint, we will investigate the consumer data in the next section.

8.2 Theme 1: Consumer perception of new technology (Consumer data)

The consumer data analysis found that the majority of consumer participants perceive EVs as a promising technology for the future. They largely support the development of the technology and do not have a resistance to the concept of an EV; by virtue consumers interviewed displayed a largely neutral view on a preference for which particular fuel source powered their vehicle.

However, the consumer data clearly shows a perception from consumers that the current state of the EV technology simply isn't 'ready'. They seem to associated EVs with a variety of 'unknowns' and this lack of clarity, along with EVs not being a 'mainstream' technology, is a key barrier to consumer adoption. The consumer perception of EVs has a strong correlation with the previously covered topic of communication and awareness, suggesting a close correlation of these topics is required in practice. The detailed analysis of the consumer interview data on their perceptions of EVs as a new technology are outlined below in the two sub-themes of 'A promising consumer technology for the future' and 'Current state of the technology has too many limitations for consumers'.

8.2.1 Sub-theme 1: A promising consumer technology for the future

The consumer data clearly identifies that when it comes to EVs, consumers see this as a promising technology for the future. Consumers believe that EVs will at some point in the future supersede conventional ICEV technology.

> I believe we will all drive EVs in the future … 100%! I'm convinced … [because of] emissions [and] they will be easy to use once we have the power points, so to speak, and I believe the energy efficiency of an electric motor is much better than that of an ICEV (C1)

> I'm pretty excited about it [EVs]. I definitely think they are probably the future technology of motor vehicles. (C2)

> I'm sure in the future we'll all be driving EVs. (C7)

While the consumer participants do see the technology as promising and fundamentally beneficial to society; they highlight, while acknowledging the benefit and potential of EVs, recognise that the concept of an EV has been around for some time and has failed to gain any significant traction in that time.

> To me it's not new [EVs] in the sense that I have been hearing about it since I was a kid reading a popular mechanic magazine, regenerative braking and EVs. It's been very slow to develop and finally to become available to us. I certainly believe it's the way of the future; because of the environmental concerns because it's clean transport. (C4)

> I think it's a bit old hat. It's been around for a while and hasn't really sort of gripped and I think there's more exciting possibilities out there. (C6)

However, while some consumers have been exposed to elementary EV concepts, there is an underlying consistency among the majority of consumers that the possibilities for real world mass market EV adoption is possible in the future. This emerges because there appears to be a fundamentally intrinsic psychological justification from consumers as to why EVs should supersede conventional ICEV technology. Those intrinsic justifications are predicated on environmental concerns and recognition that EVs may serve society with a more sustainable transport future, in comparison to conventional ICEVs.

> I’m excited about the technology. I believe it’s a cleaner technology for our environment. I just came back from Beijing and I’m sitting in a traffic jam and it’s just crazy, the pollution! And that’s by cars, and it really puts me off. I’m concerned about my grandchildren, the future of our planet! (C1)

> [EVs are] a good idea that needs to come forward to help the environment and hopefully it will be an economical means of transport. (C4)

> I know it’s [EVs] the way of the future and we’re all going to have to go that way. (C7)

Further, while there is an intrinsic justification with environmental credentials, consumer participants are also of the perception that EVs will be a more financially economical means of transport in comparison to ICEVs.

> I think it’s a great idea that OEMs are moving towards hybrids and electric technology because relying on petrol has issues. One is the cost benefit and then obviously there is the impact on the environment. (C3)

While the consumer perception of EVs is that they promise to be a more financially economical transport solution in the future, the necessity to switch to EVs in the future is also predicated on the possible limitation of fossil fuels in the future

> I think it [EVs] is a good idea. Because I think at some point, I don’t think it will be in my generation, but I think at some point we are going to reach a crisis in the world about oil reserves. (C5)

As noted above, there is a clear notion that these particular consumers find EVs a promising concept. They value what EVs can deliver in terms of environmental and cost benefit in the future. However, EVs are also seen as a promising technology because it is in fact ‘new technology’. The notion of new technology has an appeal

> The fact that it’s new technology excites me. We are moving away from the old style of petrol cars and incorporating the hybrid … I love new technology! … When you’re looking at a new car, what does it have different to what my car doesn’t have. It might be those little things like Bluetooth or USB connectivity, GPS. But also things like wireless charging, self-parking. Those things make driving and that whole experience more fun. (C3)

> I like the high-tech. I like all the sat-nav and phone stuff. It’s like getting a new phone, getting a new car. It’ really quite high tech, it never used to be like that, I love that! (C8)

Subsequently, due to the interest of some consumers to experience new technology in Australia, there is an element of frustration from particular consumers towards businesses that choose note to rollout new products (such as certain EVs) in Australia along the same timeline as elsewhere

> Yes I'm excited [about EVs] but also quite disappointed with how long it's taken Australia to adopt this technology where as other countries like the USA have had it for a few years now … the consumers there have been given the option to purchase EVs whereas here it's more something they are scared to release to the market. (C3)

There was a fundamentally confident and consistent response when asking consumers if they thought EVs were a product of the future and when they would make up a substantial segment of the market. Ultimately, the consumers see EVs coming into market in the mid-term. They do not expect them to be a mass market product in the next 5 years, nor do they believe it will take as long as half a decade for EVs to become a mass market product.

> I'm convinced EVs are the future! I think in 5 years it will have a big market share and in 10 years it will be the majority. We've got to do it; we've got to take care of the planet! (C1)

> Yes! I probably think somewhere in the 5-15 year range, but it's hard to know. I assume a lot of the issue is that with the ICEVs, OEMs are so committed to them that they're not going to be open to promoting EVs. (C2)

> EVs are absolutely a product of the future! 20 years, I reckon in 20 years we'll all be seriously considering them and there will be a lot more on the road. (C5)

> Absolutely they [EVs] are the way of the future … I don't know the time frame but I think it should be sooner rather than later … but I definitely see it as being part of the future. (C7)

> I think they [EVs] will eventually be the [mass] market … I think it will be like the mobile phone, when we all started using iPhones once they got it right and then it just changed so rapidly, the way we all communicate is just such a massive change. I think EVs will do something like that where it will sort of simmer with models for a while and then suddenly whatever is stopping them from being competitive will just go … and then automatically a car will just be an EV. (C8)

> I think EVs will make up a big part of the market, I'd say in about 10 years. (C9)

Therefore we can begin to identify that consumers are open to the concept of EVs, some even excited. However, consumers do not think EVs are at stage at this point in time where they serve as a suitable alternative to ICEVs. This will be explored in more detail in the next section. Subsequently, being rounded out with a comparison against the managerial data.

8.2.2 Sub-theme: Current state of the technology has too many limitations for consumers

While the above section indicated a clear consumer perspective that EVs will at some point in the future be a predominant and valuable technology, in the immediate term, consumers currently see EVs as inferior to ICEVs.

> I don't think the technology is quite there yet. I'll certainly be open to it in the future. (C4)

Subsequently, consumers are still preferentially choosing to purchase ICEVs over EVs

> Until the technology is more advanced in an EV I would stick with an ICEV … it needs to be reliable and easy to use. (C5)

The premise of a lot of these negative consumer perspectives on EVs, in their current state, is again associated with consumer assumptions. This indicates a lack of communication and information to moderate these assumptions of limitations

> My perception of EVs stops me buying one. The perception of them being underpowered, small and I don't know a lot about them. (C2)

This lack of familiarity with a product suggests that consumers choose not to buy or consider buying an EV simply based on the premise of not knowing enough about them. EVs are seen as too complex and the notion of voluntarily having to go against purchasing a product the consumer is familiar with, in this case an ICEV, is seen as unrealistic.

> I love new technology but the thought of having to get my head around new technology in a car, I mean we are faced with new technology every day in everything we do every time you go to do anything you're faced with new technology these days, and the thought of having to figure out new technology in a car is a little bit much really … I prefer to own something I'm familiar with. (C5)

> I think being time poor is the key issue there [with learning about EVs]. I've got a million things I need to investigate: mobile phones, best deals, electric cars – it's just the least of my worries! Give me a Toyota and I'll just drive it

> for 30 years, bit busy! You know what I mean? I don’t have the time to be researching into this; it’s not the most important thing in my life. (C6)

This lack of familiarity also extends to consumer confidence in assessing the products longevity

> Because it’s such a new system and new technology on the market, I don’t know how reliable it is, there’s nothing to compare it to. Whereas ICEVs there are comparisons; you can say this car is fairly reliable, you’re not going to have any issues. Because it’s something so new on the market, there are no tests or anything carried out that I’ve seen that show this type of car can last for so many years without any issues or it isn’t going to break down on you. With any new technology, when Apple releases a new operating system, there are always bugs that need to be fixed. So that’s the thing that kind of worries me. I want those bugs fixed before I go ahead and purchase a fully electric car. (C3)

The consumer perception of new technology being associated with reliability issues or ‘bugs’ is consistent among the consumer interview data; as a result we can observe consumers taking a ‘wait and see’ approach to their product purchase decision.

> Like any new technology, I used to be a huge embracer of new technologies, but I think new technology it takes a while for them to iron out the kinks. I used to always be the first person in line at iPhone, et cetera … I learnt a lesson with that, that the first couple of versions of any new technology has faults and you’re much better off waiting for the fourth of fifth iteration of whatever you’re getting for them to iron out the kinks … it’s a major blocker for me considering purchasing an EV at this point. When it [EVs] becomes more mainstream, I’d seriously consider it! (C5)

While the consumer data clearly demonstrates that consumers observe a variety of limitations with EVs which hinders a purchase decision; there is evidence to suggest that if these limitations were to be removed, a product purchase decision may become more likely

> I still think the overriding issues in my mind [with EVs] are power and size. I'm not prejudice against them [EVs], it's just the power and size. If you could make a big 3.5 tonne pickup truck out of it with an electric motor, I'd be looking at it. But I'd still have the concerns over recharging. (C2)

> I have an expectation that as this technology grows so will the associated infrastructure. If that weren't to happen that will raise concerns because it becomes an inconvenience and especially with petrol; you can always find a petrol station. So if you're running out of fuel sometime unexpectedly or unplanned you can always pull in and top up with petrol. If there are not many charging stations, you can't just go and top up, as well as the fact it's not going to take 5 minutes to recharge either. For me personally not too much of a problem because I'm more structured; but I'd be concerned to have that as my sole means of transportation, I can just see the battery being flat when I don't want it to be. (C4)

Considering the reasonable proposition of consumers having an element of resistance to EVs, due to the limitations they would face in product usability; consumers were asked if all things were equal between EVs and ICEVs (Range, refueling, price, power, safety, and so on) which one would they choose. The responses were largely skewed in favour of purchasing an EV.

> If everything is the same: cost is the same, driving experience is the same, I would opt for an EV over an ICEV. Knowing that in the long run that things are moving away from ICEVs to EVs makes me feel like I'm ahead of the trend. I feel it's always good to be ahead of the time compared to being behind it. (C3)

> If an EV and ICEV were identical in every way, I'd choose an EV, because it's new technology. I just like new technology, I love it, it drives me nuts but I love it. It fascinates me, I love it, I love new technology, I love learning new things. I love phones apps, all technologies. I just think it's interesting (C5)

> If it's all the same and costs the same probably the EV; just because I know the whole petrol issue and oil issue running out. If everything was the same, I'd probably go for the electric car, doing my bit … if everything is equal and I'm not put out, why wouldn't I do the right thing? (C7)

What this section highlights is that the consumer interview participants are largely open and excited about the notion of electric vehicles. However, the consumer data shows that the current state of the technology has too many limitations for the consumer.

In contrast to the management data, these concerns aren't as overtly related to the issues of range, charging and price. The data showed that consumers are far less aware of these specific issues. Their concerns are predicated on a lack of knowledge and awareness of the EV product; and to a certain degree, lack an element of faith in the reliability of new technology.

The consumers are familiar with the concept of batteries as a technology, having exposure to their application in phones and laptops. Therefore they understand the nature of battery life (rate of discharge) and the requirement to recharge. The association the consumer makes is that the application of battery technology in a passenger vehicle is that an element of compromise will be established in comparison to an ICEV, in particular in terms of charging and range.

However, these consumer concerns aren't as detailed as the management data sets out. The management perspective believes consumers require EVs to travel over 500 kilometres and be recharged in a very short period of time (shorter than currently feasible). However, the consumer data suggest that the consumers don't even have the awareness of what is currently feasible with EVs and what specific improvements are required in terms of range and charging. The exception to this is price, which is easier for consumers to understand as it is more tangible. In contrast, specific technological implications and differences such as range and charging do not carry the same amount of consumer awareness.

Therefore we can identify a clear separation between the management perspective and consumer perspective. While management has a perspective on prioritising the improvement of the product (eliminating the technological drawbacks), which they believe to be the critical barrier to adoption; the consumer data suggest the more imminent priority is to foster consumer education and raising awareness of the technology in the marketplace. The focus of management therefore should be to grow the consumer confidence that this new technology can be easily integrated into their lives without draw backs.

The findings of the first theme of 'consumer perception of new technology' has continued to highlight the disconnection between managerial and consumer perspectives. The next theme of ‘new value and image’ will further investigate the disconnection of managerial and consumer perspectives.

8.3 Theme 2: New Value and Image (Managerial data)

The role EVs may have in driving an increase in consumer value by delivering new value initiatives, such as meeting consumers’ environmental concerns and/or complementing their image, is a key layer to the future competitive landscape of the Australian automotive industry. The Australian passenger vehicle market is highlighted in the managerial data as a market that is going to become increasingly competitive, with many OEMs competing for market share. M1 highlights

> We definitely envisage future growth, it’s going to become a lot more competitive, it’s already competitive but the competition will increase with more vehicle manufacturers fighting for what is seen to be quite a small market worldwide of 1.1 million vehicles [new sales annually], approximately. So there’s going to be a lot more manufacturers fighting for that overall volume (M1).

With the heightened competition, OEMs will need to start differentiating their products in order to create their own value equations for different consumer segments. EVs and e-mobility is one such differentiation strategy many OEMs are targeting to offer consumers choice in drivetrains. When probed to highlight any changes, or new trends that might occur in the future Australian passenger vehicle market, M1 responded

> New platforms, new drivetrains! We also have smaller capacity engines, for example going down from a four cylinder to a three cylinder, using turbocharging to increase: power, torque and efficiency. So we do have a downsizing strategy but we also have a heavy emphasis on electronic mobility; and a lot of vehicle manufacturers are going towards this platform/drivetrain (M1).

The emphasis towards moving towards e-mobility is an emerging perception stemming from some of the giants in the automotive industry. Professor Dr Herbert Kohler, Chief Environmental Officer, Daimler AG outlined in an interview that

> Our long-term goal is motoring with zero CO2 emissions. Our road to emission-free driving is founded on three pillars: we are continually improving our high-tech combustion engines. At the same time, we are electrifying our product portfolio step by step – from systematic hybridisation through to electric drive systems with battery and fuel cell. (Daimler AG, 2014)

Thus, OEMs are beginning to utilise new technology such as EVs, to try and create new value for their consumers. In the current market EVs serve only a minority of customer segments, but their value as a green and innovative product does attract a promotional value, especially for non-private buyers

> We look at who’s actually got the vehicles [EVs] and who’s driving them and why they’re actually putting them into their fleet. So predominately it’s been a promotional role used for government departments and corporate institutions like banks (M7).

Although the theme that EVs are currently only attracting a minute market niche evidently reigns to be true, we appear to be on the precipice of a potential shift in the market. When discussing the current state of the EV market in Australia and what some OEMs are doing, M1 responded:

> It's certainly a niche at the moment; however we do have new manufacturers within the Australian market developing new and exciting products to promote this fantastic technology, one of those being Tesla. Tesla has really thought into the future and really looked at how to develop a product to tick all the right boxes for customers that really wish to have a performance car, but also have efficiency, but also have something that's quiet unique, but also seen quite as futuristic in our particular market (M1).

Tesla has already successfully targeted a small niche segment to sell their EVs in Australia. As the awareness of these products come to light, customer demand will begin to filter into further niche segments and eventually into the mass market. This is forcing OEMs to constantly monitor current trends and customer demands

> Vehicle manufacturers need to keep up with the demand of the customer, keep up with the technology and the demands that customers place on that technology – it's very much a dynamic space! (M1).

This is equally reflected in industry literature where OEMs acknowledge

> They need to proactively analyse consumer preferences (McKinsey and Company, 2016).

We can also recognise that investment in developing EVs carries an inherent benefit to the consumer and the brand of an OEM where

> Vehicle manufacturers always need to be seen to be developing new technologies or new products and keeping that consumer demand alive … the

challenge is the implantation and when to 100% implement the technology in the market (M1)

EVs are delivering more value to consumers as they open the door to so many new benefits where ICEVs cannot compete. Many Interviewees cite the innovative quality of these vehicles and their practical benefits for the consumer as an additional value

> We know EVs deliver power to the ground a lot more efficiently [than ICEVs]. They're quicker, they're faster and they offer so many new benefits to people, particularly around lower cost of running (M3)

> The benefits of having an EV is instant torque and performance as well … Around town these cars feel very performance-orientated. They're very quiet as well: noise, vibration and harshness, or NVH, is very minimal. So they provide a great environment within the cabin … so the general consumers, at the moment, are finding a lot of value in driving and owning an EV (M1).

> This acceleration 0 to100 kilometres an hour [of the Tesla Model S performance models], for cars in that price range, now days you'd only see this performance in supercars. If you look at normal ICEVs, we see improvements of 0-100 times of 0.2, 0.3 or even 0.5 seconds with a facelift, that's a massive gain! I have a feeling with these EVs that those improvements are coming a little bit easier (M5).

Therefore managers can identify the inherent value EVs represent over ICEVs. However a significant managerial perspective is the role of image and how EVs are a great mechanism to enhance or complement the image of a consumer. The managerial perspective highlights that they believe consumers gain value from EV ownership as they are recognised as embracing the latest in automotive technology. This goes beyond the stereotypical ‘green image’ associated with purchasing an EV and more towards technology leadership.

> Last decade, green was in. This decade, we are all aware of it, but greens not cool anymore, it’s just expected. So now it’s all about enabling technology and EVs are an enabling technology which ticks many boxes, one of them being green, but everyone just accepts green as being normal these days (M2).

As a result of the image benefits EVs delivers, in particular as a reflection of technological leadership, the current pool of EV owners is heavily saturated with people whose public image is important to them; they often stem from backgrounds such as the tech industry and medical profession. Likewise, these occupations, while being heavily dependent on public image, are also high income occupations. This reduces the price sensitivity in adopting an EV and accepting the price premium over an ICEV

> We see current EV owners coming from a variety of backgrounds. But I would say a large portion of EV buyers are doctors or work in IT or techy firms … these people are buying EVs because they’re tech-savvy individuals with a high income. For them price is less of an issue … they are very conscious of their reputation and what makes them look good. They want to reflect themselves as environmentally conscious. They want to look like a tech leader, that they are ahead of the game and forward thinking (M4).

While the managerial interview data highlights EVs to reflect more of a technology image for consumers, as opposed to a green image, this is not entirely reflective of early corporate and government buyers.

> Large corporations and government seem to be the main take-up [buyers of EVs]. They're using EVs to meet environmental targets as part of some kind of strategic corporate approach or some kind of strategic marketing or branding awareness campaign (M7).

The interview data is highly reflective of industry publications that the value equation for automotive consumers has a strong potential for future change

> When considering the potential for industry transformation, consumer preferences and behaviour are an important starting point. We believe the disruptive technology-driven trends have the potential to fundamentally change the relationship between the consumer and the automobile (McKinsery and Company, 2016).

The managerial data highlights that there is great potential for EVs to drive new value for consumers above and beyond an ICEV. However, in the context of this research it has become evident that issues such as range, charging and price are an impediment to consumer uptake. Therefore we will explore how the sub-themes of range, charging and price influence the relationship with EVs to create new value and image.

8.3.1 Sub-theme 1: Range

It has been highlighted that range limitations are crucial drawback for EVs for many consumers. However the managerial data highlights a perspective that many consumers will not be affected by the limited range of EVs. When discussing the

Nissan Leaf's limited range of approximately 150 kilometres M3 describes the car to be:

> A perfect city commuter … even if it's a second car for the family. Never have to go to a petrol station, just go home and plug it and just do the daily commute to and from work, its perfect!

There is evidence presented that certain consumer segments are less likely to be impeded by range limitations, due to their consumption behaviours, and subsequently gain more value from their EV ownership.

> These customers can be identified as slightly older people and the ones that aren't doing long distances, that probably average 50 kilometres a day on their commutes, at most! … It's that just in case mentality; some people who travel 50 kilometres one-way might get a little bit worried if they're going to make it or not. Whereas those who drive back and forth and do 20 kilometres it's a lot more logical because it is a lot cheaper … it works out that an EV that costs $10 a week [to fuel] would equate to an ICEV costing 60 to 70 dollars a week [to fuel] (M6).

However, OEMs are readily addressing the concerns surrounding range limitations to drive new value for the consumer

> A lot of vehicle manufacturers … use technology that doesn't have limitations in range via the use of a [plug-in] hybrid; using an internal combustion engine and coupling that to an electric motor (M1).

Looking further into the future, the next generation of EVs should also have more range to deliver more value to more customers and slowly overcome the issues of range.

> New technology is coming through to make EVs go further at less cost such as Tesla Model 3 with 350 kilometres range … Nissan Leaf up to 500 kilometres and the GM Bolt with 320-350 kilometre range. So they're all BEV and their pricing all those cars around that $35,000 [USD] mark (M3).

The managerial data therefore highlights that as the EV technology begins to evolve, the range of EVs will increase. This will begin to overcome this particular barrier and allow consumers to embrace the inherent value of EVs (such as carbon reduction and lower running costs) and focus less on the implications.

8.3.2 Sub-theme 2: Charging

The managerial data interestingly highlighted that charging a vehicle rather than refuelling it with petrol or diesel can be more valuable for consumers. The managerial data identified that EV owners have found a surprising new value in their EV ownership in never having to visit a petrol station. When asked what current EV owners find valuable in owning an EV, not having to visit a petrol station featured highly

> They brag about never having to go to a petrol station again, they love that … they love refuelling at home and the apps that come with it. They love statistics about their own performance. Even PHEV drivers, where there are liquid fuels

involved, will go to great lengths to avoid using liquid fuels and love the performance data that proves that. … On top of all that, they love the bragging rights; the look at me and look at what I've done and my contribution to the environment, is a great talking point for them (M2).

> It's clean, it's quiet, it's efficient and they never have to go to a petrol station again! (M3).

> When you compare EVs to conventional ICEVs, in many ways, they are far more convenient to refuel because they don't take you out of your way. Rather than having to detour to a petrol station to refuel, you can charge your EV at home overnight … and when you wake up, you have a full charge every day! (M4).

> In many ways, an EV is far more convenient for people. You don't have to go to a petrol station anymore; it's more convenient to just recharge at home (M6).

As far as EV technology goes, it's an emerging technology. With the emergence of solar energy generation and battery storage technology, we also see an emerging technology, similar to EV technology. The application of these technologies concurrently in the daily lives of consumers is recognised by managers as key

> Fuel independence will become another issue which will come up in years to come. Australia has plenty of land and tons of sunshine; so it makes sense as technology is improved to capture that [solar energy], store that, transmit that and use that for drivetrains. We will naturally levitate that way and move that way with EV technology as it makes sense to match EV technology with solar and energy storage (M2).

> A lot of the people that buy these vehicles also have solar on their roofs, so that they know when they're plugging their car in at home; they're powering it with green energy. A lot of people that buy these vehicles want to make a difference and the fact is around climate change, pollution in cities, new technology advancements; it's a position statement from people, like people who drive a Tesla, it's a status symbol now! (M3).

The managerial data highlights a perspective that managers believe that a green image is very important to consumers. The managerial data also supports that EVs in combination with sustainable energy solutions are more environmentally friendly than in comparison to ICEVs

> Not only are EVs cheaper to maintain and fuel, they provide the driver with a satisfaction that they have upheld their environmental consciousness. Being environmentally conscious is a luxury in its own right, a luxury that an EV delivers far more than an ICEV (M4).

> [EV ownership is] defiantly greener overall and provides that perception, it depends on what electricity you charge with but let's say someone is using green energy, then the green perspective and environment perspective can be covered (M5).

The managerial data therefore highlights that the new value EVs create is linked to other industries (and their products), such as the energy sector. This suggests there is a need for collaboration between OEMs and other industries to execute the full value of EVs, in particular in terms of environmental credibility.

Extending this collaborative approach, we can identify that there is a new market emerging which can provide other industries with a competitive advantage to support their own business by targeting EV owners and their charging requirements; all while providing a valuable service which supports and promotes the EV industry:

> Destination charging is a smart way for shopping centres to create a destination for people to go shopping. They might need a few hours to top their battery up, if they know it's free, the whole idea would be around them spending those few hours there and spending some more money at the shops while they're getting a free charge! It's not rocket science; create a new market for those people who have these vehicles … there's a huge market opportunity for charging infrastructure operators (M3).

The business benefit of offering charging as a service is also reflected in industry literature

> Offering charging is a direct way to attract and retain new, EV-driving customers. In addition, many consumers believe it is important to purchase products with environmental benefits and to frequent environmentally responsible companies. Hosting a charging station is a highly visible way to state your organization's environmental values, which may help contribute to a "green" image that attracts and retains customers who share these values. (U.S. Department of Energy, 2012)

Therefore, we can identify that in order to extract the maximum amount of value from EVs, OEMs must collaborate with other industry sectors. In reference to charging with sustainable energy, this involves collaboration into the energy sector to enable and promote the green credentials of EVs. In terms of offering charging, there is a wider value application across many industries; any entity could offer charging as a service to attract EV drivers and promote their support for sustainable technology.

8.3.3 Sub-theme 3: Price

Price has been identified consistently as a major barrier for EV adoption. However, the managerial data highlighted that there are certain consumer segments were pricing is less critical of a factor. The current EV buyers can be classified as high income earners and are less sensitive to the price premium associated with purchasing an EV since

> Most people who buy EVs are cashed up and have some altruistic nature to them; they want to show that they are supporting cleaner technologies (M2).

> you'll probably find that they're [EV buyers] folks on slightly higher incomes with more disposable income … also people who are really innovate, the tech heads (M3).

While the managerial data suggests that EV technology does have an appeal for some consumers, this appeal must correlate positively against the purchase price. The current state of EV pricing is resulting in many people who are interested in EVs being unable to get past the price barrier

> It's cool technology and people recognise it as cool … When it comes down to a value proposition, most people will avoid EVs, because it doesn't represent dollar for dollar value. You can have an EV at one price or 2 equivalent small cars [ICEVs] for the same price (M2).

Despite the inherent purchase price disadvantage, the managerial data does highlight that EVs do carry additional and new financial value over and above ICEVs over the course of ownership

> Running costs are lower and they are more reliable unless something really happens to the battery. There's not a lot of servicing involved, a lot can be checked via software updates. Of course with an ICEV you have to go in [to a workshop], a mechanic has to look at it and then they can evaluate what's wrong (M5).

> If you think about all the costs you need to look at (for an ICEV over an EV) in terms of servicing and all the bits and pieces that need to be replaced over the life of a vehicle, I think it's a really important purchase choice (M6).

When considering the value of an EV there is inevitably a correlation of reducing the purchase price, while conveying the additional value and finding the equilibrium in that equation

> EVs are normally at the top of the [price] range, they are the more expensive option versus a petrol or diesel. If we can get that [price] more affordable and show to a customer that it's not really an expensive choice; getting that whole understanding "you can just plug it into your wall socket overnight" and making it easy for a customer understand, I think that will help for customer adoption (M6).

The only vehicle which was identified as a successful EV currently in market was the Tesla Model S because unlike other EVs, it has a price position close to comparative ICEV models.

> It's [Tesla Model S] a great car that costs around about the same as similar ICEV luxury car but people are buying it because it's cool, it's fast and it's techy (M4).

Ultimately, what the above dictates is a requirement for OEMs to address the price point issue in order to allow EVs to deliver their full value to consumers. Concurrently, the industry literature highlights that OEMs must also continue to deliver new product innovations with the goal to drive more value for the customer, in the entirety of the product, not just individual elements.

> To retain their share of the automotive profit pool, OEMs need to find the right strategy for differentiating their products and services, which largely means evolving their value proposition from "hardware provider" to "integrated mobility service provider." Product differentiation should be pursued through a digital end-to-end user experience with a customer focus similar to software companies keeping products attractive throughout the lifecycle. (McKinsey and Company, 2016)

This introduces a managerial perspective that in order to facilitate EV adoption, OEMs must evolve how they deliver and convey value to consumers. However, are the consumer value assumptions of managers reflective of the consumer perceptions in reality? The next section will review the Consumer data and contrast the two data sets.

8.4 Theme 2: New Value and Image (Consumer data)

Observing how EVs will create new value for consumers via either direct usability or image related values such as environmental consciousness was starkly different in the consumer data, as opposed to the managerial data. While there is evidence to suggest that environmental consciousness is considered a contemporary value for consumers, the promotion of this via public image is inherently less important to consumers than

OEMs may think. At the same time, the value benefits for consumers that the managerial data highlighted was not always reciprocated or acknowledged in the consumer data. This presents evidence which again relate back to the lack of communication from OEMs prompting low overall awareness of EVs and their inherent benefits and new value proposition. Therefore, the two predominant sub-themes that emerge are ‘environmental consciousness: a contemporary consumer value’ and ‘Public image: a limited consumer value’. These sub-themes will formulate the key consumer data which presents a different view of how EVs create new value, in contrast to the managerial data.

8.4.1 Sub-theme 1: Environmental consciousness: a contemporary consumer value

When it comes to discussing the perceived effect of potentially owning an EV, the consumer data highlights that an EV would provide the consumer with a far better intrinsic value on the environmental consciousness front, as opposed to owning an ICEV. This value of being ‘environmentally conscious’ can help balance the scale of EV versus ICEV ownership, even considering an EV price premium

> I’m sure there’s a feel good factor with it [EVs] and I’m actually prepared to pay a little bit more for that. It’s a responsibility issue of what our generation leaves for the rest. (C1)

> I love the idea that it’s [an EV] helping the environment! (C8)

The theme of environmental consciousness extends to those who don’t necessarily take proactive steps to be particularly environmentally conscious. While these consumers don’t actively seek to reduce their carbon footprint, they understand that there is a necessity to begin a transition away from ICEVs

> Am I socially responsible, am I thinking about the pollution? No. But I should be! … If you just think about the thousands of cars on the road everyday pumping out pollution, that can’t be a good thing … It’s [ICEVs] a major contributor, I believe, and it is causing us an environmental problem. CO2 levels are higher than they have ever been in the history of mankind, I don’t know about the history of the world, but the history of mankind they’re higher than they have ever been. And there’s more and more people and more and more vehicles on the road and we need to be moving to cleaner options. (C4)

Subsequently, we can identify that consumers take value from the environmental benefit of EVs, in particular when compared to ICEV alternatives.

> The only benefit [of an EV] to me would be to be economical and environmentally friendly. What do I get out of it? Well, it’s contributing to the environment; it’s the socially responsible thing to do. It’s only a matter of my conscious; it makes me feel better about it! (C4)

While the consumer data suggest that being environmentally conscious is a contemporary value for consumers; this is not a unanimous position across the consumer data set.

> I’m not convinced that this climate change argument is relevant. I think we should be doing some mitigation, I agree with doing mitigation measures where possible but I’m sitting on the fence as far as the climate change debate is concerned. So, the environmental factors don’t influence my decision what so ever. (C5)

For some consumers, the potential environmental benefits are redundant in their evaluation of an EV. For these consumers, an EV must provide more value than simply a "green factor"

> I don't think the green issue is enough on its own. I think people are so confused about what's green and what's not green. (C2)

There is a high degree of conjecture among consumers when it comes to assessing the environmental benefit of EVs. While some consumers believe that EVs are more sustainable than ICEVs, others look further into the topic. While EVs have no 'local emissions'; the electricity that powers the vehicle has most likely been generated from sources which have some sort of emissions. The consumer data therefore displays a lack of confidence that an EV is truly more sustainable than an ICEV.

> Where does the electricity come from, is it coal fired? So you know, it's a six of one and half a dozen of the other argument. I've never heard that debate, does it actually save greenhouse gas or whatever? Because the electricity you are sticking in it [the EV] has to come from somewhere and what are the technologies behind the electricity you're sticking into it. Is it coal fired, or whatever? I'm not sure how the climate environmental debate stands up, and I've never really read anything on it or heard anything on it, not that I can recall anyway … more information about that in the market would be good. (C5)

> Our electricity is still coal! Solar power is OK; wind power is ugly and it also has an effect, theoretically, on those living close by. (C6)

The need for greater communication is further emphasized by the consumer data to illustrate to the consumer the true environmental benefit of an EV compared to an ICEV. If an EV truly has a proven 'green factor' this can carry an extraordinarily high value for some consumers. So high they are willing to pay a price premium for an EV to attain the intrinsic value of environmental consciousness.

> I’m prepared to pay, say a 20-30% premium, for a comparable car for the feel good factor that I’m doing the right thing. Before I make that decision, I want to be convinced that the EV is really from the environmental impact, the better solution. I want to be convinced not just told; I want to see research and data! (C1)

> I would pay more for an EV if it ticked all the other boxes … about 10 to 20 precent more, I would consider paying, if all things were equal. (C8)

Subsequently, the consumer data identifies a trend which highlights that consumers value the environmental benefits of EVs. For some consumers, they are even willing to pay more for an EV in order to unlock that value. However, before they are in a position to do so, many consumers require more information on the environmental credibility of EVs. This comes back to the need for increased communication and awareness from OEMs. However, since the environmental credibility of EVs are tied closely to the energy sector, there is a requirement here for collaboration between OEMs and the energy sector to collate information and communicate the environmental benefits of EVs to consumers.

This value position of consumers is in contrast to the management data which highlighted a perspective that consumers were not as focused on the intrinsic environmental value of EVs, but rather the social image value of owning an EV – in short ‘being seen to be green’. The next section will expand on the consumer data to highlight that a consumer’s public image has limited value, continuing to illustrate the divide between management and consume perspectives.

8.4.2 Sub-theme 2: Public image - a limited consumer value

The above analysis highlights that the ‘green factor’ of owning an EV carries a largely intrinsic consumer value, one centered on environmental consciousness. Unlike the perception from OEMs and managers, as highlighted in the managerial data, there is little to no evidence to suggest that the Australia consumer takes much regard for the ‘public statement’ an EV can make to be ‘seen to be green’.

> [A car] is purely for me, I don’t really care about anyone else. (C7)

The consumer data suggests that there is limited value or desire for a consumer in enhancing their public image by owning an EV. When asked if an electric vehicle could potentially provide a consumer with additional value in the form of public image or consciousness, Interviewees provided responses largely dismissing the value of public image:

> No, it wouldn’t give me anything, zero interest! (C2)

> No, a vehicle to me is point A to point B … Yes, I like driving a prestige car, but would I drive something else? Yeah, it doesn’t really worry me as long as it gets me from A to B. (C5)

> Would a car give me any value with image? NO! (C6)

> No … I don’t care what people think about me. (C7)

The consumer data therefore highlights that among the participants, public image is not a factor they put any particular weight on. The intrinsic consumer value of environmental consciousness is seen as far more important, both in owning an EV and also a conventional ICEV.

> I try to keep my carbon footprint as small as possible, so we're driving a tiny little VW UP. That's to go shopping, to go to work and back. It serves short trips, my day to day use. (C1)

> It's not really so much wanting to be seen to be green, it's just a general belief in wanting to be green. It's not really 'tick a box', for me it's a genuine hope and wish for my children. It's not so much for our generation but it's more for them and their children. It's the decisions we can make that's going to benefit them and their lives in their world, it's not really going to affect our world. (C8)

> I think feeling good for the atmosphere is important; I'm not so worried about image. (C9)

This theme of new value and image highlights first and foremost that an EV can deliver a consumer with additional value that an ICEV cannot. However, the managerial data and consumer data highlight a conjecture in what exactly that value is. The managerial data tends to position a value with an EV being a reflection of a consumer's technological leadership and 'being ahead of the trend'. While the consumer data does identify some correlation, the value is far more intrinsic than extrinsic. The consumer data highlights that the additional value an EV can deliver is not stipulated on public opinion or perception. The environmental consciousness of consumers, and the associated value of 'being green', is also highlight by the consumer data as far more apparent and relevant than the managerial data may suggest.

Subsequently, we can continue to highlight the growing separation between the managerial and consumer perspectives. In short, the data here suggests that from a value position, how managers think consumers will value EVs and how consumers actually value EVs is very different. This results in a flawed approach from managers in positioning, marketing and selling EVs.

Chapters six, seven and eight have analysed the data from the three overarching strands of strategic management, product innovation and consumer value. Ultimately, these chapters have slowly illustrated a gradual separation from the management perspective and consumer perspective. Managers primarily focussed on product specific issues such as range, charging and price. There justification behind a lack of consumer acceptance was predicated on the consumer demanding improvements from the EV product offer. Managers believe that the primary focus to increasing EV uptake should be addressing and rectifying these direct product shortcomings.

This management perspective was met with some credibility in the consumer data, but these product shortcomings were overshadowed by larger consumer issues, such as low awareness. Consumers largely identified that they had a lack of awareness and information on EV technology which negatively affects their purchase decision. The consumer data highlighted that most consumers are quiet optimistic of EVs but it is the underlying changes in product usability and subsequent value implications that need to be explained by strategic managers. Consumers would value an EV product if they had the information and knowledge to be confident that an EV could meet and serve their practical and intrinsic needs.

As a result, we can identify the need for a solution which in the context of new technology brings strategic management and consumers closer to the actual product innovation process; that is among other things product development, marketing and sales. Currently, these three strands of strategic management, product innovation and consumer value are largely disjointed and require a deeper integration. In the context of the Australian EV industry, the analysis has highlighted that the separation of managers and consumers has resulted in the failure of the EV product innovation. In order to work towards the success of this radical product innovation, which occupies a completely new market, there needs to be a closer alignment of management and consumer, in both theory and practice. The next chapter will discuss these findings in detail.

Chapter 9 Discussion

Having analysed the content of the existing academic literature via the conceptual framework, and performed a thematic analysis of the industry and interview data, we can see that the relationship between strategic management, product innovation and consumer value is complex. There are many components that make up each of these three strands. The literature review identified some of these key components, outlined below:

Strand of Literature	**Sub-theme**
Strategic Management	• Competitive advantage • Zero-sum and positive-sum competition • Strategic alliances and partnerships
Product Innovation	• Radical and continuous innovation • Inter-group dynamics, a catalyst for innovation • Creating new consumer value
Consumer Value	• Consumer perception of value • Product positioning and consumer value perception • Product innovation and value creation

The literature demonstrates a clear correlation between each pair of fields (for example, strategic management and product innovation, product innovation and consumer value, and so on). However, comparatively less attention has been paid to how these three strands work simultaneously. The literature review concluded that in the contemporary business environment, the complexity of bringing ever more disruptive product innovations to new markets poses multiple challenges. There is a lack of clarity at the depth of correlation between the fields of strategic management, product innovation and consumer value and how they interrelate. Subsequently, we believe that these three dimensions must be considered in concert as part of a new theoretical model that aligns the copious exisiting theory that supports each individual field.

In emphasising the need for a concentrated approach, the present research suggests that in circumstances that deal with completely new products and innovations, a typical value chain cannot be applied. Rather, since completely new products and radical product innovations often create new markets in their own right, there is a need to re-theorise the conventional value chain to account for these drastically new and different products. Re-theorising this value chain results in a shift away from structured sequential events to a more fluid, cohesive *value paradigm* where value is created in an unstructured mechanism. Reimagining this different form of value paradigm results in the formulation of new value principles and markets.

This chapter will take the following structural shape. Section 9.1 will revisit the overarching findings in the analysis chapters to reveal a clear detachment between strategic management, product innovation and consumer value. It will then progress to examine the role of product innovation in the automotive context before moving on to discuss the role of strategic managers in shaping consumer value. Section 9.2 will extend on this topic to discuss the ineffectiveness of conventional value-based models, such as the value chain (Porter 1985), in the context of product innovations. Subsequently, Section 9.3 houses the primary theoretical contribution of this body of work by introducing the value paradigm as a new model which encapsulates the fields of strategic management, product innovation and consumer value in one cohesive model. The value paradigm will then be exemplified in Section 9.4 by showcasing how it can be implemented: in this case, by utilising strategic alliances within the EV industry to achieve both strategic and consumer outcomes in the context of product innovations. Thereafter, Section 9.5 will discuss how the value paradigm can serve as a model to drive product innovations towards success and mitigate failure. Last, this chapter will close with Section 9.6, which will highlight the relevance of the value paradigm to contemporary commercial theory and managerial practice.

The following discussion draws upon the findings of the data analysis to extrapolate a deeper consideration of the changing nature of product innovation, inquiring to what extent traditional value chain models remain able to account for disruptive product innovations arising from new and disruptive technology. A detailed discussion of the traditional value chain in the EV context is included to demonstrate how this classic model essentially compromises the potential for disruptive innovation. Subsequently, the discussion proposes a theoretical extension of emergent models such as the value grid (Pil & Holweg 2006) and the value network (Peppard & Rylander 2006), encapsulated here in the term *value paradigm*, which draws upon the key finding advocated throughout this research: that strategic management, product innovation and consumer value must work in combination throughout the entire innovation process.

9.1 Revisiting the analysis and introducing the discussion

The analysis section has uncovered key insights into how product innovation is transforming firms' ability to move strategic priorities, while also uncovering the consumer's value principles and priorities.

First, the analysis section revealed a lack of cohesion between strategic managers and consumers in the context of introducing new product innovations. Therefore, a theoretical contribution is required to better understand the relationship and subsequent integrated approach between strategy, innovation and value. In particular, such an approach becomes relevant in the context of radical new product innovations that are so disruptive that the product innovation creates a new market in its own right.

Second, the analysis section uncovered that EV technology is on the precipice of just such a disruption in the automotive industry: the EV product innovation is creating its own standalone market. However, the analysis also revealed that within current market conditions and the competitive landscape of the industry, conventional corporate strategy does not offer sufficient grounds to facilitate this transition. The analysis found that there is an increasing external pressure upon OEMs to transition to more suitable and efficient technologies. This pressure, often influenced by stringent vehicle emissions policy, is forcing OEMs to uncover and leverage new technologies to meet their strategic initiatives. This opens the doors for EVs to become a more prominent feature in the model line-up of OEMs as a low-emissions alternative. However, the analysis found that there is very limited demand from the marketplace for such a product, resulting in the ultimate rejection of the EV product by the consumer.

Third, the analysis chapters indicated that consumers have rejected EVs due to a combination of factors: most pressingly, the actual product. The analysis found that consumers associated EVs with undesirable features such as low range, long charging times with limited charging locations, and a high purchase price. Consumers showed limited inclination to purchase an EV over the existing ICEV alternatives. The rejection of EVs is further influenced by the consumer's lack of awareness of the actual product functionality and potential benefits. The analysis found that many consumers are unaware of the specific product features an EV has and the current availability of EVs in the Australian market. They were also unsure of the benefits an EV has in terms of lower running costs, environmental benefit and other new values an EV offers above an ICEV.

Critically, the analysis found that what strategic managers thought consumers valued and wanted was different to what consumers actually value and want. This highlights a discrepancy in our existing understanding of value, and the relationship strategic managers have with consumers in the face of new technology and the resulting product innovations. The analysis found that radically new product innovations, which fall outside of existing markets, are associated with completely new value principles that are yet to be defined. Subsequently, existing strategies cannot be depended upon and there needs to be a closer relationship between strategic managers and consumers in the context of bringing product innovations to market.

In the context of the Australian EV industry, this shows that strategic managers want to move in the direction of introducing EVs into their product portfolios for strategic purposes. Yet the consumer is not in a position to accept the technology in its current state. This raises the question of what needs to be done for EVs to represent a valuable proposition for consumers in order for strategic managers to subsequently achieve their strategic initiatives. This discussion chapter will suggest that the answer lies in a closer integration between managers, innovations and consumers via a *value paradigm*.

Subsequently, this discussion chapter will review the existing theoretical nuances that hinder the market introduction of EVs. Thereafter, this chapter will introduce new theoretical contributions that take a deeper and more integrated approach than existing theory to the themes of strategy, innovation and value. Ultimately, the application of these new theoretical contributions will produce a better understanding of how product innovations resulting from the ever-growing suite of new technology can be successfully brought to market. This contribution has high relevance not only to the subject matter of this study but also to any broadly related industry that is influenced by new technology – which is largely becoming every industry.

9.1.1 The changing nature of product innovation

Product innovation, in its own right, is not a new concept (Agostini & Caviggioli 2015; Dolfsma & Velde, 2014; Gilbert 2006; Pitorac & Cismaș, 2012; Ruttan 1959; Schumpeter 1934). However, the way in which firms and industries go about product innovation is evolving, especially as technological development continues to accelerate (Euchner & Ganguly 2014). Product innovation is becoming more effective in making firms more competitive, and consumers are continuing to demand new and exciting products. As such, firms and managers must become more prudent in effectively managing their strategies around product innovation.

Engaging in effective product innovation strategies requires a significant contribution of resources (Caggese 2012). These resources are primarily categorised as capital investment, time resources of staff, and infrastructure resources; in most cases, engaging in effective product innovation will draw on a combination of all three (Pfeffer & Salancik 1978). Some product innovations can be simple, cheap and highly rewarding for an organisation as well as the greater industry. However, other product innovations, especially those affecting historically stable products and technologies, can be complex, require large-scale investment of resources and may experience uncertain levels of success in the marketplace. The automotive industry at the centre of this research highlights one of those scenarios where significant resource investment is required to develop the EV product with only a partial vision of the product's ultimate success in the marketplace.

Over several decades, the automotive industry has relied on a historically stable product concept. Fundamentally, cars have been the same sort of shape, size, and have been used for the same sort of purposes. In the context of this research, cars have historically also relied on the same powertrain concept – an internal combustion engine. However, the industry is beginning to see a shift away from conventional internal combustion engine technology to EV technology. EVs have been present in the product portfolio of select OEMs for several years and the analysis section highlighted that there has been minimal consumer acceptance of those products. Despite this, we are continuing to see a ramp-up of investment in the industry with more and more OEMs developing EVs. Thus, this strategy of OEMs pushing the development of a product that seemingly has little consumer appeal or demand, signals a need to reshape conventional theory on how businesses approach product innovation.

However, if we cast our attention to other industries that have taken a similar approach to product innovation by creating a product for a market that doesn't exist, we can see the enormous success these products experience within the marketplace they create: the iPhone, Airbnb, Uber and so on. They are all product innovations where strategic managers invested resources into developing a concept on the basis of no apparent or reliable consumer value measure. These innovations flag the fact that consumer reaction, value perception and subsequent desirability and success of the product can only be determined once the product is active in the marketplace, long after strategic managers have decided to invest into the product development.

There is currently a lack of research contribution that demonstrates the depth of the interrelation between why and how strategic managers make these decisions to invest in product innovation, and to what extent consumer value plays a role in those decisions. This research extends current theoretical understandings of this new relationship between strategic management, product innovation and consumer value. In order to establish this theoretical understanding, we must first revisit the context of this research to gain an understanding of the practical nuances.

9.1.2 Product Innovation in the automotive context

The automotive industry has depended on an ongoing history of continuous innovation due to the inherent benefits of the stability of the product – a low-risk strategy for OEMs (Corso & Pellegrini 2007; Denning 2010; Denning 2013; Linton 2007; Lynn, Morone & Paulson 1996; Milé 2002; Soosay & Hyland 2008). The fundamental concept of a car has remained the same throughout the last century. While consumer adoption of motor vehicles has significantly increased over that period, consumers have fundamentally used cars in a very similar manner for the past few decades. While cars are now far safer, more efficient and more practical, these improvements have come in a continuous manner over time.

With the emergence of EV technology – and OEMs committing significant resources into developing EVs – the industry is beginning to shift away from the traditional continuous innovation approach to a more radical approach to innovation (Corso & Pellegrini 2007; Denning 2010; Denning 2013; Linton 2007; Lynn, Morone & Paulson 1996; Milé 2002; Soosay & Hyland 2008). EVs are the first radical innovation in the automotive industry over the past few decades, due to the significantly different manner in which the consumers will need to use them. EVs use a completely different drivetrain to conventional ICEVs and use a complex series of batteries to fuel the car in lieu of a conventional liquid fuel tank. Their usability is different, in that the consumer must manage their refuelling habits in a new manner. The research highlighted that consumers are required to refuel by recharging, which needs to be done more often (an issue of range) and takes far longer (an issue of charging). As demonstrated in the data, the whole concept of an EV is radically different to what the greater public would consider to be a 'normal' car. It requires a customer to change their habits; and the analysis highlighted that the consumer is reluctant to do so if there is no inherent benefit to them. Couple this with EVs being more expensive than ICEVs (an issue of price) and we can begin to see the challenge for OEMs to bring such a radically new product to market and have it constitute a consumer desirability or appeal.

Subsequently, in order to consider the implications of a shift in product innovation strategies for the consumer, we must use the findings of the data presented here to define the consumer's value perception and how strategic managers can influence, predict or dictate this perception.

9.1.3 The role of strategic managers in shaping consumer value perception

The benefit of product innovation lies in how consumer perceives the end product. Strategic managers will often invest in a product innovation, based on the additional or new value it provides to consumers. Traditional theoretical models such as the Bain Value Pyramid (Almquist et al. 2016) allow managers to identify the "new value" measures of a product innovation, such as "saves time" and "reduces effort".

Traditional models such as the value pyramid have allowed managers to model their product development investment against the potential increases in sales revenue and, in turn, profit. However, while these models can be relatively reliable for an existing product, it is the consumer that fundamentally decides if a new product reflects value (Bishop 1984; Delkhah, Amouei & Moghadam 2014; Doyle 1984; Lee & Min 2014; Mehta & Ma, 2012). As such, models such as the value pyramid offer little insight for greenfield products that are yet to be market-tested and achieve a market niche. Indeed, the core challenge of radically innovative products is that they enter an unknown or – even more challenging – an unwanted market, as is the case with EVs. The consumer is central to these kinds of more radical product innovations, as their perspective on a certain product will fundamentally determine their commitment to and acceptance of that product. This consumer perception will have a flow-on effect to the overall sales revenue generated by that product, which fundamentally will determine the success of a product innovation for a firm.

If we reflect back upon the analysis, EVs are a radical innovation with significant consumer use implications around the variations in the range of the vehicle, different refuelling (recharging) habits and the different price point. In cases such as this – a radically new product with an abundance of new features and usability implications – conventional models such as the value pyramid (Almquist et al. 2016) are not a reliable foundation for managers to make large-scale product development investments. As such, we can further highlight the need for a new model upon which strategic managers can rely to define consumer value in the context of radically new product innovations.

Reflecting back on Porter's (1991) two primary methods of creating a competitive advantage, we can identify how product innovation falls into place in establishing a competitive advantage. Porter (1991) highlighted that in order to create a competitive advantage firms can lower costs without comprising quality to increase margins, or differentiate products to create a unique product for which a customer is willing to pay a premium. The latter is the primary approach we are considering when discussing product innovation in the context of this body of research. As we have highlighted above, consumer value is an influential driver of product innovation and strategy. As per Porter's (1991) perspective, we have seen that product innovation must fulfil consumer value, and this, in turn, is a unique product for which a customer is willing to pay a premium.

Comparisons can also be drawn from Porter and Teisberg's (2004) research around positive-sum and zero-sum competition. Zero-sum competition is a focus on leveraging greater bargaining power to drive the price of a product down. This approach to competition does not incorporate, nor does it facilitate, a demand for product innovation. Positive-sum competition, on the other hand, does facilitate product innovation – and the principles of positive-sum competition even drive innovation. The concept of positive-sum competition (Porter & Teisberg 2004) is surrounded by a belief in 'healthy competition', where multiple firms can be successful in the one industry. The automotive industry has long been an example of an industry where positive-sum competition works effectively to drive more value for the consumer. By embracing the principles of positive-sum competition in the Australian EV market, the industry should embrace the EV product that is slowly diffusing into the market. The new technology should not be seen as an eventual replacement to current ICEVs, but as a product that enables consumer choice. We understand that, by accepting the emergence of EVs in Australia, the market will continue to display traits of positive-sum competition. This will benefit the market as a whole, including ICEVs and EVs; the literature around positive-sum competition supports that innovation leads to new and better approaches, which diffuse widely and rapidly into a market (Balakrishnan & Pathak 2014; Efimova, Kuznetsova & Ramanauskas 2014; Porter & Teisberg 2004).

The research presented here suggests a fundamental issue that potentially confronts all forms of innovation where the consumer benefits may seem intangible or not yet salient. The essential dynamic at work in the current research shows that, from a strategic perspective, it is imperative for manufacturers to move to EVs for a range of reasons: environmental concerns, political pressure, emission regulations, and an increase in restrictions on ICEVs in certain regions (mainly in parts of Europe, the USA and China). However, the analysis section has identified EVs as a product innovation that is: 1) limited in range; 2) complicated by limited infrastructure; 3) too expensive. Thus, they require a compromise the consumer won't accept, resulting in the ultimate failure of the EV product. Additionally, the product is sufficiently under-developed to the point where it becomes difficult for the business to sell its own product. This means that firms abandon their product in the marketplace and fail to invest in critical affiliated business functions, such as communication and training, to promote the product and raise consumer awareness.

From a strategic marketing perspective, the analysis shows that: 1) the consumer is not sufficiently aware of EVs; and 2) the consumer needs information about a product to be confident to make a purchase decision. So, what can be done in a scenario where a product has little broad consumer appeal but constitutes the basis of a strategic direction in which a firm wants or needs to go? It is apparent that the consumer will not seek to engage with the product and, as demonstrated in the analysis, they will not compromise on their present advantages; they want exactly what they are used to. However, they do see that EVs have benefits around running cost and sustainability, which has a positive consumer value. Perhaps, then, the value equation in the instance of EVs will allow for minor consumer behaviour changes. This highlights a need for the current state of the product innovation to be further developed in order to alter what currently requires a drastic consumer behaviour change to one which only requires a minor consumer behaviour change.

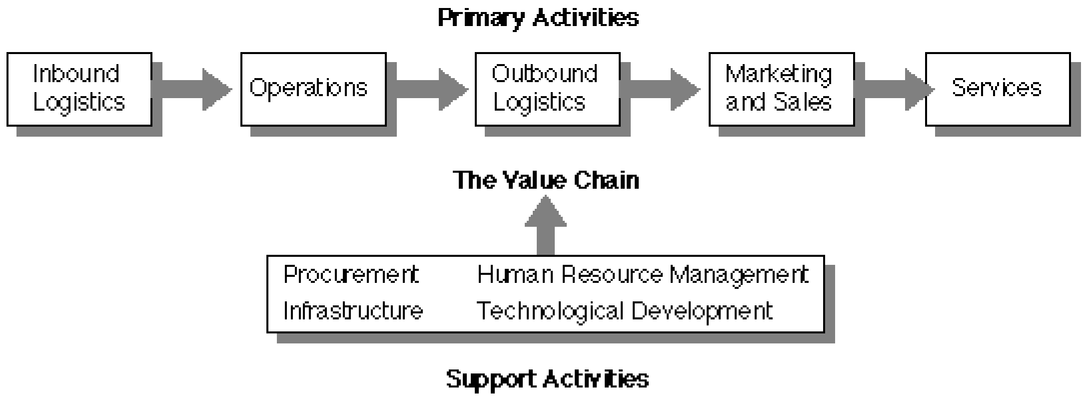
How can strategic management approaches therefore influence the product innovation and make EVs 'normal'? The reality is that the product is not 'normal' at this point. However, we can try to simulate a market situation where the user experience is normal (or better) – thus building a competitive advantage. To do this, strategic management approaches must open new business channels and multiple value chains that work in tandem – in turn, a *value paradigm*.

9.2 Uncovering the ineffectiveness of the conventional value chain model

In arguing for the validity of a new value based model such as the value paradigm, we must first highlight the ineffectiveness of conventional value models, such as the value chain (Porter 1985). The conventional value chain has been heavily discussed across various academic literature (Lampikoski et al. 2014; Madill, Haines & Riding 2004; Porter 1985; Ryans et al. 2000). The foundations of the conventional value chain remain a valid form of logic behind modern interpretations and deviations of consumer value. However, this section of the discussion will argue that the conventional value chain is out of place in the context of introducing radical new product innovations. By reviewing the foundations of a conventional value chain, at each step, against the principles uncovered in the analysis, we can identify the requirement for a new value-based model.

As highlighted in the literature review, a conventional value chain focuses on following a chain of primary activities along a sequential order: inbound logistics, operations, outbound logistics, marketing and sales, and services. The chain itself is supported at various stages by underlying activities such as technology/innovation and infrastructure. Figure 2 illustrates the conventional value chain.

Figure 2: Value Chain (Porter 1985)



The typical value chain is founded on a historically conventional business philosophy and is heavily influenced by traditional manufacturing models. That is, the manufacturer sources raw materials (inbound logistics); the raw materials are manufactured into the end product (operations); the end product is shipped to distribution centres, ready for dispatch to the end consumer (outbound logistics); a comprehensive marketing and sales strategy is implemented to attract customers to purchase the product (marketing and sales); and, finally, the end consumer who has purchased the product has at their disposal some sort of ongoing support via customer service, warranties, training, and so on (services).

While still highly relevant across some industries and in established markets, this conventional model cannot be relied upon as the sole model for firms to generate consumer value, especially when it comes to highly disruptive and innovative new products. In one sense, the Australian automotive industry is one of those industries where the conventional value chain is still relevant. By way of example, raw materials such as metals, plastics and fabrics are transported to a central manufacturing plant (inbound logistics) where they are used to produce vehicles (operations). These vehicles are then exported around the world to national sales hubs and their dealers, where they are available for purchase to the consumer (outbound logistics). The purchase of these vehicles is instigated by successful sales and marketing campaigns to entice customers into a purchase decision (marketing and sales). Lastly, customers receive ongoing support in the form of maintenance, warranties, customer service engagement, repairs, and so on (services). All these processes and steps are also influenced by various support activities along the way, from engineering in the research and development phase right through to sales and service network development. This conventional flow has been largely successful for the automotive industry to produce, supply, sell and maintain conventional vehicles in Australia (and globally) for several decades.

The following section offers a detailed analysis of how conventional value chain models potentially fail radical innovations. The data analysis highlighted numerous strategic and value-based anomalies in the innovation of EVs. This section is intended to demonstrate how these anomalies emerged and precede the subsequent discussion of how a re-evaluation of the conventional value chain is required if managers are to better conceive of, and integrate, radical innovation into their market offerings.

EVs will follow a similar conventional value chain model, since an EV will still need to follow similar processes of engineering, construction, shipping, sales and marketing, and service. However, EVs cannot depend on a conventional model to define and effectively create consumer value. If we refer back to the analysis section, we can identify that the first generation of EVs followed the same value chain process as an ICEV and were a failure in the market. If we break down the conventional value chain we can see how a disruptive product such as an EV simply doesn’t fit into this model the same way an ICEV would.

9.2.1 Inbound logistics – Component supply chain

The conventional automotive supply chain has been relatively stable as a concept and the majority of OEMs operate along similar supply chain models. Some OEMs depend more heavily on components being supplied near completion, with the majority of the internal operations involving fitment at assembly to create the final product. However, other OEMs tend to take delivery of components at an early stage of completion and finalise the component design and manufacture in-house. In practical terms, and by way of example, low-cost mass-market brands take delivery of completed and upholstered seats with the only operational measure being conducted at the final assembly point. In contrast, more premium brands take supply of only a seat shell and undergo immense measures internally to upholster and design seats before fitting them at the assembly point.

While the rate of completion of certain components does vary in the industry, there is a historical consistency in the type of components that are supplied at the first stage of the value chain. Since the automotive product hasn't undergone significant change, all OEMs are supplied with similar components: engine components, gearboxes, brakes, suspension, seats, metals, and so on. As a result, there is a raft of suppliers around the world that are accustomed to these supply chain processes and over time this market of 'automotive suppliers' has become more efficient, improving quality and reducing costs as a result of fierce competition. This reduces costs at this stage of the value chain while improving quality, in turn generating a foundation for an inherently more valuable product for the consumer further down the value chain.

Since EVs are a radical new product innovation, the component supply chain is drastically different. The major hardware components powering an EV cannot be sourced from the existing pool of suppliers. Traditional components used to build an ICEV, such as engine and transmission components, essentially become redundant in the supply chain for EVs. Rather, EVs require a different supply of key components, most predominantly, high-cost batteries.

Since the market and demand for EVs is historically low, there are minimal commercial opportunities for traditional OEM component suppliers to entertain the idea of transitioning their business model to accommodate EVs. As such, these EV-specific components need to be sourced from suppliers external to the established supply chain. Due to the low volume of EVs, critical mass is not achieved for any supplier to supply these components in conjunction with any reasonable economy of scale. Those firms that do choose to supply these EV specific components do so without any real competition. As such, there is little pressure for these firms to innovate and invest in developing their product in order to establish a competitive advantage. Concurrently, the low volume and lack of short-term financial opportunity to supply these components also reduces the appeal for new entrants into the EV component supplier market.

This scenario results in OEMs having to purchase EV components without a large degree of choice and at a higher cost. Subsequently, we can identify that because EVs follow the same processes in the supply chain as ICEVs, they are built on a foundation of high cost. This high-cost foundation immediately positions EVs as a more expensive technology at the first stage of the value chain.

9.2.2 Operations – Research & Development and Assembly

The next stage of the conventional value chain is stipulated around operations. For contemporary OEMs, the core field of operations – and where OEMs add a significant amount of value – is in research & development, and in assembly.

The R&D process within the value chain is closely aligned in principle to the processes of the supply chain; mass-market OEMs tend to invest fewer resources into the R&D process than more premium OEMs. The outcome of this is fairly simple: OEMs invest more resources into R&D in exchange for being able to offer a more refined and technologically advanced product to their consumers at a higher price. Since the automotive industry has been subject to a long history of continuous innovation and product improvement, the R&D invested into one product slowly trickles through to other products over time at a lower cost. By way of example, power windows and air-conditioning were once features reserved only for the very top-end premium models in the market. However, as the cost of developing these features decreased due to knowledge transfer (Mowery, Oxley & Silverman 1996; Simonin 1999) from previous R&D, the technology found its way into lower-end models at a lower cost.

This history of continuous innovation has been directly influenced by consumer demand and expectation. As the makers of these top-end models strive to outdo one other with new features and technology improvements in the attempt to gain a competitive advantage, the consumer ultimately determines the success of a particular new feature. The features valued by the consumer will continue in development and eventually work their way through other products in the industry. At the same time, features that are not accepted or valued by the consumer will fall away into obscurity.

As OEMs progressed with the idea of developing EVs in their first attempt at mass-market integration, they followed the same principles of R&D to which ICEVs were subject. However, since there was little historic R&D around EVs, the work and knowledge acquisition had to be accumulated from a clean slate; there was only limited prior research and product experience that engineers could rely on to assist in the R&D process of EVs. As a result, in order to deliver a product encompassing a somewhat comparable user experience, immense resources were invested to develop an EV based on the concepts a consumer was familiar with in an ICEV: they looked similar, they drove similarly and offered comparable levels of comfort and safety. However, as we learnt from the analysis section, these radically different products are not similar to conventional ICEVs from the consumer's perspective. The technologies carry two drastically different user experience characteristics in the range of the vehicle and the refuelling (recharging) process.

As a result of this heavy investment into the EV product, trying to make it similar and comparable to an ICEV, costs were driven up without a focus on how this drastically new product could be positioned and engineered differently to capture increased value. The net result of the EV product following the same value chain principle of an ICEV was the development of a product with a similar look and feel, but with inherent usability compromises. This constituted the same value chain process delivering weak results in consumer value generation. Consider this in the context of EVs being subject to higher development costs: it shows how the conventional value chain process did not add significant value and perhaps only drove up costs for OEMs. Subsequently, the inflated cost at the first stage of the value chain expands further at the next stage of the value chain as a result of upstream market conditions and operational inefficiencies associated with the transition to launching a radical innovation.

Following on from the operational implications associated with the R&D process, the assembly process is also impacted as a result of transitioning to radical product innovation. If we contrast the concept of EVs to ICEVs, EVs were forced to follow similar design principles at the R&D stage in order to be able to be produced concurrently along existing assembly lines. In order to contain costs, OEMs producing low-volume EVs – which, historically, is every OEM that isn't specialised to EVs, as Tesla is – designed their EVs so that they could be produced concurrently with ICEVs. This meant that existing assembly infrastructure could be used with no major modifications required to assimilate EVs into the production process. However, while this may have been cost-beneficial for OEMs on the assembly front, it restricted R&D departments from taking the full liberty of innovating and designing an EV to maximise the consumer value. EVs had to be designed off existing vehicle platforms and make use of largely the same common components. Since these existing platforms and components were designed in accordance with ICEVs, it meant that EVs incorporated certain design elements that were in fact redundant or reduced efficiencies. Since the majority of first-generation EVs were based off existing ICEV platforms, engineers had to package EV components as best as possible into the ICEV base platform. This, in turn, restricted the potential of R&D to add significant value and truly innovate the product, ultimately reducing the end value for the consumer.

Turning our focus back to the value chain, the operational element of the value chain was impacted in two ways. First, from an R&D perspective, far more investment and resources were required to develop and design an EV along the same principles as an ICEV. However, the net result was not a superior product or one creating any significant additional value for the end consumer. Second, due to the desire of management to curb the cost of production, EVs had to be designed in line with existing assembly line infrastructure and platforms. While containing costs at one stage of the value chain, it negatively impacted and subsequently restricted the options in product development; this in turn also had a negative net effect for consumer value.

These two key steps highlight how at the operational stage of the value chain, costs increase drastically without creating any significant additional value. In comparison to an ICEV, this stage of the value chain was far more inefficient for an EV.

9.2.3 Outbound logistics – Distribution

The outbound logistics stage of the conventional value chain is subject to far less variation between EVs and ICEVs as seen at other stages of the value chain. The process of OEMs distributing their products around the world to a variety of distribution centres and dealers has been the primary way of selling cars to the end consumer for several decades. This process adds significant value for the consumer as it gets the product from the end of the assembly line to the individual consumer's neighbourhood. The process in relatively simple terms is the responsibility of three key players: the manufacturer (that is, OEMs), the importer/distributor and the dealer.

The manufacturer is responsible for the logistics of getting the final product from the end of the assembly line to the importer/distributor. They do so via a historically reliable and comprehensive network of internal and external channels. Depending on the specific destination of the importer/distributor, these channels can involve logistical processes of sea freight, rail freight, truck freight or, in rare cases, even air freight.

Once the product arrives at the specific importing distributor, it is their responsibility to localise products for their market, via homologation and local compliance processes. Once the importer has finalised the product for the local market, it can be distributed to the dealers, who are ultimately responsible for the eventual sale to the consumer.

The dealer's responsibility in the logistical process is to prepare the product for its final sale to the customer. They must ensure the product is delivered in accordance with the agreed terms of the individual consumer.

The distribution process of OEMs, their importers and dealers is comprehensive and has been subject to years of continuous improvement and increases in efficiencies. It adds significant value to the product because it makes the purchase of the product so much more attainable for the consumer.

The distribution process has minimal implications for EVs in following the same value chain process as ICEVs. The distribution process is not dependent on or biased to a particular technology. Subsequently, an EV would benefit from the same amount of value-add as an ICEV at this part of the value chain process.

9.2.4 Sales and Marketing

The sales and marketing stage of the conventional value chain is perhaps the most applicable to this body of research. The sales and marketing functions are often completed and co-ordinated centrally in each specific market. While the global head offices of OEMs set up significant parameters and guides to ensure a brand is represented consistently around the globe, the execution of sales and marketing is conducted in the market. The sales and marketing functions are a core stage of the conventional value chain in continuing to build the value of a product for the consumer on the foundations set on the previous stages of inbound logistics, operations and outbound logistics.

The sales and marketing stage of the conventional value chain is subject to a raft of diverse functions and processes. There are sub-stages of sales planning, stock management, margin structures, product offer structures, pricing, positioning, above-the-line communications, below-the-line communications, public relations, media, sponsorship, direct marketing, customer relationship management, lead generation, lead nurture, training, sales support, and so on. The amount and depth of functions that occur are significant, with each function serving an element of value-add to the consumer.

The science behind the function of sales and marketing (Lampikoski et al. 2014; Madill, , Haines & Riding 2004; Porter 1985; Ryans et al. 2000) is profound as it serves as the ultimate touch point between the business and the consumer. The sales and marketing stage of the value chain is blessed with the power and responsibility to determine the ultimate success or failure of a product. Due to the inherent diversity and complexity of so many functions being performed concurrently or in close succession, every OEM leverages these functions in a slightly different way. OEMs often also take different sales and marketing approaches between their different product offerings. However, the fundamental orientation of the sales and marketing approach is the same: the product arrives and a wealth of research and activity goes on to determine the target market, the product offer structure, price, position, predicted sales volume and stock requirements.

Once management has determined the position of a certain product, a marketing plan takes shape to set up the product for market launch and success: to whom do we communicate, how do we communicate, what do we communicate and where do we communicate? Last, the sales execution comes in to convert the marketing plan into actual sales. The question at this stage of the value chain is how to execute all the market research and marketing activity to fundamentally result in a sale: where will the consumer purchase, how do they want to purchase, what do they need in order to purchase, who interacts with the consumer and what training is required to complete the sales process?

This model of sales and marketing is abundant in the automotive industry and, like all other stages of the value chain, has been fundamentally unchanged for decades. ICEVs have been sold in the same way today as they were several decades ago. While the individual channels of sales and marketing are now different, especially in the rise of the digital age with a higher dependence on digital marketing as opposed to historically conventional methods like print marketing, the actual method and strategy behind the sales and marketing has remained unchanged. The method and strategy of selling a car is to be presented with a product which has been developed and manufactured with no significant input from the sales and marketing channels. The vehicle is simply provided to sales and marketing departments who are tasked with the responsibility to evolve a sales and marketing strategy to sell the product. Since they have had no real input in the product development stage, they develop a strategy based on subjective perceptions about the product, review historical knowledge and results of previous similar or competitor products, and conduct market research to determine the target market, required product offer structure, price, position and expected sales volume.

There is a progressive flow-on effect through the stages of a marketing and communication plan, right down to the sales execution plan. This method is very much a top-down approach to push the product onto the customer. This approach to sales and marketing has long gone untested in the automotive industry since a radical product innovation has not disrupted the industry for decades. The dependence on subjective interpretation, historical knowledge and existing market research data was – and continues to be – a sound approach for conventional ICEVs. This position is predicated on the fact that the product OEMs sell hasn't undergone any fundamental change. Any change in the product OEMs sell has come via continuous innovation and improvement; new features are added, functionality improves, safety and performance increases, and so on. Because the product is still fundamentally the same, sales and marketing professionals conduct business in very much the same way and the consumer accepts this, due to not being exposed to any real alternative in the marketplace. The end result is that everything remains very much the same: the product, the sales and marketing strategies and the consumer buying process – including research and awareness.

However, treating EVs ‘the same’ as an ICEV results in an absolute failure of the sales and marketing function. The analysis section highlighted the inevitable flaws of the sales and marketing approach of OEMs in selling EVs. There was complete confusion among consumers as to the availability, functionality and overall product concept of an EV. The analysis section found that this consumer confusion and lack of awareness of EVs was a result of incompetent, incomplete and inaccurate sales and marketing methods. This came about as a direct result of reliance and dependence on static and rigid strategies OEMs had in place for their ICEV products. As highlighted above, these strategies stem directly from the evolution of the conventional value chain.

We have seen that OEMs have depended on aggressive ‘push marketing’ strategies to force their products upon the consumer. While these direct push marketing strategies were – and continue to be – successful for selling ICEVs, they were unsuccessful in selling EVs. The analysis found that push marketing was unable to drive any considerable desire or interest in the EV product because the consumer had no foundational knowledge or awareness of the product. The few consumers who were interested in or influenced by the push marketing strategies followed the conventional channel of acquiring more information, which led them to the existing sales channel of a dealer. Here the consumer was met by a salesperson who was unable to provide any further information to educate the consumer because the sales person had not been privy to any specific training either. This also highlighted a further staff training flaw in the existing sales and marketing strategies.

If we review the key issues EVs uncovered at the sales and marketing stage of the value chain, a pattern emerges which links back to the previous stages of the value chain. The conventional value chain model aims to build value for the consumer at every stage by turning a series of functions into a final tangible product. However, by running EVs and ICEVs concurrently along the same principles and processes of the same value chain, we can identify how at every stage EVs fail to generate the same amount of net-value due to higher costs and lower consumer benefit. The result is that, by the time the products reach the sales and marketing phase, EVs are a high-cost product with low levels of consumer benefit and convenience. In comparison, due to the series of systems and processes implemented over decades in developing ICEVs, they reach the sales and marketing phase as a far cheaper product with inherently more value. Subsequently and in simple terms, the EV becomes ‘harder to sell’.

As the analysis highlighted, EVs are expensive, lack range and have a string of refuelling (recharging) issues. Since EVs are a hard sell and since they follow the same processes as ICEVs at each stage of the value chain, inclusive of the sales and marketing stage of the value chain, the problem is simply deferred right up until the EV is put on sale. The very real scenario is that an EV sits on the showroom floor as a product riddled with compromises and a lack of value in comparison to an ICEV. However, an EV remains a subject of conventional sales and marketing methods that push the product upon consumers without focusing on educating the consumer on the technology, or adequately training the sales staff responsible for selling it.

This all comes as a result of EVs following the conventional value chain and the processes setup by OEMs to manufacture and sell ICEVs. Since EVs are a radical innovation and require a complete rewrite of what an automobile is and how it should be used, they require their own processes. More importantly, they cannot be forced to adapt to the existing processes in place for ICEVs in order to achieve a face-value cost reduction or ‘synergy’.

9.2.5 Service – Aftersales

The final stage of the conventional value chain is one the automotive industry has long embraced because it is a reliable source of consistent cash flow. The services element of the conventional value chain is stipulated around the diverse 'Aftersales' business. This area of the business has been predicated on completing the sale of the vehicle but following the sale transaction with ongoing services throughout the lifecycle of the vehicle – primarily via maintenance and parts services.

Not only does this extension of the business generate a significant portion of revenue for OEMs via parts and maintenance sales, but it also preserves a consistent post-sale dialogue between consumer and OEM. This assists in maintaining customer engagement, which often leads to customer retention and repeat business via new vehicle sales. Due to the importance of maintaining a positive relationship with the consumer to drive this customer retention and repeat business, significant resources have been set up to manage customer relations throughout the product lifecycle. Specific departments and processes exist to manage requests, complaints and general customer queries in order to facilitate the concept of retaining customers for the purpose of increasing repeat business.

As highlighted throughout this section, these strategies and processes have been common practice for decades in the automotive industry; there has been little change in how OEMs create value at the final stage of the value chain. Since the managerial practice has been the same, EVs were put through the same strategies and processes as ICEVs. Following the trend set out above, these processes did not add significant value for the EV consumer. In fact, due to the consistent lack of value being added at each stage of the value chain, the few customers who remained adamant to purchase an EV were not serviced well.

As noted in the analysis, EVs require less maintenance and fewer parts. Subsequently, the existing services available to ICEV consumers were irrelevant to the EV consumer. However, the EV consumer still requires some sort of post-sale service, which is different to the process in place for ICEVs. Since these EV-specific services were not in place, there were two drastic results in the marketplace: 1) The EV consumer was left abandoned in the market with a product the manufacturer was unable to service; 2) Because the OEM did not have the right systems in place to service the EV, it effectively considered an EV sale as a lost ICEV sale, without the attached revenue and repeat purchase potential.

These results can be attributed to, and are affiliated with, the same managerial perspective at the sales and marketing phase of the value chain. As OEMs force the radical innovation of EVs through existing processes that were formulated on the perspective of a conventional value chain, value is not created anywhere near as effectively for EVs in comparison to ICEVs, for which the existing processes ultimately cater.

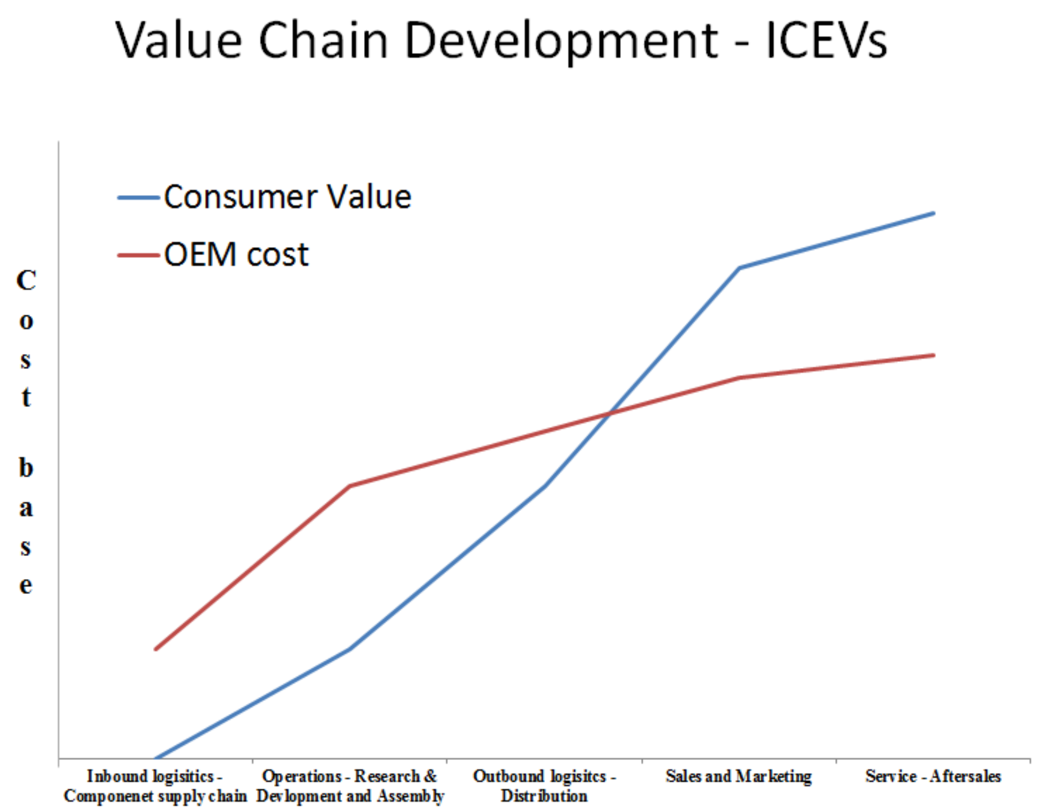
Similarly to the outcome observed at the sales and marketing phase, the EV product is left abandoned in the marketplace without any processes or strategies in place aimed to build value for the consumers of these new products. In fact, because EVs do not contribute to the OEM's cash-cow aftersales business – and even threaten the existing business model – there is further cause for managers to resist addressing the issues at the sales and marketing stage of the value chain. If the aftersales business and service stage of the value chain remains unchanged, the outcome is that for every EV sold instead of an ICEV, the OEM is reducing downstream cash flow and business opportunities.

9.2.6 Summarising the failure of EVs in a conventional value chain

What the above comparison and analysis highlights is a failure of OEMs to successfully bring EVs to market by following traditional business practice and a conventional value chain model.

The conventional value chain, as applied in the automotive industry, constantly builds value for the consumer across each stage. Due to the long history of continuous innovation around the supporting systems of the value chain, OEMs have set up processes which are highly efficient in delivering a valuable consumer product. Figure 8 illustrates these efficiencies to maintain costs while increasing the end consumer benefit.

Figure 8: Value Chain Development – ICEVs

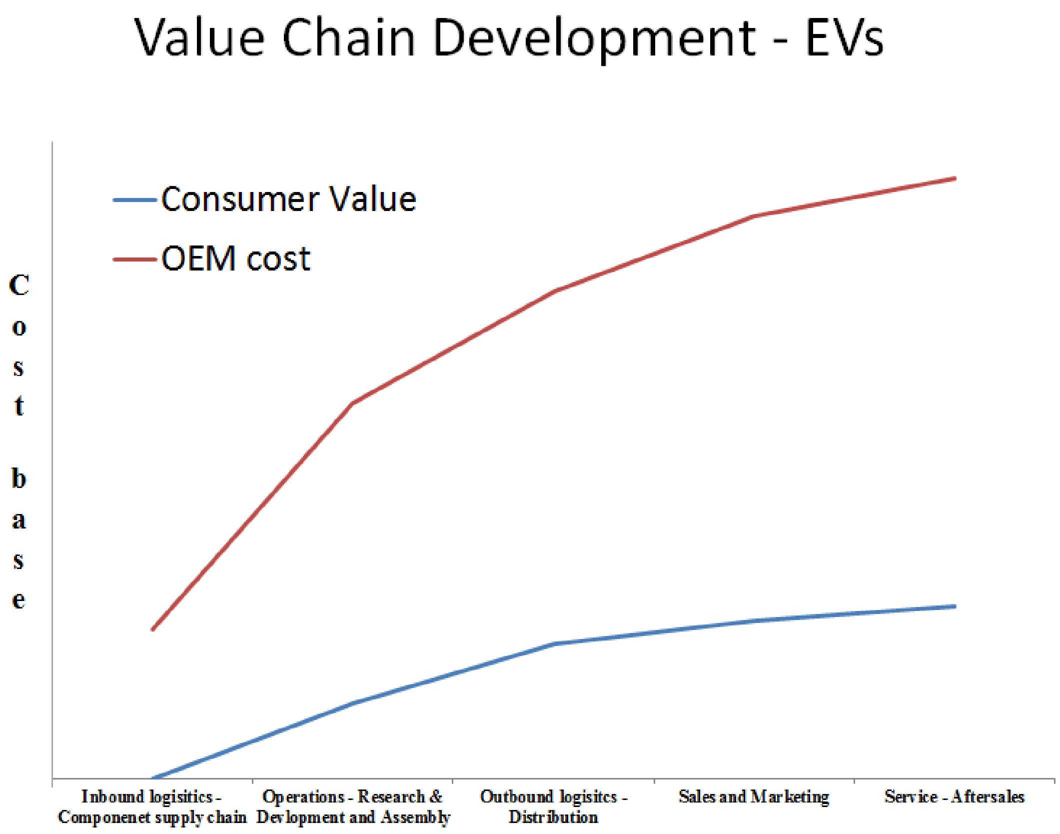


Source: Own – Illustrative

The illustration highlights how consumer value starts low and trends upwards further along the value chain as the product moves from raw materials to a final product; meanwhile, costs start high but slowly taper off. The end result is that by the time OEMs reach the sales and marketing phase of the value chain, there is a positive consumer value created for the ICEV product. In turn, the product can be considered saleable and profitable.

In comparison, from the very first stage of the conventional value chain, EVs fail to create the same amount of consumer value as ICEVs. Concurrently, the cost to the OEM of developing an EV far exceeds the costs associated with ICEVs, resulting in a far higher starting cost base. This negative trend appears at the first stage of the value chain and persists along almost all of the other stages. Subsequently, a compounded approach of negative value generation at each and every stage of the value chain becomes apparent. Costs to an OEM continue to increase, but value is not being created as efficiently, resulting in the development of a product which has no positive consumer value because it follows the conventional value chain principles. Rather, the further along the conventional value chain the product moves, the greater the gap between value and cost becomes; Figure 9 illustrates the effect outlined above, when EVs follow the same processes and value chain principles as ICEVs.

Figure 9: Value Chain Development - EVs



Source: Own - illustrative

This effect of a negative value generation trend is primarily influenced due to the fact that EVs are being developed in the presence of an incumbent technology in ICEVs. Literature by e.g Geel (2004) identifies this theory that the adoption of new technology and a subsequent transition to that technology is made difficult when the new technology needs to compete with an incumbent technology. The presence of the established technology harms the development and subsequent market penetration of the new technology. What the above highlights is a critical requirement to consider these implications in a deeper manner in the context of generating value when it comes to highly disruptive and drastically different product innovations.

The conventional value chain (Porter 1985) showcases how value can be created effectively and efficiently when dealing with existing consumer products and markets. However, it may be aided to develop a parallel theory when it comes to drastically new product innovations that have no existing market at the time of their development and initial market introduction. Therefore, in order to better theorise the development and value creation for these highly disruptive new product innovations, a new value model is required, termed here the *value paradigm*. Our attention now turns to a re-theorisation of how value can be created through the early coalescence of strategy, innovative and value creation dimensions.

9.3 Introducing the Value Paradigm

In light of the findings elaborated above, the introduction of a value paradigm comes in reaction to conventional value models not being able to reach the critical depth to successfully create value in the context of radically new product innovations. In particular, this becomes highly relevant in the sectors influenced heavily by emerging technology. Subsequently, the value paradigm will be presented as a new model that complements existing value based theory, which is highly applicable in these scenarios where emerging technology drives the development of new product innovations that create a drastically new market. The value paradigm will be presented as a highly integrated model that relies deeply on correlation between strategy, innovation and value. Ultimately, the value paradigm will be presented as a model highlighting the interdependencies of strategy, innovation and value, while also prompting the need for new business processes that are faster and more accommodating to change.

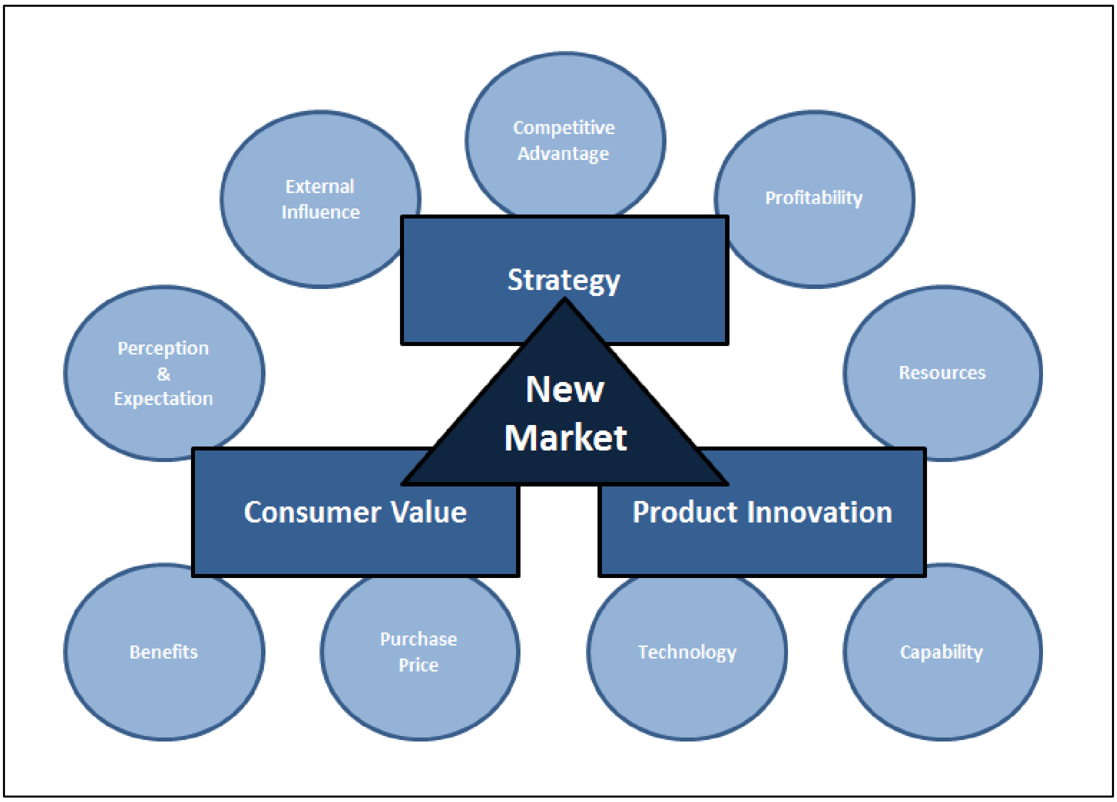
Our ambition for the value paradigm is to reconstruct the understanding of how consumer value is created through radical product innovations and the role strategic managers have to play in this space. The basis of logic founded above is that conventional models such as the value chain (Porter 1985) and value pyramid (Almquist et al. 2016) are effective when dealing with existing products or minor/continuous product innovations. In these instances, the market conditions and consumer value attached to certain products and features are already well established in the marketplace and familiar to strategic managers. However, these conventional, existing models fail to adequately represent how consumer value is created in the context of new radical product innovations that effectively have no prior market, and create a brand new market with its own unique consumer value set. As evidenced by the research on EVs presented here, this new consumer value set can be drastically different from any previous or related market or markets. The value set is also sensitive to change as the market develops and shifts in response to a range of influences.

As such, one of the key contributions of this thesis is to present the value paradigm to better understand the role strategic managers play in introducing and positioning radical product innovations in the marketplace competitively, so that they constitute consumer value. Our notion of the value paradigm has been foregrounded in such concepts as the value grid (Pil & Holweg 2006), value constellation (Normann & Ramirez 1993) and value network (Peppard & Rylander 2006), but extends these concepts to produce a more highly integrated approach to the dimensions of strategy, innovation and value rather than just presenting these as simultaneous activities.

As observed in the discussion regarding the development of EVs through a conventional value chain, the logic of following existing processes and principles has a negative impact on value creation as the product progresses through the various stages of the value chain. The preceding section clearly highlighted how EVs failed to create any value along the chain, meaning that OEMs tried to market and sell a product that constituted no value in the marketplace. However, there was, and continues to be, a clear ambition from OEMs to move towards EVs, despite the product failure and lack of market demand. The analysis highlighted this to be predicated largely on external influences such as emissions restrictions in many countries around the world. Therefore, in these instances where strategic managers intend to move their businesses and products in a certain direction where there is no known market and/or consumer demand, they require a new model that facilitates a new interpretation of how value can be created.

The value paradigm highlights the grassroots interdependencies of strategy, innovation and value when managing radically new product innovations or where managers, innovators and consumers have little to no pre-existing experience or exposure to a certain product and/or technology. Figure 10 illustrates the value paradigm.

Figure 10: Value Paradigm



The illustration of the value paradigm highlights the linkages and co-dependencies of the three fields of strategy, innovation and value upon a new market. The value paradigm assists businesses and their managers in better evaluating and understanding the necessary considerations of launching a radically new product innovation that creates a new market, in line with greenfield principles. The success of the product and the subsequent market depends on, and is influenced by, the implicit relationship between the factors that sit under each of the three fields of strategy, innovation and value. In the context of this research, the analysis enables us to identify key factors that influence the development and success of certain product innovations. These factors have emerged from the empirical analysis conducted in Chapters 6 to 8. And are discussed below:

9.3.1 Strategy factors

External Influence – This factor is derived from the political pressure OEMs are subject to, globally. The ongoing pressure on OEMs to reduce vehicle emissions and conform to tightening emissions regulations is forcing OEMs to explore new technologies in order to comply with these largely political influences.

Competitive Advantage – While OEMs are subject to strong external pressure, they continue to compete in an industry that is, at its very foundation, a highly competitive marketplace. Any new technologies, innovations or products that an OEM creates must be associated with some sort of competitive advantage to ensure the OEM remains relevant in the marketplace.

Profitability – At the centre of almost all OEMs is a board representing a demanding group of shareholders. It is a prime consideration for the majority of OEM strategic managers to fulfil their responsibility of profitability to their shareholders.

9.3.2 Product Innovation factors

Technology – Central to any strategic initiative of a business to deliver new products and/or transform a business is the state of technology available to a business at a particular point in time. The role technology plays in the modern corporate industry is ever increasing (Eggert, Thiesbrummel & Deutscher 2014; Euchner & Ganguly 2014; Pantano & Di Pietro 2012; Scherer, Wünderlich & von Wangenheim 2015; Zhang & Dongsheng 2010), but businesses remain bound within the limitations of the state of technology available.

Capability – In circumstances where technology is available in the marketplace to fulfil strategic initiatives, a business must evaluate its capability to leverage technology in order to fulfil the specified strategic initiative. Where a business does not have the capability to leverage the available technology, it must pursue initiatives to increase the firm's capability of doing so.

Resources – The availability of resources is crucial in a firm's quest to deliver product innovation. While dependencies on technology and capability are rife, the availability, allocation and investment of resources are key components of a firm's potential to deliver on strategic initiatives.

9.3.3 Consumer value factors

Perception & Expectation – Whatever product businesses bring to market will be subject to the consumer's evaluation (Choi, Shin & Lee 2013). The consumer's evaluation will be strongly influenced by their perception of the product and their associated expectations. This factor is a crucial dependency to strategy, in the form of the decisions managers take to develop a certain product and to the product innovators in ensuring the product is developed in line with consumer expectations.

Benefits – Central to the consumer value equation is the benefit a product brings to consumers. A product innovation must reflect adequate benefits in comparison to similar products already available in other markets in order to entice consumer interest.

Purchase Price – A crucial factor in establishing consumer value is associated with the purchase price of a product. While a product may deliver immense benefits and exceed all consumer expectation, it must be priced accordingly in order to constitute value for a consumer. The purchase price of a product has a strong correlation to the competitive advantage of a firm as pricing strategies, such as price reductions, can be a key method of creating a competitive advantage (Porter 1991).

9.3.4 The principles of the value paradigm

The fundamental principle of the value paradigm is to integrate the influences that occur concurrently in the scheme of developing a new market for radically new product innovations. As highlighted in the value paradigm, a range of strategic issues underline the need for a shift to a radically new product innovation. However, these strategic issues are underpinned by, and depend on, the technical options and limitations surrounding product innovation. Strategy and innovation can be considered as 'internal' because these activities manifest primarily within a specified business. At the same time, whatever approach is defined internally between strategic managers and product innovators, these decisions and subsequent products lie at the mercy of the consumer's judgement of the final in-market product.

Therefore, we highlight a deep dependency between the three fields within the value paradigm that must coalesce at inception. Strategic managers influence the ultimate direction of the company. They are responsible for deciding and funding the products which are required to fulfil the ultimate strategic direction of the firm. However, in order to do so strategic managers rely on: 1) the technical knowhow of the product innovation departments and information on plausibility of certain products; and 2) the customer expectation and ultimate acceptance of the final product.

The product innovators are responsible for the development of a particular product so that management can successfully market it. In doing so, they have the responsibility to leverage technology and the funding of a business to deliver a product that: 1) meets the expectation of the consumers, as defined by management; and 2) is done so within the resource and time allocation committed by management.

Concurrently, the consumer's interpretation of value is central to development. In the contemporary marketplace, the consumer's value interpretation and value criteria are highly dynamic. What the consumer values at the start of the year can be drastically different from what they value at the end of the year. Due to the constant shift of consumer value and expectation, the internal functions of the value paradigm – strategy and product innovation – need to accommodate the changing nature of the consumer value set.

However, the shift in the speed with which consumer value changes is not tied exclusively to the consumer. The rate of change influencing product innovators and strategic managers is also pivotal. The value paradigm sets out a range of factors that influence these fields, most of which are subject to increased rates of change and volatility. Factors such as external influences for strategic managers and technology for product innovators can change drastically in a very short time period.

Consequently, the increase rate of change experienced on the consumer value front can equally be observed in the fields of strategy and innovation. This highlights not only the express need for the value paradigm theory to drive a deeper integration across the fields of strategy, innovation and value, but also the requirement for the model to incorporate the increased rate of change across industries and marketplaces. This means that managerial processes must be far more fluid than they are set up today. Delivering radical product innovations must be the work of months and not years; a product that is planned to transform, disrupt or create a new market can only do so if it is delivered to the market before a rival product, technology or other factor has moved the market elsewhere.

9.3.5 Contrasting the value paradigm to existing value models

In order to highlight the gap in literature that the value paradigm aims to address, the value paradigm must be compared and contrasted to existing value models to highlight its relevance in the contemporary commercial sphere. This discussion chapter has already highlighted that in the age of advanced technological development and highly innovative consumer products, the conventional value chain lacks some depth in accurately defining value creation. The value chain is too linear and does not accommodate a more diverse and integrated relationship between the fields of strategy, innovation and value. The foundations of the value chain also lack the flexibility for changes in product, strategy or value as market conditions change through a growing number of influences. Where the value paradigm theory highlights its effectiveness over the value chain is that it does not rely on value being created along a set of linked chain-like activities; rather, the value paradigm is predicated on a deep integration between strategy, innovation and value with a highly flexible model to determine the course of value creation.

As the rise of technological advancement becomes ever more apparent across essentially every commercial sector, there has been considerable theoretical development on defining value in the wake of the rampant increased rate of innovation. One such contemporary value model is the Bain value pyramid (Almquist et al. 2016), which we revisit in order to contrast the value paradigm. The value pyramid takes a more consumer-oriented approach to defining value than the value chain, focusing on how consumers themselves attribute value to a product and its inherent features. The focus of the value pyramid model is to identify what consumers value, and to categorise those values for a subsequent managerial interpretation and eventual strategic application. The value pyramid highlights the hierarchical importance of the different elements of value. The foundation or base of the pyramid is made up of functional values such as saving time, convenience and reducing costs. These values are often the easiest to define in products and often become the focal selling point of a certain product.

However, sitting above these more obvious values are the emotional values that can be derived from a product, such as design, wellness and badge value. Further above these are the life-changing values such as providing hope and motivation. Finally, the value pyramid is topped by social impact values, such as self-transcendence. These values are often harder to define and less overt when considering the full scale of the product value. Importantly, these higher seeded elements of value are harder for managers to define and apply a fiscal value to. However, the value pyramid effectively highlights a model which, first, defines the different elements of value that exist and, second, goes on to present the hierarchy of those values. This theory allows strategic managers to reflect upon their products and make strategic decisions on how to better market the inherent value of their products, and/or focus on developing products that address these predefined consumer values.

While the value pyramid is a useful model to help strategic managers categorise and define the consumer value of products, it can only do so if the value of a product is known. In the context of radically new product innovations that do not yet exist, the value pyramid does not present a viable value model for these greenfield products. In this context, the value paradigm is far more applicable due to the deep integration the value paradigm theory has between all the active fields that influence the development and market acceptance of radical product innovations – these being strategy, innovation and value.

The value paradigm highlights the deep correlation between the three fields due to the uncertain nature of where product innovation can be instigated. The value paradigm highlights the range of factors that influence the development and market acceptance of an innovative new product. In particular, in the context of EVs, we can observe that the strategic factors that predicate a shift towards EVs must be balanced with the consumer value principles, which in turn shape the required investments in product innovation. However, given changing consumer value principles, changing rates of technology innovation and changing marketplace conditions, there must be a constant and deep integration between all three fields to ensure successful market deployment. It is this deep integration and in particular, the speed of reaction that underpins the contribution of the value paradigm theory in addition to existing value models such as the value pyramid.

9.3.6 The managerial implication of the value paradigm

The issue that this body of research aims to resolve with the value paradigm is twofold. The first issue is the finding that the conventional value chain lacks some suitability to understand radical product innovations; rather, a value paradigm is a more applicable model for managers to evaluate how value is created. The paradigm highlights that rather than value being created in sequence, it is created in a highly integrated and concurrent manner. Reviewing the analysis section, it is apparent that, rather than conceptualising value being created along a staged model, the value creation method needs to be far more centralised to account for the simultaneous effects of strategy, innovation and consumer value.

The second issue is one of execution: how are managers going to integrate their currently distant processes that affect strategy, innovation and value? Currently, managers face an issue that when businesses attempt to move towards radical new products, there is no clear view on what the consumer value criteria are. The lack of an existing market and competing products leaves managers with little dependable information to benchmark their ambitions for their radical product innovation. While the product concept might be evident for strategic managers, the actual consumer value of the specific product concept is difficult to accurately account for. Unable to garner key market information such as what product features are required, what the price point should be, and what the size of the market could be, strategic managers are left somewhat in the dark and cannot effectively plan the requirements for a new product to be competitive in a new market. This lack of a certain consumer value proposition results in a 'guess and check' approach from managers where they establish a hypothesis for what the product must deliver to be successful in the market. This skewed view of management represents high risk and could result in flawed product innovation approaches that ultimately result in developing a product that fails in the marketplace.

In order to circumvent this uncertainty, strategic managers must work far more closely with consumers, and engage them sooner. While conventional market research methods may aid managers in isolating the product requirements that constitute consumer value, the processes to collate this information lack the speed to suit the value paradigm model. The value paradigm model and its principles of integration highlight opportunities to define consumer value through new channels. While a certain radical new product innovation may create a new market in one industry, a similar radical product innovation may have already been introduced in another industry, or technology used to develop a radical product innovation may have already been applied to transform another industry or product. By extending the strategic scope into other industries and firms via methods such as strategic alliances, the value paradigm can result in knowledge and value definitions becoming far more apparent in the early stages of product development.

Since acquiring knowledge via strategic alliances is an effective and efficient means of spreading and facilitating innovation (Chen & Yaw, 2014; Nisula & Kianto, 2016; Rossignoli 2015; Yanadori & Cui, 2013;), it allows a business to bring a radical new product innovation to market sooner, and with a more surefooted approach to defining the consumer value. As observed in the literature review, alliances have a common presence in the automotive industry (Agnihotri 2013). Further, the analysis frequently highlighted the opportunity of collaborative effort: it is required to facilitate the uptake of EVs in Australia, to overcome key barriers and drive new value. Therefore, considering the relevance of alliances in the context of the subject matter of this research, the next section will outline how alliances can implement the theory of the value paradigm.

9.4 Implementing the value paradigm via alliances

The value paradigm highlights the deep correlation between the fields of strategy, innovation and value. Fundamentally, this model can and should be applied across a broad range of initiatives. However, this section of the discussion will highlight how the value paradigm can be applied in the context of strategic alliances. Strategic alliances will be used to show how strategic initiatives surrounding product innovation can drive consumer value. The use of strategic alliances will showcase how the case of EVs highlights the interdependency between strategy, innovation and value, while concurrently highlighting the resulting need for speed and flexibility in business practice.

Alliances can be an effective way for firms to bring radical new product innovations to market. As highlighted above, there are significant challenges and influencing factors that a firm must apprehend when endeavouring to launch a radical product innovation. Alliances represent a significant strategic initiative a firm can employ to drive the rollout of a new product innovation, especially in the quest to create a new market (Chilles & Meyer 2001). Considering the principles of the value paradigm and the concurrent nature of how strategy, innovation and value integrate, it is important to highlight alliances as a factor of the strategic pillar of the value paradigm. The strategic initiative to leverage alliances is concurrently influenced by, and in part dependent on, the model's other two pillars of consumer value and product innovation, along with the factors associated within these pillars.

The analysis section highlighted key themes that this body of research aims to address. Fundamentally, the analysis section highlighted that, despite initiatives from various OEMs and industry players, EVs have failed to penetrate the Australian market. This failure comes as a result of failed corporate strategies observed via the lack of government support and overall lack of consumer awareness, which is due to poor, incorrect or non-existent efforts from strategic managers to engage their own market, let alone other sectors. The failure can also be attributed to issues with the product on offer: primarily, the EV product compares poorly to ICEVs in terms of range, refuelling (recharging) practice and price. Last, the analysis uncovered that although EVs provide consumers with some additional value that an ICEV could not provide, such as environmental and technological benefits, this does not overcome the immense compromise a consumer associates with an EV.

Subsequently, the value paradigm highlights the need for all these issues to be addressed in a concurrent manner in order to deliver an offering the consumer would value. In the context of the analysis, the key issue comes down to the behavioural characteristics of batteries and electricity in comparison to a liquid fuel tank and an engine. The use of batteries in lieu of conventional engines and fuel tanks results in: 1) a higher manufacture price with a subsequent higher purchase price; 2) shorter vehicle range; 3) longer refuelling (recharging) times, with a lower density of available recharging points in comparison to petrol stations. These product issues result in serious consumer compromise and lack a positive value proposition for the majority of consumers.

It seems, then, that the solution required in the EV industry is cheaper batteries, with higher energy density, faster charging times and more charging points. Therefore, strategic managers must undertake two core deliverables in order to deliver a solution: 1) Find efficiencies in and accelerate the development of battery technology to reduce the cost of EVs and increase the range of EVs; and 2) Accelerate the rollout of EV charging points.

As with many new emerging technologies, the use case and beneficiary of technological advancement is not predicated on a singular firm or industry. Advancement in battery technology is subject to an ever-growing range of consumer products that are dependent on better battery technology; but technological development can only be facilitated if it is met with adequate investment. Investing in the particular area of battery technology is the significant resource commitment that is required. Firms have to ensure that their investments are met with suitable gains and if an investment is too significant, it may not be viable for firms to allocate their resources into a certain development. What this highlights, then, is a requirement that firms work together, as part of an alliance, to achieve a uniform goal – in this instance, better and cheaper batteries.

The above two solutions promise to fix the product specific issues, but they do not fix issues surrounding consumer awareness and product knowledge. For this to occur, we need to observe a different type of collaboration, this time among the automotive industry and with government. Alliances in this space must focus on communicating the advancements achieved as a result of the more technical alliances. Ultimately, we can observe the need for a range of alliances across various sectors in order to account for the full range of factors within the value paradigm.

The literature on strategic alliances (Hatten 1974; Hatten & Schendel 1977;Newman 1973 and 1978; Porter 1973 and 1979; Schendel & Patton 1978) was extensively covered in the conceptual framework. Essentially, the goals of operating in an alliance are to return a benefit to all firms participating in the alliance while lowering risk. The key benefits of an alliance are increased knowledge, growth opportunities, shared resources, and cost and complexity reduction. The drawbacks of operating in an alliance are opening up vulnerability around internal knowledge, missing out on other opportunities, and operating in an uneven alliance where the arrangement sees more resources spent than returned in the form of business benefit. The key alliance structures that will be discussed are:

Industry alliances: Firms from the same industry working together, often with similar products and customers. The focus of such an alliance would be to solve industry-wide issues for the benefit of all industry members. For example: two or more OEMs working together on an automotive issue.

Technology alliances: Firms from different industries that use similar technologies working together. The firms do not offer similar products and do not compete against each other. For example: the development of battery technologies between OEMs and firms that produce smartphones and/or tablets.

Network alliances: Firms from different industries that do not compete with one another but each firm’s product is affected and/or complemented by the other product. Firms are highly dependent on each other’s products to drive consumer value. In this instance, a practical example can be observed in OEMs that supply EVs working in an alliance with energy or utility companies that supply EV charging stations.

Government alliances: A focus on governments working with industry to deliver outcomes to the benefit of society. In the context of EVs, it is in the interest of government and OEMs to collaborate to leverage the communicative and policy power of government to promote the EV product offer of OEMs. Such an alliance gives OEMs an advantage in the marketplace but also meets the government's responsibility to support the rollout of products with a broader societal benefit.

There are many different methods for firms to work collaboratively, such as an alliance, partnership, acquisition and/or joint venture. We acknowledge that fundamentally each of these different methods of collaboration between firms has specific differences. However, for the purpose of this research, we will broadly refer to any formal collaboration between firms as an alliance. The purpose of this is to simplify the proposition and allow for a more focused understating of the broader strategic implications of alliances and their role within the context of the value paradigm.

9.4.1 Industry alliances

Industry alliances are one of the most commonly observed forms of alliances as they allow firms with similar products, similar processes and similar customers to work together to improve the performance of both firms (Rosenfeld 1997; Wonglimpiyarat 2006). We see such alliances effectively utilised across the majority of automotive OEMs, where there are more formally established groups such as the Volkswagen group (Volkswagen, Audi, Skoda, Lamborghini, Bentley, and so on) or where stakes of companies are shared between OEMs, such as Ford and its stakes in Mazda and Aston Martin (Greiumel 2015; Gomes 2016; Leggett 2015; Palmeri & Carey 2009;

Schaefer 2014; Tran 2016; Vijayan 2016; Warburton 2016; Wright 2001). These firms that operate in the same industry work together to achieve collaborative goals by utilising their synergies. From research and development, manufacturing, marketing and right through to sales networks, the automotive industry is known for working in collaboration (Greiumel 2015; Wright 2001). The benefits of operating as part of an industry alliance are vast. One of the key reasons lies in the significant issue of research and development. Certain firms have certain knowledge that others don't. Rather than investing heavily into an unknown field, OEMs exchange expertise in order to most effectively reach their goals. We can observe the application of such alliances in the automotive industry, and in particular the electric vehicle sector, with the alliance between Daimler and Tesla (Palmeri & Carey 2009; Schaefer 2014).

Tesla had immense knowledge of battery technology and its application in the automotive sector, but lacked experience and expertise in conventional automotive practice such as engineering, production and supply chain (Tesla 2010). On the other hand, Daimler had 120 years of experience in the engineering, production and supply chain processes but lacked knowledge and experience in the application of battery technology in the automotive sector (Tesla 2010). Subsequently, the two companies formed an industry alliance in order to aid them both in delivering their strategic initiatives. Importantly, their initiatives correlate to the concurrent and integrated principles of strategic management, product innovation and consumer value, which the value paradigm dictates. The goal for both firms was to take a *strategic initiative*, via the formation of the alliance, to improve their own *product innovations* in order to ensure that their product is competitive in the marketplace by delivering *consumer value*.

The analysis section found the high purchase price of EVs resulted from the high development costs associated with an EV. An industry alliance, as highlighted above, could be a primary method of reducing the development cost of an EV and in turn drive down the price while also improving the product due to the effects of synergies. This could enable the EV to be positioned far more competitively than it currently is, improving the consumer value equation.

The principles of industry alliances can be extended even further beyond conventional research and development synergies and into sales and marketing methods. Currently, OEMs spend a sizeable amount of resources in marketing their products to consumers. A lot of these marketing strategies use conventional “push” methods such as above-the-line marketing: OEMs are constantly pushing their products and their features onto consumers in order to entice them into purchasing. These methods are valid when particular market segments exist and consumers are fundamentally aware of the product concept. However, in the context of EVs, this market segment essentially does not exist yet beyond a very small niche, and EVs will become a new market. The challenge, therefore, for OEMs is that they do not have a market to push their products onto; and as the analysis revealed, the consumer has little awareness or knowledge of what an EV product is.

Subsequently, an industry alliance on the sales and marketing front creates the opportunity for new and dynamic collaborative approaches to solve this issue. Rather than opting for conventional push marketing strategies for individual products, OEMs have the opportunity to combine resources and get a greater market share of voice by communicating the technology as one, essentially moving away from ‘Buy Audi’s/BMW’s/Mercedes-Benz’s EV’ to a more streamlined ‘Buy an EV – any EV’.

This messaging approach will raise awareness, but it will also allow for a more structured approach in how the messages are being delivered to consumers.

Due to the bulk of resources behind the messaging strategy, it can be clear, consistent and effective in raising the awareness of EVs and help overcome the pre-existing misconceptions surrounding EVs. Fundamentally, the initiative would move away from push marketing to more educational marketing. This enables the consumer to educate themselves about the technology before seeking out the particular product that appeals to them from a specific OEM. This turns the perspective of marketing strategy away from the 'push' of new products onto consumers, instead favouring a 'pull' of consumers towards new products.

The concept of utilising industry alliances as part of a value paradigm model is about embracing economies of scale. It's about leveraging initiatives that benefit the industry as a whole, rather than depending on isolated activities from only certain players.

9.4.2 Technology alliances

Forming alliances with firms from different industries that use similar technologies is an emerging yet vital strategic element (Agostini & Caviggioli 2015). The rate of technological innovation is continually increasing. At the same time, consumer demand for technologically advanced products is also increasing dramatically. Therefore, there are growing opportunities for firms from different industries to work together in order to develop their products, which are both underpinned by similar technology.

The analysis section and this body of research highlight that to remove product compromises and cost concerns for the consumer, advancements in battery technology are required. Advancements in battery technology such as greater energy density, shorter recharging speed and cost reductions can result in an improved value proposition for consumers and ultimately deliver a more desirable EV product to consumers. Since the benefits of improved battery technology stretch well beyond EVs and the automotive industry, there is merit for OEMs to seek potential alliance partners among other firms that are also dependent on battery technology. This could take shape in several ways, but two primary views are to either engage firms who also use battery technology in their products – such as smartphone and tablet manufacturers – or to work directly with battery suppliers/manufacturers such as Panasonic or LG Chem.

Both of those options will positively affect the business case of all the firms involved in the alliance. As outlined previously, an improvement in battery technology will have a positive effect on EVs and their consumer value perception. However, the focus of an alliance should be on mutual benefit, and therefore we must evaluate the benefits of both primary views to the non-automotive firm. In the case of a partner firm which also uses batteries in their products, a marked improvement in the technology will also lower the cost of their product(s).

If an alliance is formed with the actual battery manufacturer, the manufacturing firm can harness significant benefits from advancement in battery technology. By working with the users of their products, battery manufacturers can better understand the use case of batteries and focus the development of batteries on their best usage scenario.

For example, batteries have inefficiencies in hot climate conditions (Yuksel & Michalek 2015). If an alliance can identify significant demand for EVs from markets subject to hot climates, then this product issue can be addressed and additional resources invested in finding a solution. Concurrently, such an alliance might identify the opposite market conditions and rather than investing in methods to improve the ideal operating temperature range of batteries, the focus is on improving battery functionality under ideal climate conditions.

Inter-industry alliances can be applied across a significant variety of industries to help drive improvements in product innovations, with the ultimate goal being to increase the consumer value of these products. With an ever-increasing demand from consumers for information and innovation, we can identify huge opportunities for industries to engage with one another to create new consumer value while concurrently driving both firms into more competitive market positions. Be it traditionally oriented firms embracing digital strategy or high-tech firms continuing to push the boundaries of technological feasibility, these examples show that there is notable benefit in forming alliances across industries.

9.4.3 Network alliances

The concept of a network alliance feeds off a similar logic to that highlighted in the preceding ‘technology alliance’ section. The technology alliance focused more on the additional value and improvements in product innovation that can be created in the development phase. The concept of a network alliance, however, is predicated more on a strategic 'sales and marketing' focus. A network alliance would be most applicable between firms that have a developed product which is available in the market as a tangible consumer product.

The firms that would benefit from a network alliance are those firms whose products are highly dependent on other products. The analysis section highlighted that an EV has many dependencies on other products such as public recharging infrastructure, energy supply and home integration. If these dependent products fail to be sufficiently saturated and accessible to consumers in the market, it directly affects the consumer appeal and subsequent success of an EV. Therefore, we can highlight an opportunity for OEMs to engage the firms behind the dependent products to drive an alliance which focuses on delivering value for all the products that make up such a 'product network'.

These 'product networks' exist in the current scope of the automotive industry with existing ICEVs: most notably, ICEVs depend on petroleum products offered by the petroleum industry. However, we have seen little collaborative work between these industries, possibly because the marketplace is so mature and both industries are self-sufficient. However, considering the context of the ever-growing rate of EV products emerging, the petroleum industry and its 'service stations' could soon find themselves with an uncompetitive product in the marketplace.

Service stations in their current capacity offer little to no value to EV owners. As outlined in the analysis, most EV customers will charge their cars at home overnight, moving away from the existing consumer behaviour of refuelling exclusively at service stations. The analysis also identifies that a major issue with EVs is the lack of EV charging stations. This highlights an opportunity for firms in the petroleum industry to collaborate with OEMs, leveraging their network of service stations to cater for a new product such as offering refuelling/recharging infrastructure for EVs. Such an initiative would help solve a critical issue in EV uptake for OEMs, while also allowing the petroleum industry to diversify into a new market segment. As a result, we can identify the opportunities for firms from completely separate industries, but with products in the same product network, to operate in an alliance in order to generate consumer value for their products concurrently.

A further opportunity for EV OEMs to develop an alliance within a product network lies in leveraging the prolonged stationary time required to recharge EVs. If we identify areas where EVs are stationary for prolonged periods of time away from the home, those areas can be targeted for the rollout of charging infrastructure. Typical locations where vehicles (EVs and ICEVs) are stationary for prolonged periods of time away from the home are car parks located in shopping centres, entertainment districts and business districts. OEMs must engage the operators of these car parks to find ways to roll out EV charging infrastructure in these areas. The logic behind this is simple: if an EV driver has a choice of visiting two shopping centres, one of which has dedicated EV charging spots and the other doesn't, the driver will most likely visit the shopping centre with the EV charging spots.

When OEMs form an alliance with a seemingly unrelated partner, such as shopping centre operators, the firms can work together to build mutual value. From an OEM perspective, it is a step towards addressing the consumer's noted concern of a lack of charging infrastructure. By addressing that concern for the consumer, the EV product increases in value. Likewise, for the shopping centre operators, offering the charging spots gives them a competitive advantage as they attract EV drivers to their centres rather than to their competitors.

With the emergence of EVs and their dependence on electricity, we can also identify opportunities for OEMs to work with the electricity supplier network. A noted issue with energy networks is their requirement to 'balance the grid' (Tuffner & Kintner-Meyer 2011). Electricity demand experiences notable daily peaks and troughs (Tuffner & Kintner-Meyer 2011); however, the issue faced by electricity suppliers is that power plants cannot be casually switched on and off as required, depending on the demand. Since the demand can fluctuate drastically, and in such short periods of time, the electricity network must be constantly running to produce enough electricity to meet the peak demand. However, during the lower demand periods, a significant proportion of energy is produced and not utilised. As a result, electricity suppliers are constantly trying to find ways to 'balance the grid' to even out the demand and minimise wastage.

As a result, OEMs can leverage EVs as a prime mechanism to help balance the grid. The analysis section highlighted that the average EV owner will plug their car in when they get home at night and unplug it again the next morning with the EV fully charged. Incidentally that night-time period where the EV is stationary is also the period when the electricity grid is at its lowest demand. By working together, energy suppliers and OEMs can identify the best time for EV owners to charge their vehicles and offer a special 'EV electricity tariff'. Such an EV tariff would make it cheaper for EV owners to charge their cars at a certain time, and this incentive will encourage owners to change their charging habits and ultimately help utilities 'balance the grid'.

Such an incentive will help drive down the total cost of ownership for EV owners, further increasing the value equation behind EVs. Concurrently, the energy providers benefit from increased operating efficiencies. This is a key example showcasing how working with partners in product networks can help drive the strategic ambitions for both firms. In this scenario, the OEM finds a way to continually deliver more value to its consumers and the energy supplier can reduce its operational costs.

The importance of a network alliance will become more urgent in the future as firms continually strive to create new value for their products and build a competitive advantage. If firms can evaluate ways to make their products more relevant in the lives of their consumers by actively engaging alliances with other firms, we will see a drastically positive change in the application of certain products. Innovation is about achieving things that once were non-existent. By leveraging knowledge, expertise and strategically identifying consumer usage habits, firms can confidentially work together to continually increase the value of their respective products to the consumer.

9.4.4 Government alliances

The analysis section of this study highlighted that the success of EVs in Australia is particularly dependent on government support and policy. In particular, the analysis highlighted that when some countries in the EU or states in the USA implemented public policy and support in favour of EVs, they were far more successful in driving consumer uptake of the technology in comparison to markets that offered no such incentives. The analysis section highlighted that the lack of government support and policy in favour of EV technology is a key reason for the lack of consumer uptake in Australia. The analysis section goes on to highlight that more favourable public policy and government support could be a key driver in overcoming the inherent product issues of EVs such as price, range and charging.

On the subject of price, fiscal incentives such as grants and tax exemptions were identified in the analysis as key drivers behind reducing the price premium of an EV. A reduction in the outright price of an EV directly adjusts the value scale of an EV for a consumer. If, for some consumers, an EV was positioned as a cheaper alternative to an ICEV as a result of fiscal policy incentives, they may find the fiscal benefit more valuable than associated product compromises of range and charging; the analysis data supports this.

Subsequently, we can begin to identify the power of government in supporting the uptake of radical new product innovations. Since the government has this power to determine the consumer appeal of a product, it becomes evident that when trying to launch radical product innovation, an alliance with the government could be a key strategic initiative for firms to employ. A collaborative approach where government and private enterprises combine resources in order to create a fruitful environment for the introduction of a new product innovation could be a key driver for the success of new product innovations, especially in the context of a new market such as EVs.

The role of government in an alliance to help deliver product innovations to consumers goes beyond just fiscal policy. It extends to creating a supportive network where a certain product works in the life of the consumer. While financial incentives could be effective in increasing the appeal of an EV, they do not overcome the obstacles associated with range and charging. In these instances, different government functions would be required to help create a supportive network for the EV product. They can execute this by delivering infrastructure projects that accommodate the requirements for EV charging; just as public infrastructure facilities offer services such as car parks for commuters, EV chargers can be integrated into future projects to overcome the issues of a lack of recharging infrastructure.

The communicative strength of government could also be leveraged as part of an alliance. If governments and firms share the same vision for a certain product, they can leverage a combined communication strategy to raise awareness and provide information to consumers which supports the development of a new market. A key issue the analysis found was that consumers lack confidence in radically new product innovations in their first iteration, due to a lack of knowledge and clear information on the product. It takes some time before consumers are exposed to enough information and experiences to have confidence in a new product innovation and can proceed to purchase. The opportunity for a government alliance is to help expedite the time it takes for consumers to gain enough information and exposure to a certain product innovation. This can be achieved by using government as the independent source of reliable information for consumers, bypassing the marketing puffery consumers may associate with a manufacturer's claim about its own product.

Ultimately, a government alliance is predicated on a transparent collaborative approach between industry and government towards a common goal. In the context of EVs, the introduction of this particular product innovation justifies a government alliance since the uptake of EVs is a mutually agreeable target; government aims to reduce CO2 pollution in major cities and nationally, while OEMs strive to deliver the product innovations that enable this.

9.4.5 Combining alliances and delivering product innovations to the consumer

The above four alliance structures highlight immense benefits to both alliance partners that promote the success of radical new product innovations in the market. Table 7 summarises the key benefits of each alliance structure.

Table 7: Alliance benefits

Alliance Structure	**Benefit**
Industry alliances	• Reduce development costs of product innovation • Increase market awareness of product innovation
Technology alliances	• Cooperation to develop the state of a technology with similar firms dependent on the particular technology or work directly with the lead supplier of the technology
Network alliances	• Increase the appeal of the product innovation in the product network • Develop consumer value in tandem with a firm of a co-dependent product or service
Government alliances	• Develop incentives and policy in tandem to aid the market penetration of a product innovation • Develop a sound user environment network in tandem to assist the usage of a product innovation by consumers • Work in tandem to increase the public awareness of a product innovation

Under the principles of the value paradigm, we recognise that the strategic approach of establishing and delivering product innovations via alliances is a key aspect of increasing the consumer value of certain product innovations. However, the underlying principle of the value paradigm is to highlight the concurrent nature and deep integration of strategic management, product innovation and consumer value when attempting to deliver a product to a new market. The alliances listed above highlight just one measure of the concurrent processes required in managerial practice to deliver radical new product innovations to a new market. The requirement of several alliances further highlights the interdependency and concurrent operation of the value paradigm. Establishing just one of the above alliances would not be sufficient to promote the success of EVs in the Australian marketplace. The requirement, rather, is for all four of the alliances to be established in managerial practice concurrently, in order to ensure value is being created throughout the diverse new market.

By way of example, we can identify how the four types of alliance discussed above integrate soundly in the context of the subject matter. Technology alliances can be used to attack the key product issues the analysis identified, which were causing consumer compromise around battery range, battery recharging time and battery cost – a major contributor to the total vehicle cost. By collaborating with firms that leverage similar technology, the fundamental product issues consumers experience can be addressed to provide a product that consumers identify as a suitable alternative to ICEVs.

Network alliances could then be used to address the issue surrounding the lack of an abundant charging network in comparison to the existing service station network for ICEVs. By working across sectors, the industry could deliver a network of chargers along the principles of differentiation (Porter 1980) and positive-sum competition (Porter & Teisberg, 2004), ultimately delivering to the consumer the confidence an abundant refuelling (recharging) network delivers.

With the key product issues of price, range and charging (both time and availability) addressed by technology and network alliances, the next step is for the remaining alliances to generate awareness while building and conveying additional consumer value. Industry alliances can effectively leverage the resources of OEMs to portray one 'big voice' of the automotive industry, as opposed to the many 'small voices' of each OEM acting independently. This would be particularly effective to generate awareness and announce EVs as a product that, as a result of the technology and network alliances, is now a complete and valuable consumer product. Once the industry alliance communication has educated the consumer, each OEM can return to its individual communication strategies, which encompass its traditional brand strategy approach. In this way the nature of competition among OEMs will continue along common trajectories.

Finally, OEMs can leverage government alliances to complement each of the three alliance strategies listed above. Government alliances could support OEMs in the development of battery technology via grants and other funding initiatives. Governments could also support the network alliance initiatives by incentivising the rollout of charging infrastructure via policy strategies such as legislating the requirement for EV chargers to be mandatory in certain areas or under certain conditions – for instance, as part of future development approvals. Finally, government could support industry in communication strategies and further assist in increasing the consumer value proposal through policy which incentivises EV ownership, such as access to priority parking or transit/bus lanes.

Ultimately, we can observe that alliances highlight the concurrent and highly integrated manner in which strategic management initiatives must be implemented to deliver product innovations with a high degree of consumer value to a new market.

9.5 Converting product innovations from failure to success with the Value Paradigm

What we can observe throughout this thesis is a recognition that relying on conventional automotive industry strategies has resulted in the failure of EVs in the marketplace. The EV product was developed, positioned and marketed using the same methodology of a conventional ICEV. However, the product that OEMs delivered was far from conventional due to its inherent product-related issues of range, charging and price. Subsequently, the EV product had little chance of success in the marketplace, as OEMs did not adequately recognise the need for new strategies and new processes required to bring to market a new product that created an entirely new market. This is all fundamentally predicated on a great divide between the perspectives of strategic managers and consumers in the context of radical product innovations. Fundamentally, existing theory and managerial practice lack the flexibility and integration that radical new product innovations require, in particular those that create a new greenfield market.

The analysis identified that, by following conventional theory and practice, OEMs have failed to develop and bring EVs to market. However, certain firms from the industry are strongly committed to continuing their initiative to transition to EVs in their product portfolio. Due to this strategic approach from OEMs to pursue a market that currently doesn’t exist in any scalable mass, the principles of the value paradigm highlight how an integrated approach between strategic management, product innovation and consumer value is required.

Rather than the conventional linear approach to strategy – managers wanting to move their product in a certain direction, investing in R&D to develop a particular product innovation, and then relying on conventional sales and marketing methods to sell consumer value to the customer – the value paradigm highlights the need for a far deeper integration of all these activities with the consumer’s perspective. The principles of the value paradigm suggest that strategic managers need to listen far more actively to the consumer, asking why consumers did not value EVs and what the consumers expect from an EV. Finding the answers to these types of questions is key to shaping the strategic direction of OEMs. Decisions on product development and the subsequent investment strategies into product innovation must stem from strategic managers – but they must understand the consumer value position, and direct their strategies towards it.

The strategic initiatives available for OEMs and their managers are in effect limitless, so long as they cater to the concept that the product innovation must be developed in line with what the consumer will determine as valuable. This thesis has highlighted alliances as exactly such strategies: they reduce costs, remove product compromises, integrate the product within a network and communicate the value of the product in this state to the consumer. By leveraging alliances, the product can build value along a far more diverse platform than the contemporary linear approach offered as an alternative. The OEM can overcome the product’s inherent flaws and compromises in a far more efficient manner, as opposed to taking a singular approach. If the OEM were to forgo the practices of an alliance highlighted above, it is inevitable that it would struggle to overcome the magnitude of selling a product with inherent compromises that the consumer doesn't accept.

Since alliances address the compromises and subsequently create value far more efficiently, the product becomes more valuable not only for the consumer but also for OEMs. Because alliances open up product efficiencies and offer OEMs a product with a scalable consumer appeal, OEMs can begin to implement conventional strategies in parallel to exploiting the principles of concurrency in the value paradigm. OEMs can focus on more strategies beyond alliances to achieve a competitive advantage in the marketplace. So long as this competition is formulated along the principles of positive-sum competition (Porter & Teisberg 2004), it will further drive an increase in consumer value across the industry, fundamentally establishing a lucrative new market which attracts new entrants.

The value paradigm provides a gateway to better understand how strategic managers can leverage radical new product innovations to create a new market without a known consumer value set. The value paradigm requires a deep integration of all the relevant fields across strategic management, product innovation and consumer value. Core to the success of the value paradigm is its requirement for speed. Firms are required not only to operate in a far more integrated manner but also to be faster and leaner in order to accommodate the constant changes in the marketplace. If OEMs are able to implement the principles of the value paradigm, they will be able to turn the EV product from a failure into a success.

9.6 The relevance of the value paradigm

The value paradigm has a high degree of relevance in contemporary commercial theory and managerial practice. Specifically, the value paradigm goes a long way to contributing new knowledge to better complement growing innovation-based industries. Innovation-based industries are increasingly spreading beyond specific conventional technologically advanced sectors, such as IT, and are beginning to saturate every market. Therefore, the value paradigm is highly relevant in contemporary literature as it can be applied in a growing number of situations across essentially every industry.

The theoretical nuance of the value paradigm is that by the virtue of its very nature, innovation is a concept that is derived of unknown need. The consumer does not recognise their need for a certain product, and learn to value it, until they have been exposed to it. Recent high-impact, market-shifting product innovations such as smartphones, Airbnb and Uber possess a high degree of consumer value in the marketplace today. However, this value and consumer need for these products were unrecognisable just a few years ago. Only through the virtue of hindsight can managers recognise the gap in the market and high potential for success. However, at the time of introducing these radical product innovations the consumer value set was unknown, and the benefits to both consumer and managers of introducing these products was not apparent.

This very notion of a 'yet to be needed need' challenges the fundamental understanding of market-led economics and conventional consumer value models such as the value pyramid and value chain. The value paradigm highlights how strategic management, product innovation and consumer value are tightly interdependent. It also highlights the speed of the internal processes that are required to accommodate these interdependencies to bring a product to market, while concurrently flagging the need to maintain quality and accuracy throughout these internal processes to serve the consumer with a more valuable product.

The principles of the value paradigm extend to firms needing to be able to react to changing market conditions more quickly and effectively. Predicated on the increasing rate of technological change, this flexibility becomes vital to ensure product innovations and subsequent management investment in product development continue in order to sustain the ever-increasing consumer demand for advancements in the products they use.

Finally, the value paradigm highlights a need for a closer relationship between managers and consumers when dealing with radically new products. The conventional push mentality, in which firms push their products onto consumers and sell the value of the product, becomes less relevant under the value paradigm construct. Rather, due to the integrated approach the value paradigm signifies, it focuses on firms pulling information and requirements from consumers in order to deliver them with value in products that consumers are yet to discover and demand.

Chapter 10 Conclusion

This final chapter revisits the aim of the research and the research question, and summarises the findings against them. Further, it highlights the implications of the research. The chapter completes with an outline of the research limitations and the recommendations for future research.

10.1 Research Aims revisited

The role of product innovation is becoming ever more paramount in the contemporary commercial context. Consumer demand drives the evolution of product innovation, facilitated by the strategic managers who operate businesses (Barney 2002; Bishop 1984; Delkhah et al. 2014; Govindarajan et al. 2001; Porter 1979, 1980; Veryzer 1998; Zeithaml 1988). As such, there is a growing requirement to research and analyse the strands of product innovation, strategic management and consumer value and their trilateral relationship when operating in unison.

The research surrounding these three strands has been extensively covered and the literature that sits behind each strand individually is extensive. There is also a clear depth in the linkages between individual strands (such as strategic management and product innovation). However, the existing literature lacked an analysis that uncovers the relationship between all three strands: in particular, how the functions of each theme correlate to create value concurrently. As the three strands individually hold so much merit, a clear requirement was identified to research the relationship between all three strands. As such, the research aimed to answer the following questions:

- *To understand how strategic management, product innovation and consumer value interact within a retail context to deliver upon strategic initiatives of OEMs and deliver value for their consumers.*
- *Can a deeper integration of strategic management, product innovation and consumer value principles better facilitate the uptake of emerging technology?*

In order to answer this question, the Australian electric vehicle industry was nominated as the subject matter to formulate the context of the research. The industry was selected because the electric vehicle is emerging as one of the most drastic product innovations in the conventional automobile industry, and because of its linkages to the emerging technological trend of electrification and energy storage. The electric vehicle industry (or marketplace) has so far seen little success, as was highlighted by the industry literature and analysis section, which concedes consumer concerns around the product in relation to different operating habits and price.

The research aimed to highlight the fundamental requirement of a deeper correlation between the functions of strategic managers, product innovators and the consumer. It is also hoped that the research could provide an insight into how the electric vehicle industry can adopt the findings of this research to better operate in a practical context.

10.2 The need for innovation – highlighted by the Australian EV industry

The need for better management strategies around product innovation in the Australian electric vehicle industry comes from the insight that the EV product offers little consumer value in the Australian market. This is highlighted by the history of low sales volume, as per the industry reportage in the analysis section, but also the general reluctance of consumers to accept an inferior product with compromised features. The research highlights that the EV product does not meet the Australian consumer's expectation on price, vehicle range and refuelling (recharging) options. Essentially, the EV product constitutes too many compromises in comparison to a conventional ICEV. Couple that with a significant price premium for an EV over an ICEV, and the problems with the consumer value equation are even further exacerbated. The issue is further complicated by consumers' general lack of awareness surrounding EVs. This in turn negatively influences strategic managers, who are poised to try and sell a product which evidently has no place in the marketplace; yet it remains the strategic priority of the business to move in that direction due to external influences such as government policy and regulation.

This highlights the need for a revised concept of how to bring to market products that are drastically different to comparable conventional products. This concept extends well beyond EVs and towards any product or industry that is subject to increased rates of product innovation, which is increasingly becoming every industry.

The catalyst for innovation can come from a variety of sources, such as consumer demand, reacting to competitors, a business's new strategic vision, or a range of other internal and external factors. This research has found that in order for the EV product innovation to constitute consumer value and in turn a sustainable market, strategic managers must find ways to address the drawbacks of the EV product and change the speed at which they operate to accommodate rapid changes in technology. The research highlighted that the product needed to represent a justifiable consumer purchase decision, which meant lowering the purchase price for the product, increasing its operating range and reducing the refuelling (recharging) time, while increasing the saturation of available charging stations/locations.

In order to achieve this, we need a new approach to building value in a product that complements exisiting value based models. Value in the context of radical product innovation can no longer be observed as linear and being built along a conventional value chain. In the context of radical product innovations there needs to be a mechanism to build consumer value concurrently to the technological capability of product innovators and the ambitions of strategic managers. Importantly, the rate of change in priorities and influences between consumers, product innovators and strategic managers is vast; and these differing changes have an implicit effect upon one another.

10.3 The emergence of a value paradigm

The emergence of a value paradigm comes as a result of the research suggesting that the conventional value chain (Lampikoski et al. 2014; Madill, , Haines & Riding 2004; Porter 1979; Porter 1980; Ryans et al. 2000) does not accurately reflect the models required for some contemporary businesses, in particular those influenced by radical product innovations, to build value in their products. The value chain is a long-established principle, and while its application in modern management is still relevant for some businesses, it is in need of a supporting value model as the role of technology actively influences a growing range of commercial sectors. Subsequently, as the prevalence of technological advancement and innovative increases, a more fluid value generation concept becomes more applicable.

The value paradigm is introduced to present the evolution of a new value-based model. The value paradigm at its core is hinged on the proviso of a concurrent correlation between the themes of strategic management, product innovation and consumer value. The value paradigm has been foregrounded in such concepts as the value grid (Pil & Holweg 2006), value constellation (Normann & Ramirez 1993) and value network (Peppard & Rylander 2006), but extends these concepts to produce a more highly integrated approach to the dimensions of strategy, innovation and value rather than viewing them as just simultaneous activities.

The value paradigm highlights the deep integration that can be observed in a growing number of market-disrupting technologies. The value paradigm is closely aligned to product innovations that operate in line with a greenfield strategy; that is, where no prior market exists for a particular product innovation in question. The implications of this are that all current value-based models, such as the Bain value pyramid, are predicated on strategic managers making decisions on products which already have a known consumer value. When it comes to drastically new product innovations that create a new market in their own right, strategic managers cannot know the consumer value as the consumer has had no exposure to express their desire or acceptance of the product, let alone define a value for it.

A consumer's judgement of a product can only be concretely defined once the tangible product has been introduced to market. Before then, value definition is reserved for an exclusively subjective interpretation from strategic managers. However, as the analysis section has observed, the subjective interpretation of value from strategic managers surrounding EVs was misplaced. This resulted in an inferior product going to market, which offered no consumer value in comparison to conventional product alternatives available in the market. While this displayed a product failure on one front, the value paradigm serves to rectify the inherent product and market issues of EVs by identifying the concurrent and deeply integrated relationship between strategy, innovation and value.

The value paradigm highlights the deep integration across strategy, innovation and value. However, the principle underpinning the value paradigm is the element of speed. Since the value paradigm is complex in nature and subject to a range of influencing factors, it highlights the need to accommodate and incorporate processes that are a lot faster. This allows firms to remain agile and react to a raft of influencing factors such as changes in consumer expectation, changes in technology or changes in the commercial landscape of a particular firm.

Since the value paradigm is stipulated on a deep integration across the themes of strategic management, product innovation and consumer value, such an integration reflects all the sub-themes represented among the three core themes. As a result, the discussion examined how the sub-theme of alliances could be integrated to drive the value paradigm. Alliances were highlighted as a key mechanism to overcome key issues in the subject matter, with the ultimate goal of driving value creation concurrently with a variety of other entities.

Ultimately, the value paradigm highlights the emergence of a value-based model that is highly applicable to the ever-growing innovation-based businesses and industries. The value paradigm displays how the rise of technological advancement requires a deeply integrated perspective on strategy, innovation and value. The value paradigm also highlights the requirement for businesses to reshape processes and business methods to become faster in order to keep up with the ever-increasing rate of change.

10.4 Implications for practitioners

The implications of this research for practitioners are comprehensively covered throughout the discussion chapter. However the key findings and lessons that this research uncovers can be summarised specifically for the practitioners.

Although many managers are already aware of product innovation and adopt strategies around facilitating it, there needs to be a broader acknowledgment of the growing role of product innovation, particularly as advances in emerging technology affect businesses. This research outlines that for a growing number of businesses, there needs to be a more integrated approach to managing product innovation and the inherent consumers of those new products.

Emerging technology enables businesses to substantially transform their products and create new markets with radically new product innovations. While such products may serve as an ideal platform to enhance company performance, there must be ample consideration to the complex and highly integrated processes of doing so. Managers must work more closely with product innovators to observe the challenges and opportunities that exist in new technology. Concurrently, managers must take a deeper view of the possible market adoption of certain products and react to consumer evaluation and their changing value perspectives.

Finally, managers must ensure that their operations become far more accommodating to the increasing rate of change within their respective industries. Change in the commercial landscape of a firm is naturally the primary focus of practitioners; however, the principles of the value paradigm dictate the need for an integrated approach across strategy, innovation and value. Changes in technology and the implications for product innovation, in addition to the changing rates of consumer preferences and value principles, can drastically change the product requirements to be competitive in the marketplace. Therefore, firms must set up their processes and business methods to accommodate inevitable changes to the business, which will become more frequent and more disruptive.

10.5 Implication for researchers

The implications of this research for researchers are to consider its outcomes – such as the emergence of the value paradigm and its principles – in future research. In particular, this research has identified that in the context of new product innovations, specifically EVs, conventional value models do not adequately provide a sound foundation for determining how value is created with these products. Instead, the value paradigm aims to serve as a far more relevant value-based model in the context of product innovations that emerge as the result of new and disruptive technology.

Although the value paradigm has emerged in the context of the Australian EV industry, we believe that the principles of the value paradigm are applicable to the majority of innovation-based industries. This means that the value paradigm dictates a high degree of relevance for researchers, since innovation-based industries are quickly diffusing into the majority of industries overall. The effects of innovation are readily being felt in a rising number of industries, with often drastic implications for managers and consumers alike. Therefore, there we see that the value paradigm has the potential to influence an ever-growing number of products that create a new market.

For researchers, the implications of this research also highlight the need to re-evaluate existing value-based models that were not discussed in this research. It is hypothesised that the value paradigm may complement other value-based models which were formulated in the past and not considered in the context of radically new product innovations and disruptive technology.

Last, this research has identified a separation between manager and consumer perspectives. This separation had significant effects upon the entire competitive positioning, product development and marketing of a firm's new products. While this divergence in perspectives was found in the context of new product innovations, there may be cause for researchers to consider this separation in future work. Ultimately, this research has found that in the context of product innovations, there must be a far closer alignment between the strands of strategic management, product innovation and consumer value.

10.6 Research limitations

This research is limited primarily in its breadth. This research was conducted with a focus on a specific market: the Australian electric vehicle industry. The value paradigm and the theoretical contribution of this research stems directly from the results derived from this small market. While we believe that the theoretical contributions contained within this body of work have relevance to and are applicable in many other industries, the fact remains that this falls out of the scope of this researcher. We are unable to systematically justify the applicability of principles such as the value paradigm in industries beyond the one studied.

That means that the research is limited to the electric vehicle niche among the automotive industry; it is not necessarily proven to be applicable to the broader automotive industry. Concurrently, since the research focused on only the Australian market, it can also not be proven that the theoretical contributions stem beyond the Australian market.

This research is also limited by the depth to which each strand of strategic management, product innovation and consumer value was studied – in particular with reference to the extensive literature that compromises each strand. This researcher only focused on selected topics in each strand. While we believe these selected topics are highly relevant and suffice to highlight a theoretical gap in the interoperability of the three strands, there remain limitations in the depth of study in each particular strand.

Last, due to the limited size of the Australian EV market, only a small amount of interviews were conducted, focussing on quality of response as opposed to mass saturation. Subsequently, the results of this research serve primarily an indicative role, as opposed to suggesting a definitive presence of new theory.

However, while we identify these as limitations of this particular body of research, there is an opportunity to address these limitations in future research. This will be highlighted in the next section.

10.7 Direction of future research

As highlighted above, there are opportunities for future research to be conducted based on the contributions of this particular research. Specifically, one direction for future research is to extend the theoretical contribution of the value paradigm and test its applicability across a broader spectrum of industries. By doing so, this theoretical concept can be challenged and its applicability in other industries either validated or dismissed.

Similarly, there is an opportunity to test the applicability of the value paradigm in other markets and regions. While the value paradigm may accurately address the requirement for a closer alignment between strategy, innovation and value in Australia, this may not be the case in other regions.

Last, the opportunity exists to test the validity of the value paradigm theory from different perspectives. As highlighted above, a limitation of this research was that it only looked at select topics that formulate the three strands of strategic management, product innovation and consumer value. There are definite opportunities for further research which looks at other topics under the three strands which could validate or dismiss the validity of the value paradigm theory.

We encourage that this researcher's theoretical outcomes are challenged and critiqued. We envisage that the opportunity to build on this work is significant and relevant to the establishment of a far deeper understanding of the relationship that managers, consumers and product innovations share in the context of technological development.

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Appendices

Appendix 1 – Managerial Interview Questions

1. What role do electric vehicles play in the current Australian passenger vehicle market?
2. What are the reasons why electric vehicles hold this position?
3. How could the adoption of electric vehicles be improved and what future potential exists for electric vehicles in Australia?
4. How does Australia compare to the rest of the world in the adoption of electric vehicles? Are there any specific markets where electric cars have been successfully adopted into the mainstream passenger vehicle market? What reasons exist for this success?
5. Are there any specific requirements in product innovation required for electric vehicles to be successful in Australia?
6. What types of customers are currently purchasing electric vehicles?
7. What types of customers are potentially willing to adopt electric cars but have not? What are the barriers for consumer adoption?
8. What role does government support and policy play in the take-up of EVs?

9. What is the current state of awareness around EVs? How can this be improved and what communication strategies should be implemented?
10. What is the current consumer perception of EVs as a new technology?
11. To what degree do EVs provide additional value to consumers?
12. To what extent does 'total cost of ownership' influence a consumer's decision to purchase an EV?
13. To what extent do EVs require a consumer to experience a 'product compromise' in comparison to an ICEV? What are these compromises and how relevant are they in the ultimate vehicle purchase and ownership decision?
14. Will electric vehicles ever make up a substantial segment of the Australian passenger vehicle market? When and how much?
15. Further comments or feedback on strategies that may better convey or create value for consumers of these new product innovations (EVs)?

Appendix 2 – Consumer Interview Questions

1. What are your initial impressions on electric vehicles? Do you know what options are available to you and do any of these options interest you?

2. What do you consider when making a purchase decision on a vehicle?

3. Have you ever considered purchasing an EV?

4. What stops you from purchasing or considering purchasing an EV?

5. What would make you more likely to consider purchasing an EV?

6. If there would be more government support via grants and tax concessions, would you consider buying an EV? What if there were additional taxation penalties on conventional and less fuel-efficient cars?

7. If there would be more government support in the form of non-cash incentives such as access to bus/transit lanes, priority/unmetered parking, free use of toll roads, would you consider buying an EV?

8. Are you, overall, aware and educated on EV technology? Do you know the benefits of EV technology? What communication do you expect, and from whom?

9. What is your perception of EVs as a new technology? Are you excited, satisfied or unhappy with the current state of the technology?

10. Can EVs potentially provide you with any value that an ICEV cannot, such as image and consciousness?

11. How relevant is the TCO equation in your vehicle purchase decision?

12. Are there any compromises that you would experience in owning an EV? How do these compromises affect your purchase decision?

13. Under what circumstances would you consider buying an EV over an ICEV?

14. Imagine if an EV performs all the functions you get from an ICEV near identically. They travel the same distance on a single fuelling, they can be refuelled in the same manner, they have the same performance, and they deliver the same amount of practicality, safety and comfort, at the same price – would you choose an EV over an ICEV?

15. Do you think EVs are a product of the future? When do you think EVs will make up a substantial segment of the market?