From Value Creation to Customer Experience and Engagement: The Rail Passenger's Perspective

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"If you can make one heap of all your winnings

And risk it on one turn of pitch-and-toss,

And lose, and start again at your beginnings

And never breathe a word about your loss;

If you can force your heart and nerve and sinew

To serve your turn long after they are gone,

And so hold on when there is nothing in you

Except the will which says to them: 'Hold on!'

If you can talk with crowds and keep your virtue,

Or walk with Kings—nor lose the common touch,

If neither foes nor loving friends can hurt you,

If all men count with you, but none too much;

If you can fill the unforgiving minute

With sixty seconds' worth of distance run,

Yours is the Earth and everything that's in it,

And—which is more—you'll be a Man, my son!"

'If—'

A Choice of Kipling's Verse (1943)

by Rudyard Kipling

Dedication

I dedicate this thesis to…

My loving family, friends and fellows, who saw me through the hardest points of trying times and offered reassuring words when I faced doubt. Without your support, this thesis would not have been possible.

My departed dad, who is looking down with pride and smiling.

My incredible supervisors, who gave me guidance when needed most and intellectual freedom throughout. Without your help, this thesis would have remained only an idea.

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Next, I would like to thank Transport for Wales for all their support, networking and funding throughout the study. Without this support and guidance, navigating the world of rail services would have been far more difficult. I would in particular like to thank Silke Boak for all their help with main data collection and feedback which was invaluable for the study's progression. I must thank the staff at Cardiff University for all their support. Sol Alim and Lydia Taylor at the PhD Office were superb in handling my questions with patience and understanding. Lastly, I must thank ESRC DTP Collaborative Studentship for its funding that made the thesis possible.

List of Abbreviations

TOC – Train Operating Company

SBB – Swiss Federal Rail Service

SDL – Service Dominant Logic

CDL – Customer Dominant Logic

PSL – Public Service Logic

PSDL – Public Service Dominant Logic

C2C - customer-to-customer

PLS-SEM – Partial Least Squares Structural Equation Modelling

SEM - Structural Equation Modelling

CEBs – Customer Engagement Behaviours

CX – Customer Experience

VCC – Value Co-Creation

IVC – Independent Value Creation

Digital DSS – Value from digital self-service

Physical DSS – Value from physical self-service

SVCC – Social Value Co-Creation

Positive viu – Positive Value-in-use

Negative viu – Negative Value-in-use

Abstract

The objective of this thesis is to develop and test a conceptual model to help understand rail passengers' behaviour from the customer perspective. Services marketing has focused on the experiential value that emerges positively and negatively for customers during use (i.e. their value-in-use) as they interact with providers (i.e. value co-creation), social actors (i.e. social value co-creation) and resources (i.e. independent value creation). Research has only examined these processes separately but has not examined value creation holistically as a combination of these processes from the customer perspective.

This thesis fills the gap by estimating holistic value creation as a novel higher-order construct resulting from these processes, in the customers' value sphere. Holistic value creation is important as it is useful for examining the construct's relationships with customer experience, passenger satisfaction, and customer engagement to provide a more comprehensive understanding of the rail passenger's perspective. To conceptualise passenger's value creation, the thesis draws predominantly on service logic research and the paradigms value model, but also draws upon research in the paradigms of Service Dominant Logic and Customer Dominant Logic.

The integrative model developed and tested in this thesis also advances public transport research. At present, public transport research suggests that supporting passengers' value creation processes, experiences and service engagement increases satisfaction. However, no study has examined precisely how passengers' value creation, experiences and engagement relate to passenger satisfaction. The thesis fills this gap by examining the impact of passengers' holistic value creation and service experience on satisfaction and engagement behaviours. This offers a means of improving passenger satisfaction in Transport for Wales's rail users.

Main data collection was performed between November 2022 and March 2023 through a self-administered survey distributed online to cover a range of rail users throughout Wales and targeted passengers of Transport for Wales, specifically. Overall, a cleaned dataset of 406 respondents was obtained and Partial Least Squares Structural Equation Modelling (PLS-SEM) was used to test the proposed model.

The key findings of the thesis are summarised in five key points. Value co-creation contributes most strongly to holistic value creation, followed by social value co-creation and independent value creation. Second, customer experience fully mediates the relationship

between holistic value creation and passenger satisfaction. Third, passenger satisfaction most strongly relates to the engagement behaviour of advocacy, followed by feedback intentions and future patronage. Fourth, customer experience plays a more important role in the value-engagement relationship than satisfaction or holistic value creation.

The main theoretical implication of the thesis is as follows. While service logic offers a multi-faceted approach to understanding value creation that can improve a providers' performance via strategic options, integrating its separate processes offers a more holistic understanding to how customers create value. Customers' value creation is still a complex and multi-dimensional phenomenon, which is empirically shown in this thesis. The novel model, proposed and validated in this thesis, advances the theory and research on rail passenger services by offering a unique customer perspective. This provides a comprehensive understanding of the complexities of passenger behaviour that is useful to researchers and practitioners in rail services and other service contexts.

Keywords: services marketing; service logic; Service-Dominant Logic; Customer Dominant Logic; co-creative activities; value co-creation; positive value-in-use; negative value-in-use; independent value creation; self-service; social value co-creation; customer experience; passenger satisfaction; customer engagement; co-design; feedback intentions; advocacy; future

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Chapter One - Introduction

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1.1 Introduction

Public transport typically operates as a public good and research has focused on its economics and logistics rather than passengers' value creation and experiences (Gebauer, Johnson and Enquist, 2010). In services, value for customers is experiential and emerges via different interactions (Grönroos and Voima, 2013; Grönroos, 2017) that can leave them feeling better or worse off (Medberg and Grönroos, 2020). When combined, these processes form a customer's value creation sphere (Grönroos and Voima, 2013) referred to as holistic value creation by the thesis. Despite the prominence of value, experience and engagement as concepts in services marketing, public transport research has given them limited attention (Gebauer et al. 2010; Lu et al. 2015; Alexander and Jaakkola, 2014).

This lack of attention has arguably contributed to low passenger satisfaction in UK rail services (BBC News, 2020; Transport Focus, 2023a). Transport for Wales (TfW) passengers show notably low satisfaction and nationally rank in the bottom quarter in the UK (National Rail Passenger Survey, 2020; Transport Focus, 2023b; Howorth, 2023). A potential remedy is to support passengers' value creation, experiences and engagement in public transport services, which can improve passenger satisfaction (Gebauer et al. 2010; Echeverri and Skålén, 2011; Lu et al. 2015) and a provider's performance (Gebauer et al. 2010; Jaakkola and Alexander, 2014; Nunes et al. 2014).

This thesis aims to develop a comprehensive model of passenger behaviour by incorporating holistic value creation, customer experience, passenger satisfaction and three customer engagement behaviours (i.e. feedback intentions, advocacy and future patronage). The chapter offers an overview of the thesis and comprises ten sections. The first introduces the thesis; the second addresses its context; the third discusses its theoretical background; the fourth outlines its research problem; the fifth describes its objectives; the sixth presents its research questions; the seventh demarcates its justifications and contributions; the eighth explains its methodology; the ninth highlights the thesis's structure and lastly the chapter closes with a summary of the thesis.

1.2 Research context

1.2.1 Services marketing & value creation

Gummesson (1987, p22) offers a comical description of a service as "something that can be bought and sold but which cannot be dropped on your foot", highlighting the intangible nature of a service. At present, the service sector accounts for over half of global GDP (Wirtz, Chew and Lovelock, 2022). With the shift from product to service industries, value creation has moved accordingly from focusing on operand (i.e., tangible) to operant (i.e., intangible) resources (Vargo and Lusch, 2004; Vargo and Lusch, 2008). From the rise of service industries, services marketing now represents a distinct discipline from marketing products. Research on services marketing arose in three notable stages, beginning with its 'crawling out' stage (i.e. pre 1980s), followed by its 'scurrying about' stage (i.e. 1980–1985) and 'walking erect' stage (i.e. 1986 to present) (Fisk, Brown and Bitner, 1993). Contemporary research in services marketing has maintained this momentum by establishing itself as an explicit academic sub-discipline in industries like healthcare, tourism, hospitality and finance (Grove, Fisk and John, 2003).

In services marketing, the three dominant paradigms of value creation research are service dominant logic (SDL), service logic and customer dominant logic (CDL). This chapter introduces these paradigms before Chapter 2 reviews literature on each. SDL examines value creation from an economics perspective in terms of actors integrating resources (Vargo and Lusch, 2008; Vargo and Lusch, 2016) within the wider service ecosystem (Vargo and Lusch, 2016; Akaka et al. 2021). In contrast, service logic examines value creation from a marketing perspective, as passengers interact with providers (i.e., joint value co-creation), resources like self-service (i.e., independent value creation) and social actors (i.e., social value co-creation). This value can also emerge positively (i.e., positive value-in-use) and negatively (i.e., negative value-in-use) for customers (Sweeney et al. 2018; Medberg and Grönroos, 2020).

Diverging from the provider perspective of SDL and service logic, CDL focuses on value creation from a customer's perspective in terms of their service consumptions and social ecosystems (Heinonen et al. 2010; Heinonen and Strandvik, 2015). Research on value creation has so far considered its underlying processes in isolation from one another rather than holistically and this is the major gap the thesis contributes to filling.

1.2.2 Public transport research on value creation, customer experience and engagement

Public transport typically refers to "land-based passenger transport and, in particular, bus and train services" (Preston, 2020, p 113) and passenger demand fluctuates around external factors, making it a demand derived service (Cole, 2009). Historically, services marketing research on public transport uses service quality as its theoretical framework (Eboli and Mazzulla, 2014; Barabino and Francesco, 2016; Barabino et al. 2020). This leaves passengers' value creation, service experiences and engagement underexplored (Gebauer et al. 2010; Carreria et al. 2013; Ittamalla and Kumar, 2021).

Nevertheless, there are a few studies which can provide some insights into value creation, service experiences, and engagement in public transport literature. Gebauer et al. (2010) describes the positive impact of supporting passengers' value creation processes on rail users' satisfaction, and Echeverri and Skålén (2011) explores how different interaction practices contribute to value co-creation and co-destruction in bus services. With respect to self-service, public transport research highlights different functional and hedonic value outcomes for passengers (Lu et al. 2015) and how value from self-service can increase rail passengers' satisfaction (Gebauer et al. 2010). Public transport passengers also create value as they interact with other passengers too, which can differ between passengers' social contexts (Reichenberger, 2017) and particularly their purpose for travel (Carreria et al. 2013). Lastly, research highlights passenger sacrifices, reflecting negative value-in-use (Sweeney et al. 2018) negatively impacts on perceived value in public transport (Sumaedi, Bakti and Yarmen, 2012). These studies selectively explore passengers' value creation processes but have yet to examine them holistically.

Public transport research on customer experience is scarce, and arguably leans strongly on service quality dimensions (Ittamalla and Kumar, 2021). This research focuses on constructs like safety, service provisions, vehicle maintenance and off-board facilities (Stradling et al. 2007; Hutchinson, 2009), which are used to conceptualise service quality in public transport services (Barabino and Francesco, 2016). Carreria et al. (2013) examines hedonic and utilitarian passengers' service experiences, and Ittamalla and Kumar (2021) proposes the holistic passenger experience scale, though both studies still incorporate constructs that closely align with service quality dimensions in public transport (Barabino et al. 2020) and specifically rail services (Eboli and Mazzula, 2014). This diverges from marketing research, which considers customers' service experiences under experiential dimensions (e.g., quality, valence, time flow, etc) (De Keyser et al. 2020) and the experience

stages of brand, provider and post-purchase experiences (Klaus, 2014; Lemon and Verhoef, 2016; Kuppleweiser and Klaus, 2021).

Research describes customer engagement as emerging in terms of behaviours like word-of-mouth, blogging and customer-ratings (Van Doorn et al. 2010). In rail services, Jaakkola and Alexander (2014) note engagement behaviours like influencing and co-developing to benefits passengers' by offering social value and TOCs by enhancing the product market fit of service functions. Additionally, Nunes et al. (2014) champions passengers' engagement with TOCs for offering real-time feedback on service delivery in the London underground. During value creation, this feedback forms service providers' value-in-use as customers use services (Gebauer et al. 2010) and holds particular importance in public transport services for co-designing service improvements (Nalmpantis et al. 2019; Bowen et al. 2022).

1.2.3 Rail passenger services in the UK and Wales (TfW)

In the UK, rail services support over 1.4 billion passenger trips per year (Office of Rail and Road, 2023). In the past, TOCs received all risks, costs and revenues associated with offering rail services, though this exposed them external factors like recessions or changing market forces (White, 2017). During the COVID-19 pandemic this exposure became apparent, as passenger numbers fell by 70% in the UK on average (Office of Rail and Road, 2023). To remedy the situation, the UK government began absorbing all revenues, costs and risks incurred by train operating companies (TOCs) to ensure rail services continued operating (Department for Transport, 2020b).

Prior to the COVID-19 pandemic, rail services in Wales supported over 31 million passenger trips between 2018 and 2019 (Statistics for Wales, 2023). However, passenger numbers in Wales fell by over 80% due to the COVID-19 pandemic (Statistics for Wales, 2023). This led the Welsh Assembly Government to effectively nationalise rail services by establishing Transport for Wales (TfW) to ensure rail services continued operating (Welsh Government, 2020). Despite passenger numbers somewhat recovering between 2021 and 2022, numbering 18 million passenger trips that year (Statistics for Wales, 2023) Welsh rail users still rank in the bottom quarter nationally for satisfaction (Transport Focus, 2023b; Howorth, 2023).

TfW aims to rectify this issue through initiatives like the South Wales Metro and by electrifying its network, at the respective costs of £1 and £5 billion over the next 10 to 15

years (Transport for Wales News, 2023; Shirres, 2022). The South Wales Metro aims to offer South Wales passengers a once-in-a generation renovation to rail services in the region (Transport for Wales, 2023). Additionally, the TOCs electrification scheme aims to upgrade its rolling stock to the more modern Class 197 units, increasing passenger comfort (Figure 1) (Transport for Wales, 2021a; Shirres, 2022). Alongside these efforts, TfW has partnered with key passenger communities to improve rail services (Transport for Wales, 2021b) and collaborated with Cardiff University in support of this thesis.

Figure 1. TfW Rail's new Class 197 (left) and older Class 150 rolling stock (left)

Source: Shirres (2022, p1) and Transport for Wales (2021a, p5)

1.3 Theoretical background

Research on value creation in services centres on value stemming from operant (i.e., intangible) rather than operand (i.e., tangible) resources (Vargo and Lusch, 2004). Under this perspective, resource-integrating actors co-create value (Vargo and Lusch, 2008) as customers co-produce value offerings and experiential value emerges for them during use (i.e. value-in-use) (Ranjan and Read, 2014). Research also underlines the ways in which value can emerge for customers as they interact with other social actors and resources, which represent social value co-creation and independent value creation, respectively, in service logic literature (Grönroos and Gummerus, 2014; Grönroos and Voima, 2013).

Value creation can emerge positively for customers, representing positive value-in-use (Ranjan and Read, 2014) but can also emerge negatively when customers feel worse off from

using a service, which represents negative value-in-use (Medberg and Grönroos, 2020). Negative value-in-use reflects sacrifices for customers and can emerge under tangible dimensions, like monetary costs, and intangible or behavioural dimensions like emotional, time, effort and lifestyle costs (Plewa et al. 2015; Sweeney et al. 2018). More recent research on negative value illustrates the broad range of potential sacrifices for customers, which can range from political to envrinomental and privacy costs (Leroi-Werelds, 2019) and how sacrifices can emerge outside direct service consumption (Heinonen, 2023).

In combination, co-production, positive value-in-use, value co-creation, social value co-creation, independent value creation and negative value-in-use make up the customers' value creation sphere (Grönroos and Voima, 2013) that the thesis refers to as holistic value creation. This is conceptualised in the existing literature (Grönroos, 2017), but research has yet to examine value creation empirically in a holistic sense as it emerges from these processes.

Research on customer experience examines the construct in various service settings (Klaus, 2014; Lemon and Verhoef, 2016; Kuppelwieser and Klaus, 2020) and offers a nomenclature to assist research (De Keyser et al. 2020). Conceptual research also examines customer experience in relation to value creation and service engagement from the customer's perspective (De Keyser et al. 2015). However, empirical research only examines customer experience in the relationship between perceived value and a singular engagement behaviour (i.e. WoM) (Kuppelwieser et al. 2021) and in terms of specific dimensions of co-creation and satisfaction (Solakis et al. 2021). At present, research has yet to comprehensively examine the role of customer experience in terms of holistic value creation and marketing outcomes like satisfaction or other engagement behaviours.

Services marketing research on public transport typically takes service quality as its framework (Eboli and Mazzulla, 2014; Barabino and Francesco, 2016; Barabino et al. 2020) but pays scant attention to passengers' value creation and experiences (Stradling et al. 2007; Hutchinson, 2009; Ittamalla and Kumar, 2021). Research shows that value co-creation supports passengers' value creation before, during and after using rail services (Gebauer et al. 2010) and stems from passenger-personnel interactions being harmonious, whilst inharmonious interactions lead to co-destruction (Echeverri and Skålén, 2011).

Both social value co-creation and independent value creation can also support passengers' value creation and service experiences (Reichenberger, 2017; Lu et al. 2015).

Reichenberger (2017) emphasises the importance of social groups in passengers' value creation, as passengers travelling alone and in larger groups generate distinctly different value from interactions with other travellers. With respect to independent value creation, Lu et al. (2015) shows the different roles of self-service use for passengers' value creation and service experiences at each service stage. During self-service, Lu et al. (2015) highlights that functional and hedonic value tends to emerge before and after using public transport, whilst both value dimensions contribute to passengers' value creation and experiences at the during (i.e., travel) stage.

In public transport, passengers service engagement can offer both passengers and TOCs benefits (Gebauer et al. 2010). Passengers can offer real-time updates to transport providers (Nunes et al. 2014) and insights for co-designing service improvements (Hildén et al. 2018; Nalmpantis et al. 2019; Bowen et al. 2022). Public transport research and specifically research on rail services outlines the relationships between passenger satisfaction and different engagement behaviours from the perspective of service quality (Saha and Theingi, 2009; Dölarslan, 2014; Suki, 2014). Additionally, public transport research on rail services specifically details the role of passengers' engagement behaviours during value creation (Jaakkola and Alexander, 2014) and for supporting TOCs operational success (Nunes et al. 2014) and development (Bowen et al. 2022). However, this research falls short of examining the satisfaction-engagement relationship during value creation specifically in rail services.

1.4 The research problem

This research advances knowledge by addressing the gaps outlined in sections 1.2 and 1.3. It offers significant insights into services marketing on value creation and consumer behaviour, as well as public transport research. For services marketing, it empirically estimates holistic value creation as a novel higher-order construct whilst identifying the relative contributions from its underlying processes. Extending on this, the thesis examines how holistic value creation relates to key consumer behaviour constructs (i.e., customer experience, satisfaction and engagement behaviours) offering managerial implications for rail practitioners, specifically.

For services marketing research on consumer behaviour, the thesis examines the role of customer experience in the value-satisfaction and value-engagement relationships. At present, research has yet to develop an integrative model that includes these constructs. The

thesis addresses this gap by developing and validating an integrative model connecting holistic value creation, customer experience, passenger satisfaction and three engagement behaviours. This specifically addresses the scarcity of literature on public transport passengers' value creation, service experiences, and engagement behaviours, in a single cohesive model.

The thesis aims to offer practical insights for managerial action to improve low passenger satisfaction in UK rail services, and specifically TfW's passengers. As supporting passengers' value creation, experiences and engagement increases passenger satisfaction in rail services (Gebauer et al. 2010; Lu et al. 2015; Ittamalla and Kumar, 2021) and benefits TOCs (Jaakkola and Alexander, 2014; Nunes et al. 2014; Bowen et al. 2022) doing so offers a double dividend of benefit that rewards both parties (Gebauer et al. 2010).

1.5 Research objective

This study's main objective is to develop a comprehensive model of passenger behaviour by incorporating value creation, customer experience, passenger satisfaction and three customer engagement behaviours (feedback intentions, advocacy and future patronage). Specifically, it aims to understand how passengers' value creation processes relate to holistic value creation and, in turn, how this relates to satisfaction. It also considers the role of customer experience in the value-satisfaction relationship, as well as the value-engagement relationship, and considers how satisfaction relates to three customer engagement behaviours.

1.6 Research questions

To achieve these aims, the study formulates the following key research questions:

Q1) How do the different value creation processes undertaken by passengers relate to holistic value creation?
Q2) How does their holistic value creation relate to passenger satisfaction and what is the role of customer experience in this relationship?
Q3) How does passenger satisfaction relate to customer engagement behaviours?

1.7 Research contributions and justifications

The study's major contribution relates to its integrative approach to examining value creation, customer experience, satisfaction and engagement behaviours in a single cohesive model. Services marketing research on consumer behaviour examines these constructs separately (Vivek et al. 2014; Kuppelwieser et al. 2021; Solakis et al. 2021) but has yet to examine them in a more comprehensive and cohesive manner. The thesis contributes to filling this research gap by developing and validating an integrative model connecting these constructs.

The thesis also fills important gaps in public transport research. At present, research explores passengers' value creation processes separately (Gebauer et al. 2010; Lu et al. 2015), but not holistically. Outside qualitative research scholars have yet to incorporate passengers' experience stages (Lu et al. 2015; Carreria et al. 2013) or consider the conceptual order of value creation and customer experience with respect to marketing outcomes like satisfaction, like in marketing research (Kuppleweiser and Klaus, 2021). Lastly, research has yet to examine the satisfaction-engagement relationship during value creation, specifically.

For services marketing and public transport scholars, these contributions hold significance given the overlapping nature of these constructs in the former (Ranjan and Read, 2014; De Keyser et al. 2015; Abid et al. 2022) and the scarcity of research on the constructs in the latter (Gebauer et al. 2010). Additionally, these contributions hold practical importance for service and transport providers, as the constructs support their performances (Nunes et al. 2014; Imhof et al. 2019; Barari et al. 2020; Alexander and Jaakkola, 2014). The thesis's key contributions and related justifications are shown in Table 1.

Table 1. Research contributions and justification of the thesis

Contributions		Justification	
1.	Develops and empirically validates a model connecting holistic value creation, customer experience, satisfaction and engagement, which is lacking in research that addresses these relationships selectively but not comprehensively.	1.	Important to scholars, due to the overlapping nature of the constructs, and for providers as support their performance.
2.	Estimates holistic value creation, showcasing the multi-faceted nature from customers' perspective.	2.	Value creation is a prominent construct in marketing but is scarcely explored by public transport research. Thus, offering a holistic understanding for the construct holds scholarly importance for research, and commercial utility for increase passenger satisfaction.
3.	Examines the relative contributions of each process to holistic value creation		
4.	Examines passengers' holistic value creation in public transport, specifically, as prior research in public transport only focuses on specific value creation processes.		
5.	Analyses customer experience with respect to holistic value creation, satisfaction and customer engagement behaviours and, simultaneously, examines its role in the value-satisfaction and value-engagement relationships, evidencing its central role in both.	3.	Passengers' value creation and experiences contributes to passenger satisfaction and supports a transport providers' performance. Thus, offering a cohesive understanding of the inter-relationships between these constructs, and the role of customer experience, holds scholarly and commercial importance.
6.	Validates customer experience as a reflective multi-dimensional construct in terms of passengers' journey stages, which is only present in qualitative public transport research.		
7.	Considers different conceptual orders of value creation and customer experience, with respect to passenger satisfaction		
8.	Examines the satisfaction-engagement relationship in public transport services in the contexts of value creation, which public transport research only considers in the contexts of service quality.	4.	Passengers' engagement forms TOCs' value-in-use and supports TOCs operational success, and so practitioners will benefit greatly from a fuller understanding of this relationship.

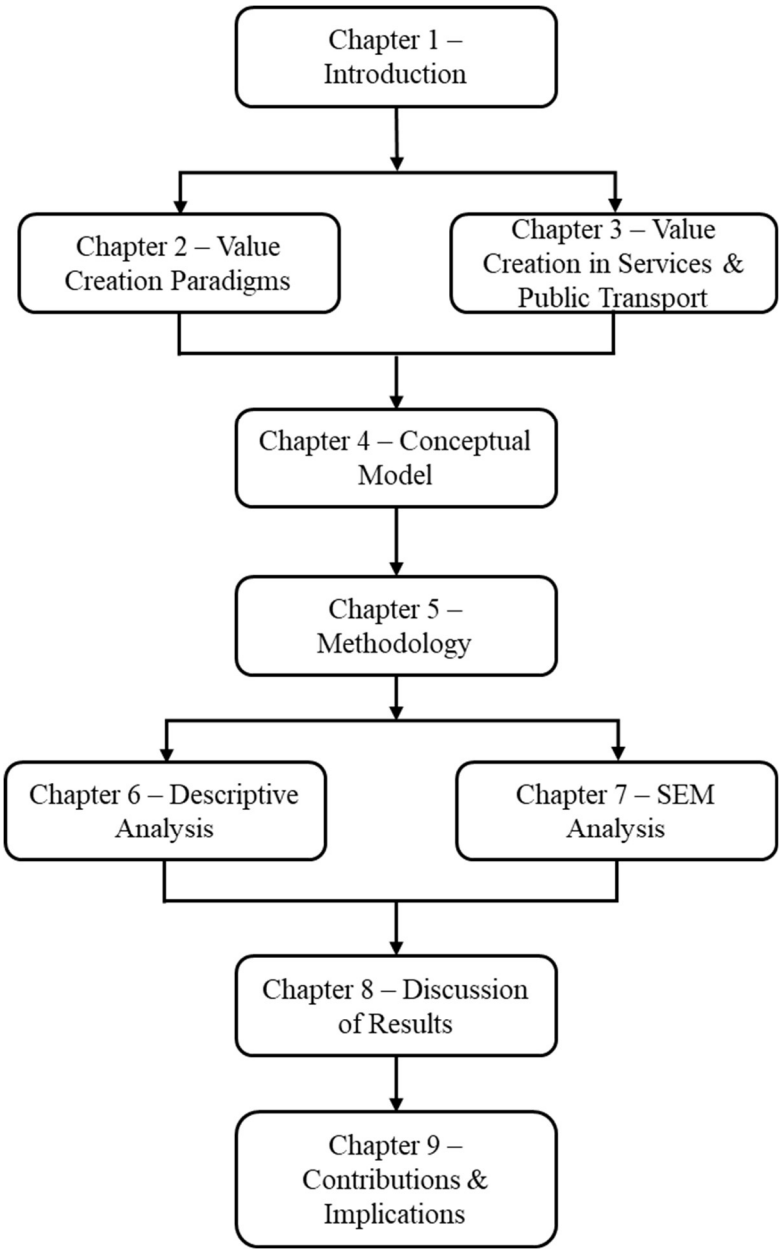
1.8 Research methodology

This is a positivist study that develops a conceptual model and tests its hypotheses. Data collection consists of an initial pilot study and main data collection phase, with the latter distributing surveys online via passenger communities, TfW and educational institutions. TfW assisted with main data collection, and partial funding for the thesis, although the analysis was independent of the TOC. The thesis applies PLS-SEM to a clean dataset of 406 rail passengers, and this approach to SEM is chosen due to its strength in working with complex models and formative constructs (Hair et al. 2014; Hair et al. 2019). During the analysis, assessment of measurement and structural models helps to fortify the validity of construct measurements and the model's structural relationships, respectively. The study uses a two-stage approach to estimate higher-order constructs, mitigating potential issues with multi-collinearity (Ringle et al. 2012; Hair et al. 2014), and applies robustness checks in line with PLS-SEM research standards (Hair et al. 2014; Shmueli et al. 2019).

1.9 Thesis structure

The thesis comprises nine chapters (Figure 2).

Figure 2. Study structure



Chapter 1 introduces the thesis's research problems, aims, methodology, justifications, contributions and structure. **Chapter 2** reviews the different research paradigms of value creation, namely SDL, service logic and CDL.

Chapter 3 reviews research on value co-creation, focusing on scholarship adopting a service-provider perspective and, to a lesser extent, a customer perspective. This chapter also

covers specific literature on value co-creation, co-design and co-recovery in public transport services. **Chapter 4** introduces the thesis's conceptual model and discusses how it uses existing literature as a springboard. As such, the chapter reviews research on each value creation process, customer experience, passenger satisfaction, and customer engagement behaviours.

Chapter 5 sets out the thesis's methodology, including its philosophical rationale for using positivism, deductive reasoning, and survey development. This chapter also explains the thesis's approach to data collection, analysis via PLS-SEM, and ethical considerations. **Chapter 6** offers a descriptive analysis of the thesis's dataset in terms of demographic variables and response patterns. **Chapter 7** discusses the thesis's PLS-SEM analysis, with respect to its hypotheses, and **Chapter 8** summarises its findings in terms of prior literature. Lastly, **Chapter 9** discusses the thesis's findings for their theoretical implications, main contributions, managerial implications, limitations and recommendations for future research.

1.10 Summary

This introductory chapter offers a general overview of the thesis, reviews the research context and problems and summarises the theoretical background with reference to public transport research. It also sets out the thesis's main research objectives, questions, background, methodology, contributions and structure. The next chapter focuses on value creation research from SDL, service logic and CDL.

Chapter Two - Paradigms of Value Creation & Co-Creation

Chapter Two - Paradigms of Value Creation & Co-Creation

2.1 Introducing co-creation & value-in-use

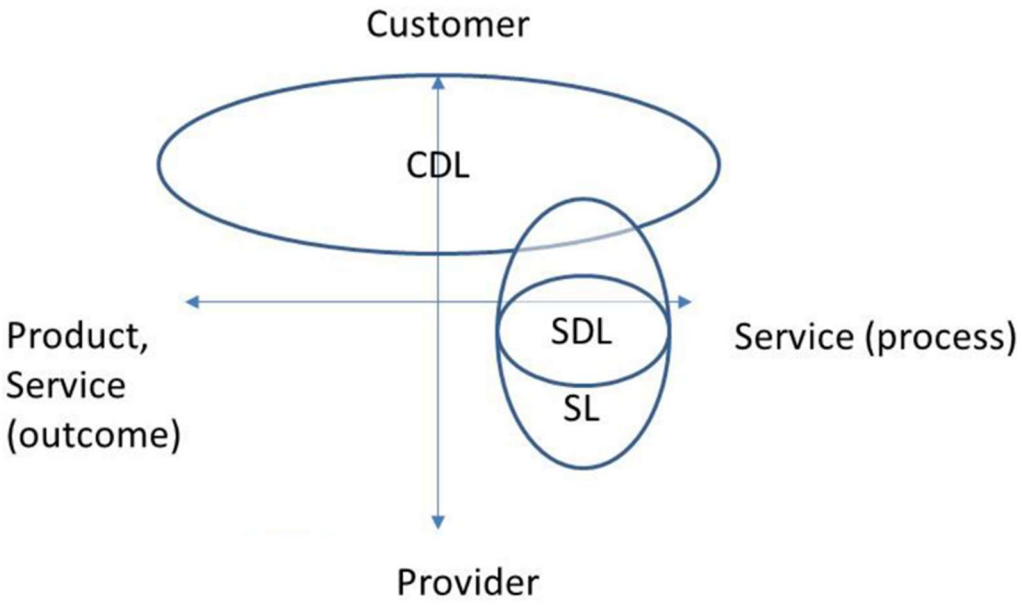
Chapter 2 discusses research on value co-creation and value-in-use from the perspectives of Service Dominant Logic (SDL), service logic and Customer Dominant Logic (CDL). Co-creation has been defined as a set of "joint activities by parties involved in direct interactions, aiming at contributing to the value that emerges for one or both parties" (Grönroos, 2012, p1520). Later research has distinguished value co-creation from value creation, with the former being contingent on customer-provider interactions, whilst the latter can also include customers' interactions with resources and social actors (Grönroos, 2017).

Value-in-use has been conceptualised in terms of goal achievement (Macdonald et al. 2011) and has been described as the "use of a product or service in a situation to achieve a certain goal or set of goals" by early SDL research (Flint et al. 1997, p170). More recently, service logic has argued value-in-use does not necessarily entail value co-creation (Grönroos & Voima, 2013) and has offered a more nebulous definition of value-in-use in terms of customers feeling better off (Grönroos, 2008). Both paradigms offer harmonious conceptualisations of value-in-use (Medberg and Grönroos, 2020) although service logic focuses on how it emerges from different customer interactions (Grönroos and Ravald, 2011; Grönroos and Voima, 2013; Grönroos, 2017) whilst SDL examines it in terms of resource integration (Vargo and Lusch, 2008; Vargo and Lusch, 2014).

Unlike either of those paradigms, CDL has conceptualised value co-creation and value-in-use from a customer's perspective in terms of "how customers embed services in their processes" (Heinonen et al. 2013, p5) and under customer-centric dimensions of service use (Heinonen and Strandvik, 2015). SDL, service logic and CDL are not mutually exclusive, however, but instead reflect different "buildings, each with its own foundation represented by the fundamental assumptions and stories consisting of models, concepts and methods" (Heinonen and Strandvik, 2015, p4). When comparing these paradigms, Heinonen and Strandvik (2015) have visualised their differences in terms of focusing on a customers and

provider's perspective, and in terms of focusing on service outcomes and back-office processes (Figure 3).

Figure 3. Characteristics of SDL, service logic and CDL



Source: Heinonen and Strandvik (2015, p6)

Public transport research has shown the significance of supporting value co-creation and value-in-use for increasing passenger satisfaction (Gebauer et al. 2010). Additionally, research has shown the importance of supporting co-creation for transport providers, specifically, as passengers can assist with developing value offerings (Jaakkola and Alexander, 2014; Nalmpantis et al. 2019), enable service delivery (Echeverri and Skålén, 2011) and offer real-time feedback on service functions (Nunes et al. 2014; Stelzer et al. 2015). As such, a concerted effort was made by the thesis to conceptualise value co-creation, and value-in-use, from the perspective of different research paradigms. This was done to offer a solid theoretical foundation for theory development by the thesis.

Chapter 2 is divided into the following sections. First, it introduces value co-creation and value-in-use and then discusses SDL research on co-creation. It then reviews service logic research on co-creation and CDL research on co-creation. The discussion then pivots to value-in-use and, next, how value-in-use has been conceptualised by SDL and service logic. The chapter closes by reviewing research on value-in-use in CDL.

2.2 Theoretical paradigms of value creation & co-creation

2.2.1 Service Dominant Logic (SDL)

SDL begins by distinguishing value creation from physical goods and services in terms of operand and operant resources (Vargo and Lusch, 2004; Vargo and Lusch, 2008). Using this distinction, Vargo and Lusch (2004) highlighted how operant resources form the primary unit of exchange in services whilst operand resources only act as vehicles. During value creation, customers become active co-producers of value through service consumption and represent operant resources themselves. Under these rationales, Vargo and Lusch (2004) proposed SDL's eight fundamental premises (FP) (Table 2).

Table 2. Foundational premises of SDL

Premise		Explanation / Justification
FP1	Service is the fundamental basis of exchange.	The application of operant resources (knowledge and skills), "service," is the basis for all exchange. Service is exchanged for service.
FP2	Indirect exchange masks the fundamental basis of exchange.	Goods, money, and institutions mask the service-for-service nature of exchange.
FP3	Goods are distribution mechanisms for service provision.	Goods (both durable and non-durable) derive their value through use – the service they provide.
FP4	Operant resources are the fundamental source of competitive advantage.	The comparative ability to cause desired change drives competition.
FP5	All economies are service economies.	Service (singular) is only now becoming more apparent with increased specialization and outsourcing.
FP6	The customer is always a cocreator of value.	Implies value creation is interactional.
FP7	The enterprise cannot deliver value, but only offer value propositions.	The firm can offer its applied resources and collaboratively (interactively) create value following acceptance but cannot create/deliver value alone.
FP8	A service-centred view is inherently customer oriented and relational.	Service is customer-determined and cocreated; thus, it is inherently customer oriented and relational.
FP9	All economic and social actors are resource integrators.	Implies the context of value creation is networks of networks (resource-integrators).
FP10	Value is always uniquely and phenomenologically determined by the beneficiary.	Value is idiosyncratic, experiential, contextual, and meaning laden.

Source: Vargo and Akaka (2009, p35) adapted from Vargo and Lusch (2004)

FP1 states that value creation is based upon operant resources, as humans hold both physical and mental skills that create intangible value. FP2 proposes that value exchanges have shifted from "one-to-one trading of specialised skills" directly with customers' to "indirect exchange[s] of skills in vertical marketing systems" as employees become micro-specialised (Vargo and Lusch, 2004, p8). Thus, value exchanges are masked as vertical marketing systems become "exchange vehicles" of value themselves (Vargo and Lusch, 2004, p8). FP3 emphasises how, in services, physical products only distribute value propositions and now represent the "application of specialised knowledge, mental skills, and to a lesser extent, physical labour" (Vargo and Lusch, 2004, p9). FP4 focuses on knowledge as an operant resource as it fuels competitive advantage and economic growth through propositional (e.g. technology patents) and prescriptive (e.g. marketing strategies) knowledge. FP5 reflects the micro-specialisation of services, since even production-based industries increasingly rely on service-based functions to embed value in products.

FP6 presents a core dynamic of co-creation in SDL as customers co-produce value by "learn[ing] to use, maintain, repair and adapt the appliance" to their needs (Vargo and Lusch, 2004, p11). Thus, FP6 positions customers as a primary operant resource during value creation. In contrast, FP7 states that providers can only make value-propositions, not generate inherent value without customers' usage. FP8 highlights that services must be intrinsically customer-orientated for value propositions to match customers' usage contexts. Vargo and Lusch (2008) elaborate on these premises via FP9 and 10 which, respectively, incorporate the roles of social and economic actors during value creation and integrate the notion that customers determine value phenomenologically.

Since its initial formation, SDL has gained significant traction with over "fifty well-recognised scholars react[ing] and respond[ing] to and elaborating S-D logic" (Vargo and Lusch, 2008, p 1). Later research by Vargo and Lusch (2014) has condensed these FPs into four axioms from which all other FPs can be derived (Table 3).

Table 3. Axioms of SDL

Premise / Axiom		Explanation / Justification
FP1 / axiom 1	Service is the fundamental basis of exchange	The application of operant resources (knowledge and skills), "service" is the basis for all exchange. Service is exchanged for service
FP6 / axiom 2	The customer is always a co-creator of value	Implies value creation is interactional
FP9 / axiom 3	All economic and social actors are resource integrators	Implies the context of value creation is networks of networks (resource integrators)
FP10 / axiom 4	Value is always uniquely and phenomenologically determined by the beneficiary	Value is idiosyncratic, experiential, contextual, and meaning laden
FP11 / axiom 5	Value co-creation is coordinated through actor-generated institutions and institutional arrangements.	Consideration of the essential role of institutions in value creation from a S-D logic

Source: Vargo and Lusch (2014, p240) and Vargo and Lusch (2016, p8) for FP11

Lusch and Vargo (2014) have proposed that the service ecosystem, rather than individual actors, acts as an appropriate scope for studying value creation. They concluded that the global narrative of SDL is one of generic "actors co-creating value through the integration of resources and exchange of service" (Lusch and Vargo, 2014, p241). Following this concept, Lusch and Vargo (2014) posited that service ecosystems are relatively self-contained, self-adjusting systems of resource integrating actors that share institutional logics to support mutual exchanges. Within such ecosystems, interactions emerge from the ground up as actors leverage local opportunities, thus actor-to-actor exchanges "ripple through tiers of actors, resulting in the emergence of what is a relatively self-contained structure" (Lusch and Vargo, 2014, p162). These actors share institutional logics by holding spatial or temporal connections and sharing common lexicons or codes of conduct. Value creation itself occurs through mutual exchanges as actors "continually invite other actors to engage with and exchange service[s]" to form value propositions (Lusch and Vargo, 2014, p167).

Vargo and Lusch (2016) further refined FP4, 6, 7 and 8. For FP4, they suggested that operant resources offer strategic benefits, rather than competitive advantages, to position providers as beneficiaries of co-creation. FP6 was amended to emphasise that co-creation is not restricted to dyadic interactions, but also includes multi-actor interactions. FP7 and 8

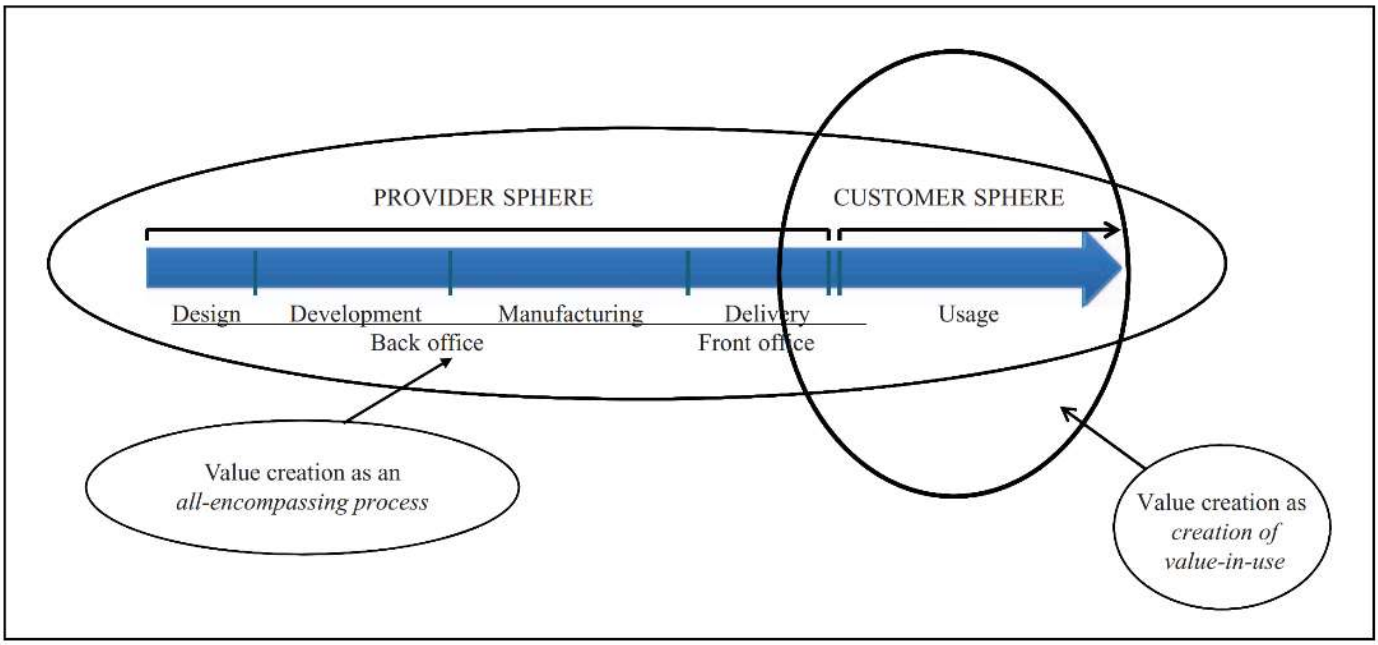
were amended to align with the actor-to-actor orientation of recent SDL research by proposing, for the former, that value itself cannot be delivered and, for the latter, that services should be beneficiary rather than customer-orientated. Vargo and Lusch (2016) incorporated the paradigm's more recent focus on service ecosystems via its eleventh foundation premise (i.e., FP11) and fifth axiom, which details the role of institutions during co-creation (Table 3). These institutions aid co-creative interactions by offering specific guidance (e.g., norms, meanings, symbols, laws, accepted practices). Similarly to how actors are spatially and temporally connected during co-creation (Lusch and Vargo, 2014), several institutions can form institutional arrangements, which offer "relatively coherent assemblage[s] that facilitates coordination of activity in value-cocreating service ecosystems" (Vargo and Lusch, 2016, p18).

More recent research in SDL has extended this perspective on the role of service ecosystems during co-creation by attempting to link micro, meso and macro level co-creation practices in responses to the Covid-19 pandemic (Akaka et al. 2021). In rail services specifically, meanwhile, Alexander and Jaakkola (2011) have dissagregated co-creation in terms of micro (e.g. passenger communities), meso (e.g. TOCs) and macro (e.g. National Rail) level interactions and practices and their associated value outcomes.

2.2.2 Service logic

Although SDL has offered significant contributions to research, criticism has been levelled at the lack of clarity in the way it conceptualises co-creation (Grönroos, 2008; Grönroos, 2011). Grönroos (2011) highlights that SDL presents value creation as an all-encompassing process (Figure 4), contradicting FP6 (i.e. that providers cannot deliver value but only offer value propositions). Grönroos (2008, p307) had earlier emphasised that operand resources, presented as mere vehicles by SDL, are important for value creation by "mak[ing] it possible for customers' to create value, i.e. they facilitate customers' value creation". Grönroos (2008) critiqued SDL for under-incorporating operand resources into value creation and depicting them as only offering potential value.

Figure 4. Value creation as the customer's creation of value-in-use or as an all encompassing process including provider and customer activities



Source: Grönroos (2011, p283)

Grönroos (2011) further critiqued SDL by scrutinising its FPs. For FP1, Grönroos (2011. p285) argued that reciprocal value creation, rather than service itself, is the primary unit of exchange during value creation because "value is created by the customer, through the support of a supplier, enable[ing] the supplier to gain financial value in return". For FP3, Grönroos (2011, p294) argues if customers cannot adequately create value, they cease engagement, therefore value-in-exchange forms a significant function of value-in-use as "all resources and processes are distribution mechanisms, without including value in themselves".

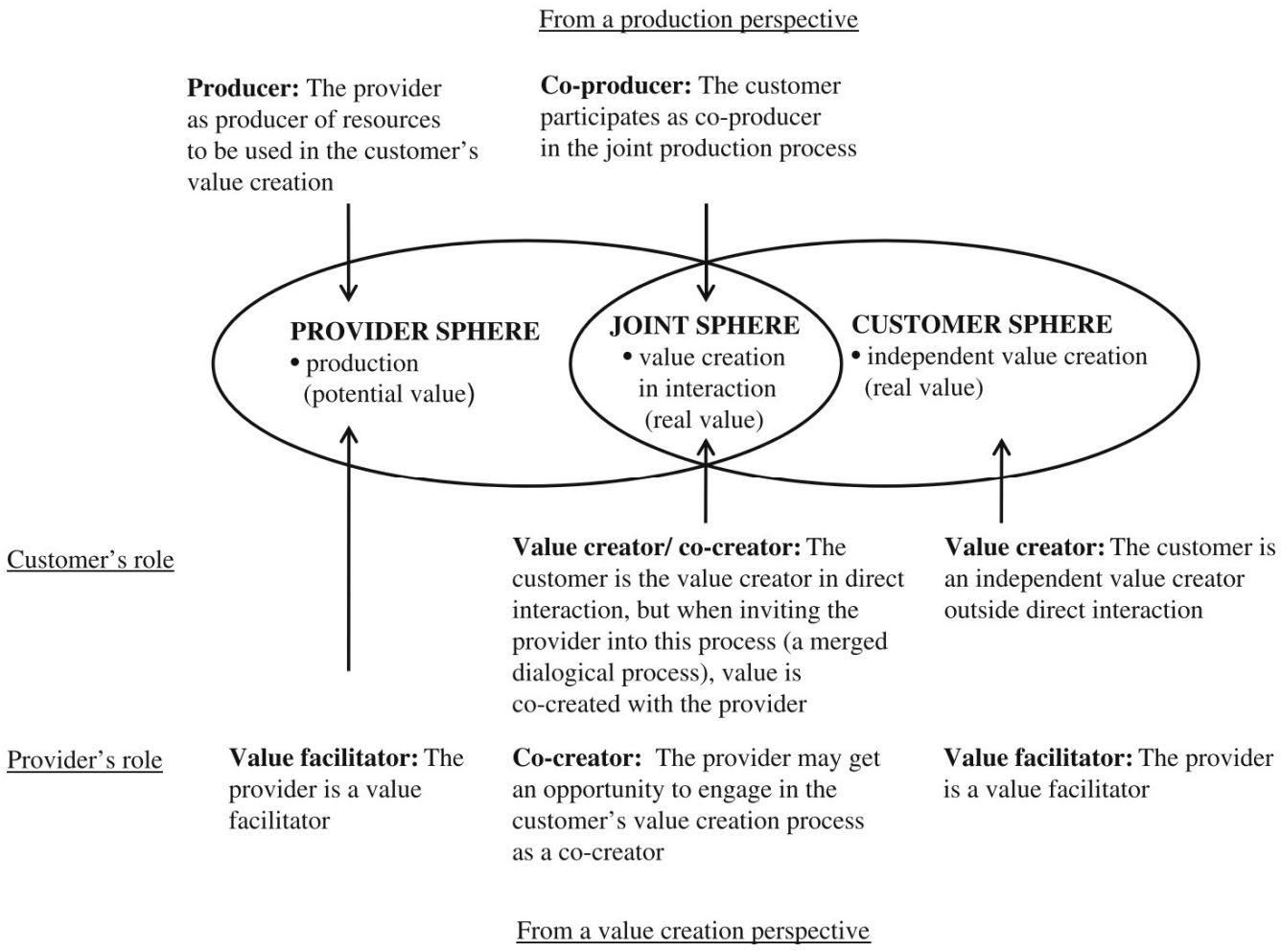
For FP6, according to Grönroos (2011, p287), the premise suggests services and customers engage in an all-encompassing process of value creation and co-creation, which offers "no conclusions for meaningful decision making". To remedy this, the study contends that FP6 should be revised to state that "fundamentally, the customer is always a value creator" rather than co-creator (Grönroos, 2011, p294). For FP7, the study separated the premise into two statements, namely that firms cannot deliver value and can only offer value propositions. The former assumption seems congruent with the value-in-use principle, although Grönroos (2011) argues it fails to account for customer-provider interactions that allow providers to co-create value. This led Grönroos (2011) to claim that a provider's role is

initially one of a facilitator, via resource provisions, which extends to value fulfilment through interactions. The second statement — that providers can only offer value propositions but not deliver value itself — was rectified in this amendment. For FP9, Grönroos (2011) held that customer-service interactions allow providers to graduate from facilitators to fulfillers to also become resource integrators. For FP10, the study argued for including services in the phenomenological processing of beneficiaries, as customers' value-in-use can derive from past service experiences.

Based on these criticisms, Grönroos (2011) proposed the Value Facilitation and Fulfilment model that focuses on customer-service interactions and within which providers can become co-creators via direct customer interactions, whilst also facilitating value creation through resource offerings. The model permits providers to incorporate customers into their production process through feedback, which forms providers' value-in-use. Thus, for Grönroos (2011, p290), value creation does not entail "two parallel processes but one merged coordinated interactive process" during co-creation. Outside interactions, the model clarified that customers can independently create value (Grönroos, 2008), congruent with CDL's mental dimension of value-in-use (Heinonen et al. 2010; Heinonen et al. 2013).

Grönroos and Voima (2013) have further clarified the roles of customers and providers during co-creation and value creation in terms of their spheres, scopes, loci and natures, arguing that the locus of value creation cannot be value-in-exchange because value creation is also constituted by customers' usage. Advancing Grönroos's (2011) initial proposition, Grönroos and Voima (2013) claims that value-in-use resides within customers' sphere of value creation and that resources should only represent potential value-in-use, from which was born the Grönroos-Voima value model that the thesis used to conceptualise passengers' holistic value creation (Figure 5).

Figure 5. Grönroos-Voima model and value creation spheres



Source: Grönroos and Voima (2013, p141)

Grönroos and Voima (2013) also argued for the ways in which providers extend their influence over customers' usage and enter their value sphere by way of direct and dialogical interactions (Table 4). Outside interactions, customers' value-in-use emerges during independent value creation. Value-in-use does not necessarily, therefore, form co-creation, but still constitutes value creation, congruent with CDL's proposal of mental usage (Heinonen et al. 2010). Grönroos and Voima (2013) expanded on the theoretical distinctions between direct and indirect interactions between providers and customers. Direct interactions occur when "the interacting parties are involved in each other's practices" (Grönroos and Voima, 2013, p140). This makes co-creation contingent on the overlap between the customers' actualised (i.e. real) and the providers' potential value-in-use. The study describes a grey zone

of interactions where providers monitor customers' usage but cannot actively influence their value creation, congruent with CDL's notion of asynchronous co-creation (Heinonen and Strandvik, 2015).

Grönroos and Gummerus (2014, p221–222) extend these conceptualisations to describe social value co-creation, which occurs when social "actors' processes merge into one collaborative, dialogical process, which forms a platform for co-creation." This point is congruent with CDL's focus on customers' ecosystems as the study emphasised the act of service reflects the "use of resources in a way that supports customers' everyday practices" in terms of "physical, mental, virtual, possessive" usage (Grönroos and Gummerus, 2014, p208).

Table 4. Direct and indirect interactions in value creation & co-creation. Dashed line denotes line of visibility

	Provider Sphere	Joint Sphere		Customer Sphere	
Value	Provider	Provider	Customer	Customer (individually)	Customer (Collectively)
	Potential value-in-use	Value-in-use	Value-in-use	Value-in-use	Value-in-use
	Indirect interaction	Direct Interaction		Indirect interaction	
	Value facilitation	Value co-creation	Value co-creation / Value creation	Independent value creation	Independent social value co-creation
Value Creation	The service provider facilitates (e.g. products and delivers) the customer's value creation with resources / processes that are used and experienced in the customer sphere	The service provider's resources / processes / outcomes interact with the customer's resources / processes in a merged dialogical process	The customer's resources / processes interact with the service provider's resources / processes / outcomes in a merged dialogical process	The customer's resources / processes / outcomes (Visible and / or mental) interact with the service provider's resources / processes / outcomes in an independent (individual and / or social) value creation process (indirect interaction)	Other actors / activities / resources interact with the customer's resources / processes / outcomes (visible and / or mental) in a collective / social value creation process

Source: Grönroos and Voima (2013, p143)

Grönroos (2017) performed a micro-analysis on value creation, co-creation and value-in-use (Table 5). Using the Grönroos-Voima value model (Grönroos and Voima, 2013) Grönroos (2017) refined the concept of value as being distinct from value-in-use. Value creation in a services sphere reflects potential value-in-use; in the joint sphere, this value forms actualised value-in-use during customers' usage and feedback. Extending the premise, Grönroos (2017, p132) showed how the micro-foundation of value and value creation in services is to "compile resources and processes to offer potential value (-in-use) to the customer". In the customer's sphere, Grönroos (2017) highlighted that value can be co-created through social interactions, a finding that aligns with Grönroos and Gummerus (2014).

According to Grönroos (2017), providers cannot merely offer preprepared value offerings but must instead understand their role as facilitators to tailor value offerings and support customers' value-in-use. This bears relevance and resemblance to Prahalad and Ramaswamy's (2004) notion of experience enablers, which facilitate customers' service consumption, and are discussed in Chapter 3. Grönroos (2017) also highlighted that providers must leverage contact channels that positively contribute to customers' value-in-use, thus recognising their role in customers' wider social context and consumption ecosystems. Focusing on managers in particular, Grönroos (2017) emphasises that the scope of what customers seek extends beyond service functions. Thus, managers should consider these extended elements in terms of a provider's value offerings (e.g. in terms of service design, delivery, third-party services). This notion resonates with Prahalad and Ramaswamy's (2004) concept of experience networks and CDL's proposal of considering value creation under customer-centric dimensions (where, what, why, how, etc) (Heinonen and Strandvik, 2015).

Table 5. Lexicon and micro-analysis of value creation

Phenomenon	**The Provider Sphere** (closed to customer)	**The Joint Sphere** (open to customer and provider)	**The Customer Sphere** (closed to provider)
Value concept	Value-in-use	Value-in-use	Value-in-use
Nature of the value process	Provider: Value facilitation	Customer: Value creation, possibly value co-creation Provider: Value facilitation, possibly value co-creation	Customer: Value creation, possibly social value co-creation with peers Provider: Value facilitation
Role in the value process	Provider: To facilitate the customer's value creation	Customer: To create value, possibly also to co-create value with the provider Provider: To facilitate the customer's value creation, possibly also to co-create value with the customer	Customer: To create value, possibly also to cocreate value socially with peers; to determine the level of value that emerges Provider: To facilitate the customer's value creation
Goal in the value process	Provider: To compile resources and processes to offer potential value (-in-use) to the customers	Customer: To create value and possibly co-create value to become better off Provider: To facilitate the customer's value creation, and possibly to influence the customers value fulfilment through co-creation	Customer: To create value independently of the provider, and possibly co-create value with peers to become better off Provider: To enable the customer to become better off through value facilitation
Value outcome	Potential value (-in-use)	Value-in-use for the customer, and possibly also for the provider	Value-in-use for the customer
Nature of value	Potential value (-in-use)	Value (-in-use) evolving throughout the use process	Value (-in-use) evolving throughout the use process
Nature of provider-customer interactions	No interactions	Direct interactions provided that a platform of co-creation is formed	Indirect interactions with resources provided by the provider; possibly direct interactions with peers

Source: Grönroos (2017, p132)

2.2.3 Customer Dominant Logic (CDL)

CDL centres on the customer's perspective during value creation in terms of how services become "embedded in the customers' contexts, activites, practices and experiences" (Heinonen et al. 2010, p9). From this perspective, Heinonen et al. (2010) argued that the temporal and ontological parameters of value creation, co-creation and value-in-use shift to include mental engagement. They proposed several challenges to services marketing research, first challenging the nature of co-creation and value creation itself by focusing on the "context, activities and experiences performing different tasks and how the service supports customers' life" (Heinonen et al. 2010, p9, 2010, p8). Second, from this challenge they contended that value creation is not always a straightforward activity orchestrated by providers, particularly when considering mental engagement, thus value creation expands beyond customer-provider interactions and "mostly beyond the visibility of companies" into customers everyday lives (Heinonen et al. 2010, p9).

Third, the study underlined how customers' usage contexts are dynamic and "dependent on the customers' role, position and interaction within a social structure" (Heinonen et al. 2010, p10). As such, the authors proposed that value-in-context (Vargo, 2009) is an inherent part of value creation as it includes prior service experiences, congruent with Grönroos's (2011) critique of SDL. Fourth, they suggested that services marketing should further refine the concept of customer experience to incorporate the mental dimension of value creation. These challenges expanded previous conceptualisations of value creation, co-creation and value-in-use in customers' ecosystems (Table 6).

Table 6. Contrasting provider and customer dominant logics in terms of co-creation, value-in-use and customer experience

	Provider-dominant logic	Customer-dominant logic
Co-creation • Involvement • Control	• Customer involved in co-creation • Company controls co-creation	• Company involved in customer activities • Customer controls value creation
Value-in-use • Visibility	• Focus on visible interactions	• Also considers invisible and mental actions
Customer experience • Locus • Character	• Formed within the service • Extraordinary	• Emerges in customers' life • Also mundane and everyday

Source: Heinonen et al. (2010, p14)

Heinonen, Strandvik and Voima (2013) have also expanded on a previously unrecognised aspect of CDL with respect to customers' dynamic and multi-contextual sense of reality. Their work expanded on value creation research by coining the term value-in-experience, congruent with a recent value creation paradigm by the name of Experience Dominant Logic (Abid et al. 2022). This concept reflects the impact of longitudinal experiences on value creation, as value emerges before, during and after service use (Heinonen, Strandvik and Voima, 2013).

Later research by Heinonen and Strandvik (2015) consolidated CDL into central tenets and formalised a lexicon for the paradigm. The first suggests viewing marketing as a "business perspective, moving beyond a limited functional view of marketing" (Heinonen and Strandvik, 2015, p11). This is congruent with SDL's emphasis that marketing now spans a wide array of business activities because it supports promise fulfilment and not just promise making (Vargo and Lusch, 2008). Thus, for Heinonen and Strandvik (2015), managers must continuously incorporate not only customers' activities and experiences but also their logic for using services into business activities. Along similar lines, managers must continuously monitor and align value offerings to support customers' activities and experiences, a perspective aligned with Prahalad and Ramaswamy's (2004) experience enabler of evolvability where value offerings continuously adapted to support customers' usage.

The second tenet of CDL is grounded in the concept of customer logic which reflects a "coordinating concept in which the patterns of customers' overt and covert activities, experiences, and goals are integrated" into their value creation (Heinonen and Strandvik, 2015, p12). In CDL, all customers are subjectively rational to their own logics. From this premise, the study recommends that managers attempt to categorise customers based around common logics for strategising.

The third tenet relates to value offerings themselves, with Heinonen and Strandvik (2015, p13) recommending managers view them as recipes for how providers may be involved in customers' value creation. Providers may not be capable of offering bespoke support to each individual customer's value creation, but they may be capable of tailoring in-house capabilities and strategies to enhance their degree of involvement in it.

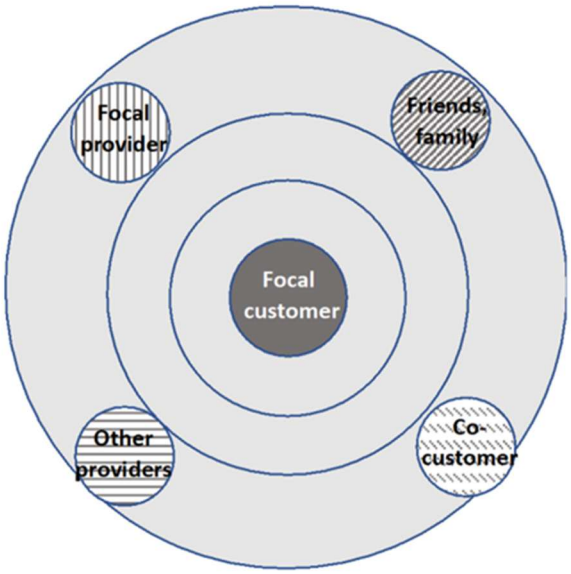
The fourth tenet concerns value formation, which emerges for customers and through physical and mental experiences and can occur beyond service interactions (Heinonen et al. 2013). By shifting the parameters of value creation to include mental usage, Heinonen and

Strandvik (2015) included within the parameters of co-creation the monitoring of customers' usage. Asynchronous value co-creation, where providers can monitor but not influence customers' value creation, was the study's next proposition, from which is born a novel dimension to co-creation in the form of involvement. This dimension assists in calibrating the extent to which providers are present and involved in customers' everyday lives, in value creation and in co-creation. Heinonen and Strandvik (2015) propose that value creation be considered in terms of the customer-centric dimensions of content (i.e. what); process (how); time (when); location (where); and actor (who).

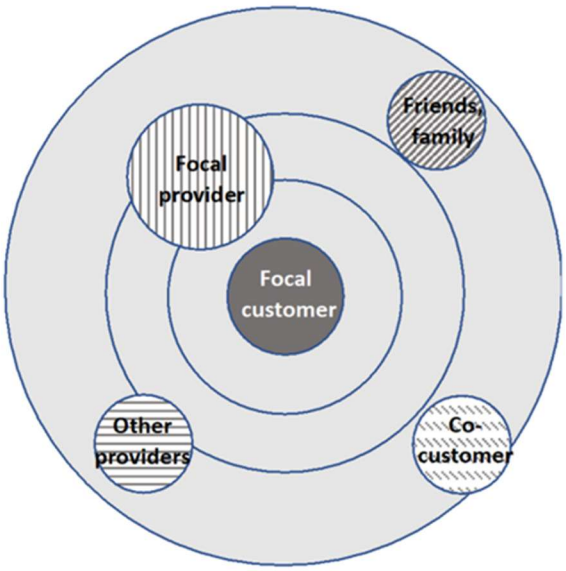
The fifth and final tenet relates to how customers' ecosystems are defined by those customers, not providers, in terms of central components. This produced the managerial implication that providers should aim to understand both their position in this ecosystem, and its relevant components, to support customers' value creation.

Recent research by Lipkin and Heinonen (2022) takes seriously the theoretical implications of this literature by examining how social actors co-create customers' ecosystems and experiences. By way of an exploratory approach of semi-structured interviews and personal diaries, Lipkin and Heinonen (2022) categorised customers' experiences whilst using smart watches to track athletic performance as being customer, brand or socially driven (Figure 6). Customer-driven ecosystems revolve around focal customers and experiences are co-created by factors like mood, individual performance and improvement. In brand-driven ecosystems, providers are positioned more centrally than customers and experiences are co-created by functional and technical features of value offerings. Socially driven ecosystems contain multiple social actors and experiences are co-created by factors like a sense of connection, belonging and social status.

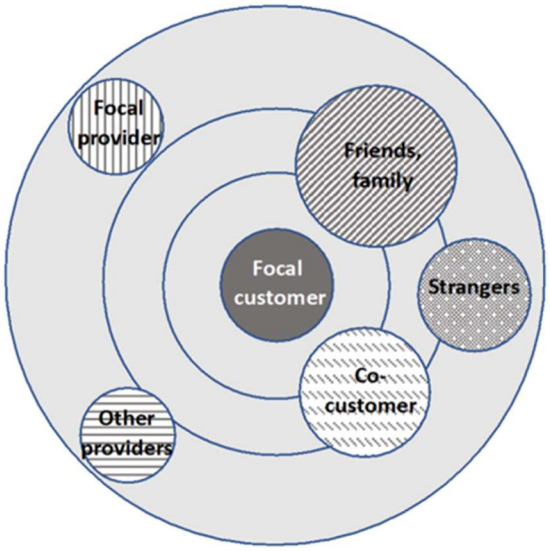
Figure 6. Different types of customer ecosystems



Individually-driven customer ecosystem



Brand-driven customer ecosystem



Socially-driven customer ecosystem

Source: Lipkin and Heinonen (2022, p9–10)

2.3 Defining and conceptualising value-in-use

The previous sections focused on how SDL, service logic and CDL have conceptualised value co-creation and value creation. This section considers how research in these paradigms has conceptualised value-in-use.

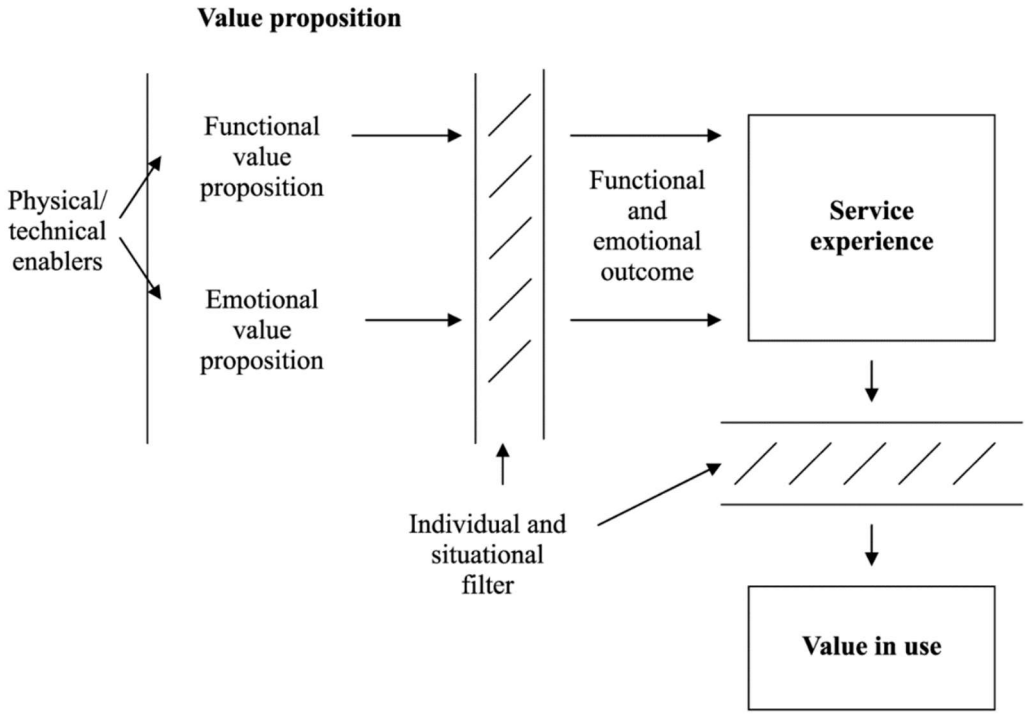
The idea that value emerges during use became prominent as services marketing grew into a distinct discipline (Fisk, Brown and Bitner, 1993). Early research on value-in-use described it as the "use of a product or service in a situation to achieve a certain goal or set of goals" (Flint et al. 1997, p170). This positions value-in-use as emerging during use, but does not explicitly define the concept. Some conceptual research has considered it as a functional outcome reflecting a "goal purpose or objective that is served directly through product consumption" (Payne and Holt, 2001, p162). More recently, research has conceptualised it as an end-outcome, whilst developing an operational framework (Ranjan and Read, 2014), or as a dynamic accumulation (Grönroos & Voima, 2013; Heinonen and Strandvik, 2015) that can emerge in customers' ecosystems (Sandstrom et al. 2008; Heinonen et al. 2010; Heinonen et al. 2013). These different conceptualisations are not mutually exclusive; they represent different fundamental assumptions and perspectives (Heinonen and Strandvik, 2015).

SDL and service logic view value-in-use, respectively, from the bases of classical economics (Vargo and Lusch, 2004) and marketing (Grönroos, 2016). The distinction between these paradigms for conceptualising value-in-use lies in the role of products during value creation. SDL views them as transmitters of services (Vargo and Lusch, 2004). In contrast, service logic considers them in terms of how "the customer contacts of goods marketers include an increasing number of service elements" (Grönroos, 2016, p318) as products now facilitate customers' use (Grönroos, 2011). CDL conceives of value-in-use from the customer's perspective in terms of usage contexts (i.e. what, how, when, where and who) and their idiosyncratic logics (Heinonen and Strandvik, 2015). Scholars have more recently argued that service quality and value-in-use are intimately linked, with the former potentially acting as a proxy measure of the latter (Medberg and Grönroos, 2020). The discussion will now review how research in SDL, service logic and CDL has conceptualised value-in-use.

2.3.1 Service Dominant Logic & value-in-use

Within SDL, Vargo and Lusch (2004, p6) describe value-in-use as "defined by and co-created with the consumer rather than embedded in output". Sandstrom et al. (2008, p120) suggest that the construct reflects "the sum of all the functional and emotional experience outcomes" after value offerings have been filtered through customers' idiosyncratic characteristics (e.g. demographics, level of competency, consumption setting) (Figure 7). Although Sandstrom et al. (2008) used SDL as its theoretical paradigm, the study incorporated customers' idiosyncratic consumption. This is congruent with CDL and service logic research on customers' consumption ecosystems (Heinonen et al. 2010; Heinonen et al. 2013; Grönroos and Gummerus, 2014). On this note, Vargo (2008) has suggested the term value-in-context replace value-in-use to emphasise the contextualised nature of value emerging during customers' use. Additionally, Edvardsson, Tronvall and Gruber (2010) have theorised value-in-use in accordance with customers' social structures and in terms of their meaning (signification), control (domination) and morality (legitimation).

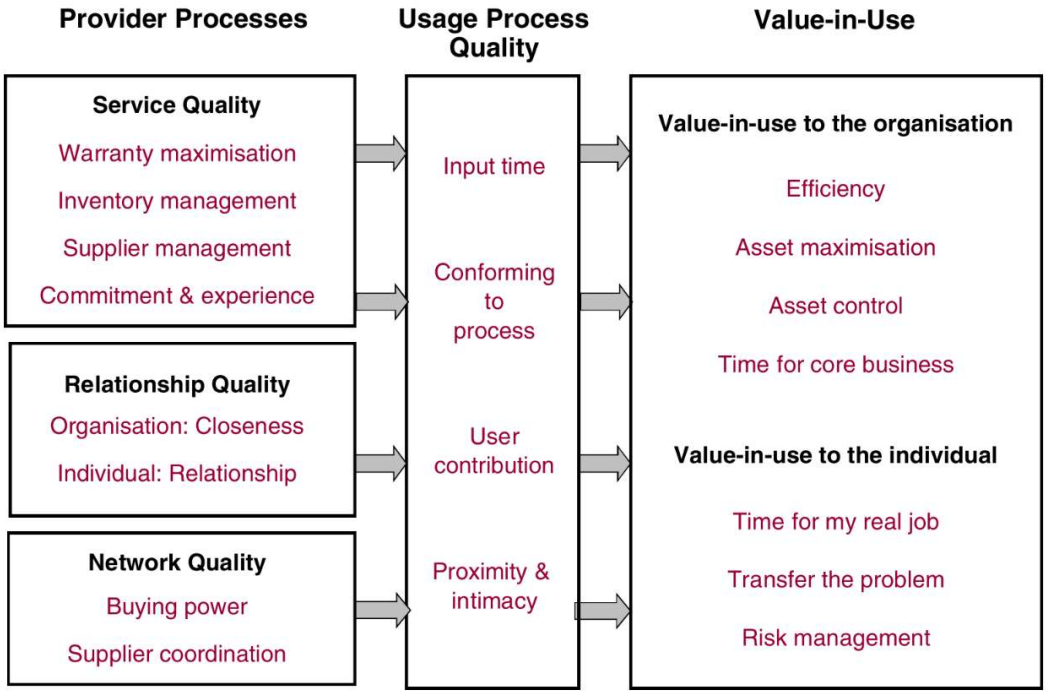
Figure 7. Processes that constitute the service experience for customers



Source: Sandstrom et al. (2008, p121)

In B2B contexts, Macdonald et al. (2011) adopt a hierarchical means-end approach that produces goal hierarchies with the aim of reimagining value-in-use. To assess goal hierarchies, they applied the laddering method of categorising qualitative data. This method begins with a random seed question and responses direct enquiries upward, downwards or sideways. Upward and downward laddering elicits information relating to higher and lower-order constructs, whilst sideways laddering differentiates points (Rugg et al. 2002). Macdonald et al. (2011) conceptualised goal hierarchies in terms of corporate and individual perspectives during value-in-use. From a corporate perspective, value-in-use emerged from how value offerings supported an employee's ability to create organisational value. In contrast, from an individual's perspective, value-in-use emerged from how value offerings supported an employee's job proficiency within organisations (Figure 8). These findings agree with Rugg et al.'s (2002) findings that the value-in-use of IT services differs around corporate or individual goal hierarchies.

Figure 8. Customer perception of quality and value-in-use to their employing organisations and for themselves



Source: Macdonald et al. (2011, p677)

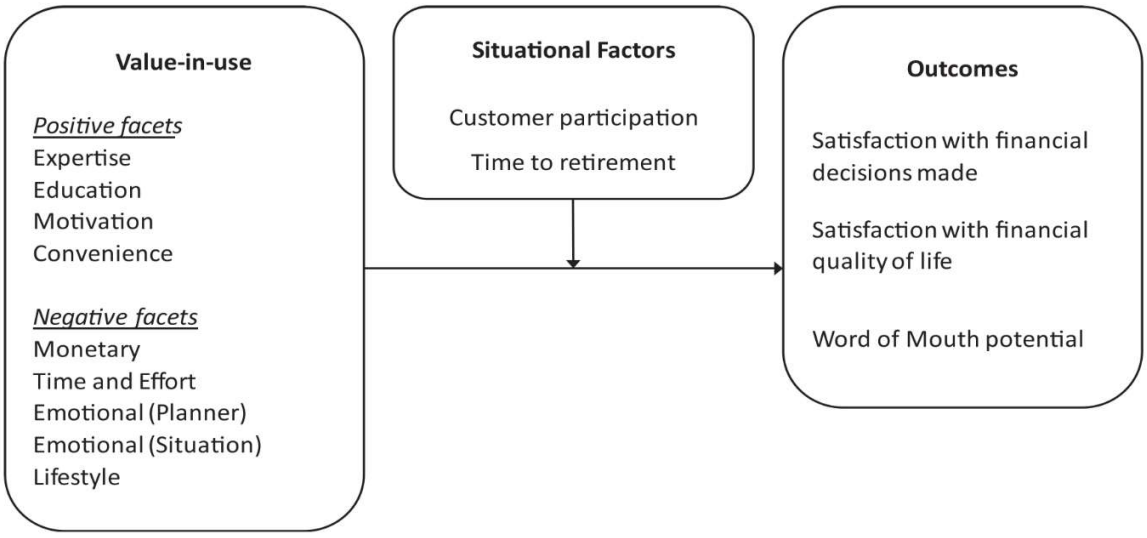
Empirical research by Ranjan and Read (2014) thinks of value-in-use as a formative construct measured in terms of experience, personalisation and relationship. The study examined value-in-use in healthcare, education and hospitality services. During value-in-use, Ranjan and Read (2014, p294) defined experience as "relating to emotional and empathic aspects of customer-service interactions" that delivered memorable experiences. More recent research has focused on the important role of experience during value-in-use by developing the paradigm of Experience-Dominant-Logic (Abid et al. 2022). During value-in-use, personalisation and relationship refer to "the uniqueness of the actual or perceived use process" and the "joint, reciprocal, and iterative processes" between customers and value offerings, respectively (Ranjan and Read, 2014, p293–294). Of these dimensions, the study found that experience and personalisation offer similarly strong contributions to value-in-use, whilst relationship contributed less to the construct.

2.3.2 Service Logic & value-in-use

Service logic has conceptualised value-in-use as a process where customers feel better off after using services (Grönroos, 2008). Later research finds that value-in-use can emerge "through experiences somehow related to consumption", highlighting how the construct forms from customers' total service consumption (Grönroos and Voima, 2013, p136). More recently, scholarship has looked at the construct's positive and negative valences and defines value-in-use as "value that emerges, is created or realised by the customer during their usage of resources" (Sweeney et al. 2018, p1101).

In financial planning services, Sweeney et al. (2018) delineate positive value-in-use in terms of convenience, motivation, education and expertise and negative value-in-use in terms of costs associated with money, lifestyle, time and effort and emotions (Figure 9). Beginning with a qualitative stage, Sweeney et al. (2018) identified six facets of positive value-in-use and four negatives from which they created 84 survey items that were validated for representativeness by fellow researchers of co-creation. Following survey refinement and exploratory factory analysis, 24 items were retained. Facets of positive and negative value-in-use were found to correlate appropriately with service outcomes, and customers' degree of participation moderated these relationships.

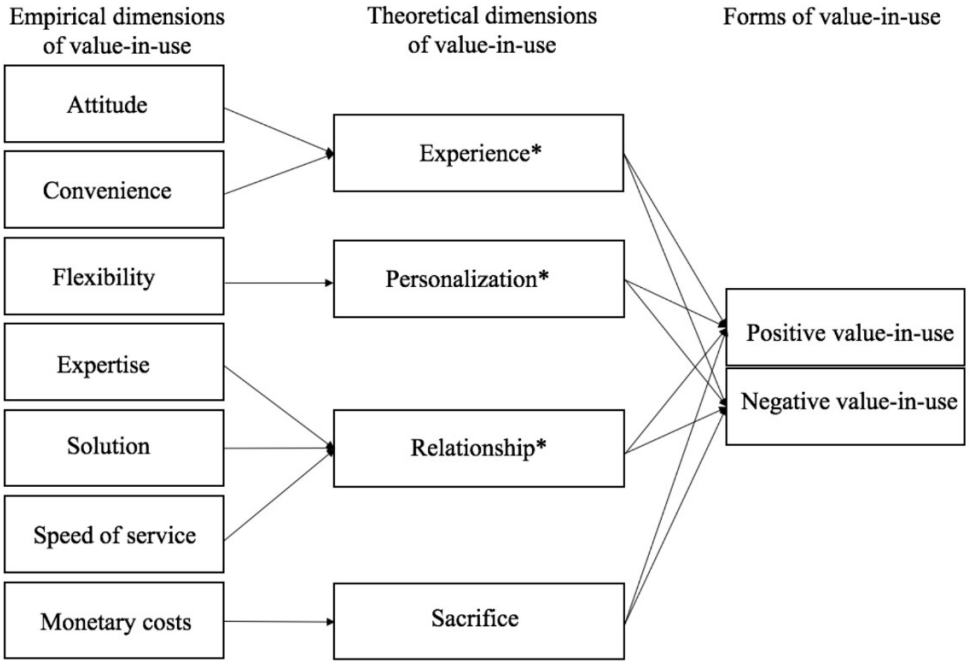
Figure 9. Conceptual model of positive and negative value-in-use



Source: Sweeney et al. (2018, p1102)

Medberg and Grönroos' (2020) theorisation of value-in-use in banking services pays attention to solution, attitude, convenience, expertise, speed of service, flexibility and monetary costs (Figure 10). These factors, the authors pointed out, mostly align with Ranjan and Read's (2014) findings: attitude and convenience relate to customers' experiences; flexibility relates personalisation; and expertise, solution and speed of service relate to relationship. Medberg and Grönroos (2020) did report one dimension, sacrifice, omitted by Ranjan and Read (2014). They emphasised a conceptual overlap between dimensions of service quality and value-in-use. This led Medberg and Grönroos (2020) to argue that customers may experience service quality and value-in-use phenomenologically the same, and that service quality may act as a proxy measure of value-in-use.

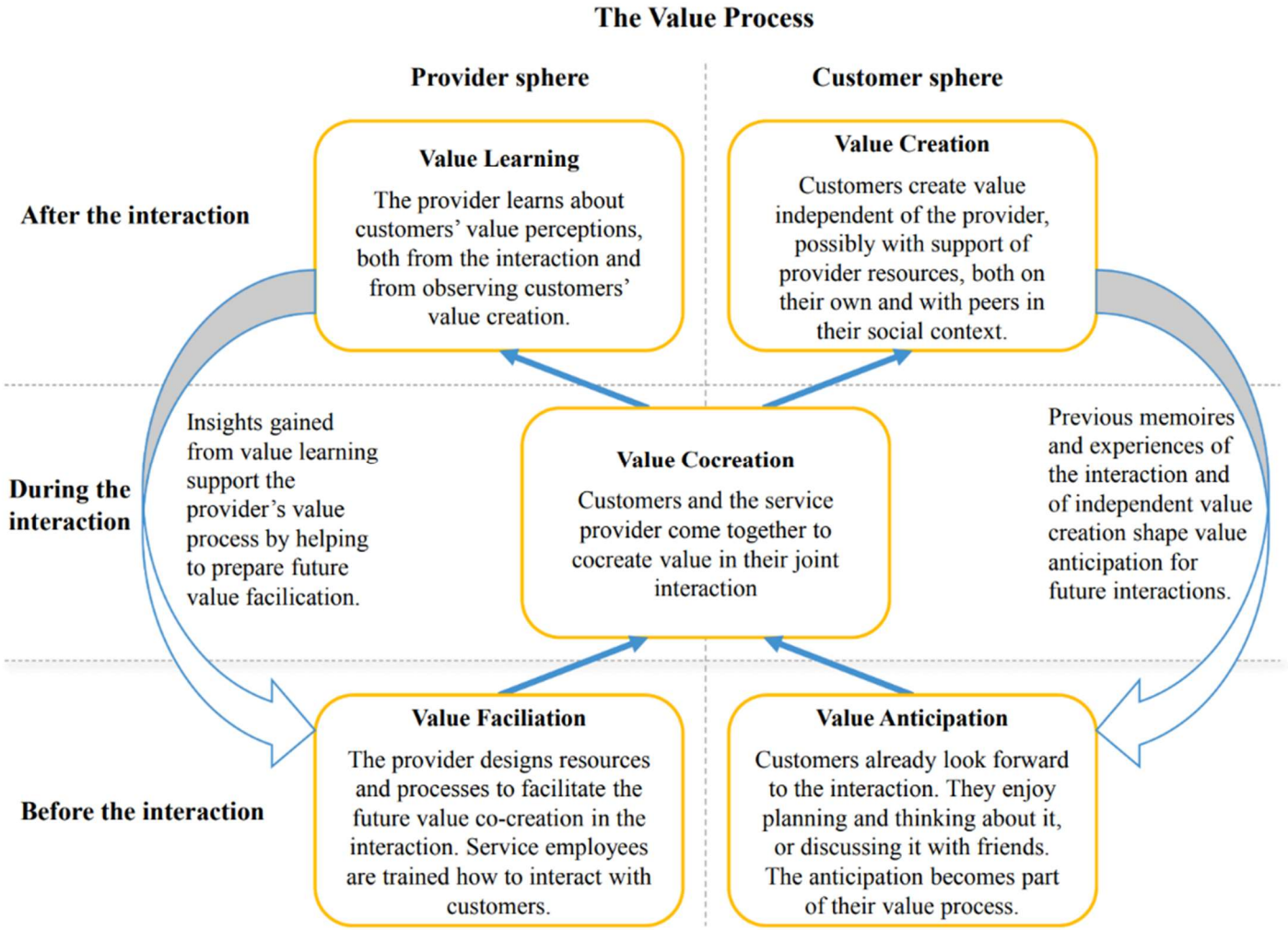
Figure 10. Conceptualisation of value-in-use along positive and negative valences



Source: Medberg and Grönroos (2020, p44)

Holmqvist et al. (2020) has extended service logic's idea of value-in-use by including customers pre, during and post stages of service consumption. Using a qualitative approach, the study interviewed customers of a luxury boutique to examine the roles of customers and providers during value creation (Figure 11). Holmqvist et al. (2020) found that value-in-use emerged before customers' consumptions in terms of anticipation (e.g. planning for and mentalising service usage). Post-service use, the study found value-in-use emerged through conspicuous consumption and anticipating future consumption. The study recommended that providers identify customers' interactions after using services to inform their roles as value facilitators, a piece of advice that runs in parallel to CDL research prompting providers to recognise customers' wider consumption contexts (Heinonen and Strandvik, 2015).

Figure 11. Conceptualisation of value-in-use in luxury services before, during and post service consumption

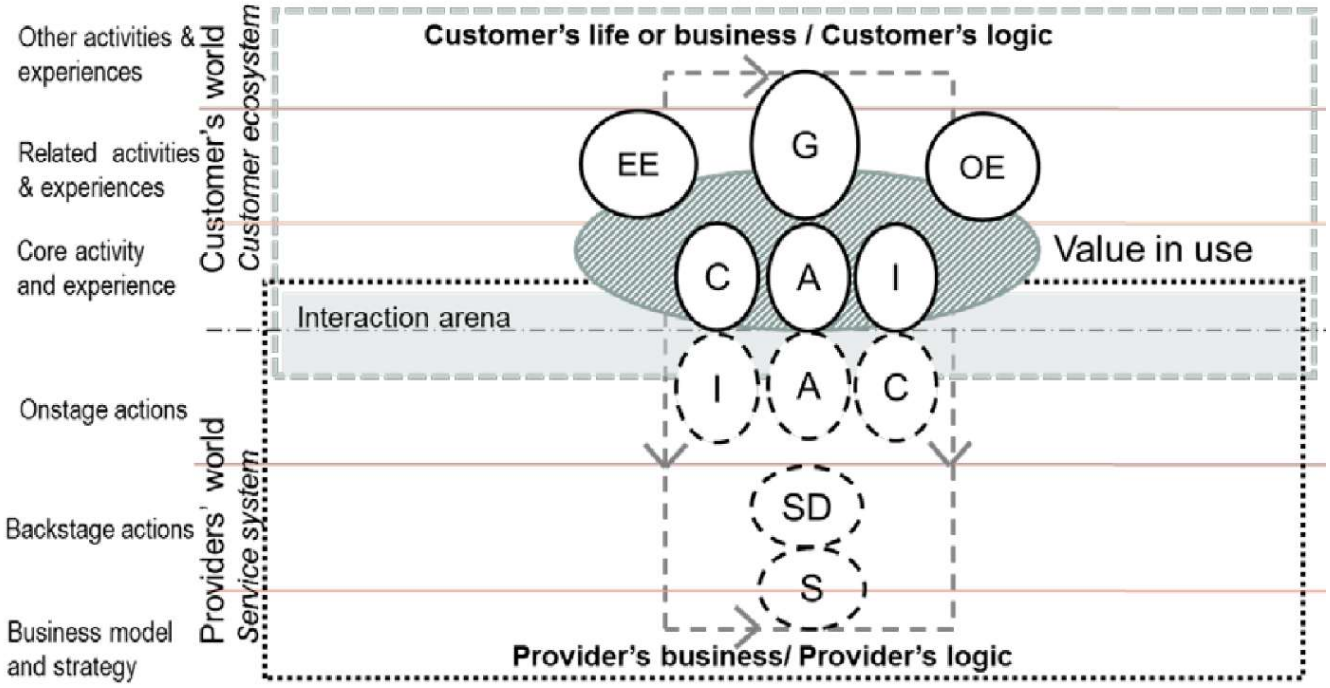


Source: Holmqvist et al. (2020, p119)

2.3.3 Customer Dominant Logic & value-in-use

CDL has nebulously defined value-in-use as "everything that a company does that the customer can use in order to improve his life or business" (Heinonen et al. 2010, p 543). This customer-centric perspective is affixed to the notion that "value emerges also in the customers' sphere" and extends beyond a service provider's visibility (Heinonen et al. 2013, p106). Heinonen et al. (2013, p108) note that the starting point of value-in-use is not the "service company and its processes or even the visible service processes" but the customer's sense of reality and ecosystem. Heinonen and Strandvik' s (2015) novel dimension of visibility extends customers' value-in-use to include invisible interactions with value offerings (e.g. via mentalising). This expansion opens the timeframe and scope of value-in-use and redefines customers' usage as extending beyond service events. This work visualises the narrative of value creation and value-in-use in terms of customers' ecosystems, wherein value-in-use is partly influenced by customer-service interactions, but mainly formed from customers' businesses and lives, as well as earlier experiences with a provider and competitors (i.e., EE, G and OE) (Figure 12).

Figure 12. Factors influencing customers' value-in-use formation



Source: Heinonen and Strandvik (2015, p18). C = customer-provider communications, A = direct and indirect service activities, I = information collected on other providers, EE = earlier experiences related to services and provider, G = customer's goals and tasks, OE = earlier experiences related to other providers.

Recently, Heinonen (2023) has introduced the concept of ex situ value which emerges explicitly outside customer-provider interactions and direct service consumption. Ex situ value represents a culmination of individual and collective dimensions before and after service use. Using qualitative thematic analysis, Heinonen (2023) interviewed 84 tourists on topics ranging from self-guided tours to air, rail and road travel. The study found positive dimensions of ex situ value arose in terms of inspiration; related activities and experiences; local scope (i.e. community building) and self-development. Additionally, Heinonen (2023) found negative dimensions of ex situ value emerged in terms of addiction (i.e. compulsive interest); coverage (i.e. relevance of information) and time accumulation. Based on these, aggregated individual and collective dimensions associated with value-in-use emerge explicitly outside service consumption.

Although based in tourism, Heinonen's (2023) findings are in some ways apposite to public transport services. For individual benefits, the dimension of local scope resonates with Rihova et al.'s (2013) finding that travellers engaged in neo-tribe interactions to offer social networks post journeys. For collective benefits, Jaakkola and Alexander (2014) have shown how engagement from passenger communities offers value through resource mobilisation in rail services. Conversely, Gebauer et al. (2010) have noted the impact of anti-social behaviour on rail passengers' journey experience, representing a collective sacrifice to borrow the terms of Heinonen's (2023) analysis.

In summary, chapter 2 reviewed research on value co-creation and value-in-use from different research paradigms. SDL has focused on co-creation in terms of generic actors integrating resources in service ecosystems (Vargo and Lusch, 2016; Akaka et al. 2023) and has disaggregated the construct in terms of co-production and value-in-use (Ranjan and Read, 2014). Service logic has clarified co-creation as arising from customer-provider and social interactions (Grönroos and Voima, 2013; Grönroos and Gummerus, 2014) and has offered a harmonious conceptualisation of value-in-use to SDL (Medberg and Grönroos, 2020). Meanwhile, CDL has focused on customers' consumption ecosystem (Heinonen et al. 2010; Heinonen et al. 2013) and expands the spatial and temporal dimensions of co-creation and value-in-use (Heinonen and Strandvik, 2015; Heinonen and Lipkin, 2022; Heinonen et al. 2023).

Next, Chapter 3 focuses on co-creation research in services, predominantly from a provider's perspective, and how co-creation has been examined in public transport.

Chapter Three - Co-Creation in Services & Public Transport

Chapter Three - Co-Creation in Services & Public Transport

3.1 Introduction

The previous chapter discussed research on value co-creation, value creation and value-in-use in SDL, service logic and CDL. Chapter 3, comprised of four sections, reviews research on co-creation in services, and specifically public transport. The first section breaks down the chapter's contents and the second discusses co-creation research, focusing on its activities, behaviours and supporting mechanisms (Parahalad and Ramaswamy, 2004; Bharti et al. 2015; Tommasetti et al. 2017). The third reviews research on co-creation in public transport in terms of how TOCs have supported passengers' value creation and experiences to increase passenger satisfaction (Gebauer et al. 2010) and interaction typologies that support co-creation and co-destruction in public transport services (Echeverri and Skålén, 2011). The fourth and final section considers research on how co-creation has been applied to public transport during co-design (Gebauer et al. 2010; Hildén et al. 2018; Bowen et al. 2022) and co-recovery (Roggeveen et al 2011). The research context covered here will later inform managerial implications by offering strategic options that support passenger' value creation and increase satisfaction.

3.2 Value co-creation in services

Prahalad and Ramaswamy (2004) have examined concepts that are important for co-creation from a provider's perspective. Firstly, they proposed the concept of an experience network which represents the "infrastructure for effectively co-creating value through personalised experiences" for customers (Prahalad and Ramaswamy, 2004, p93). The experience network consists of nodal firms which offer leadership to other firms and "create new business opportunities by providing other firms with access to their competence base" (Prahalad and Ramaswamy, 2004, p112). This notion echoes SDL's premise that operant resources form the

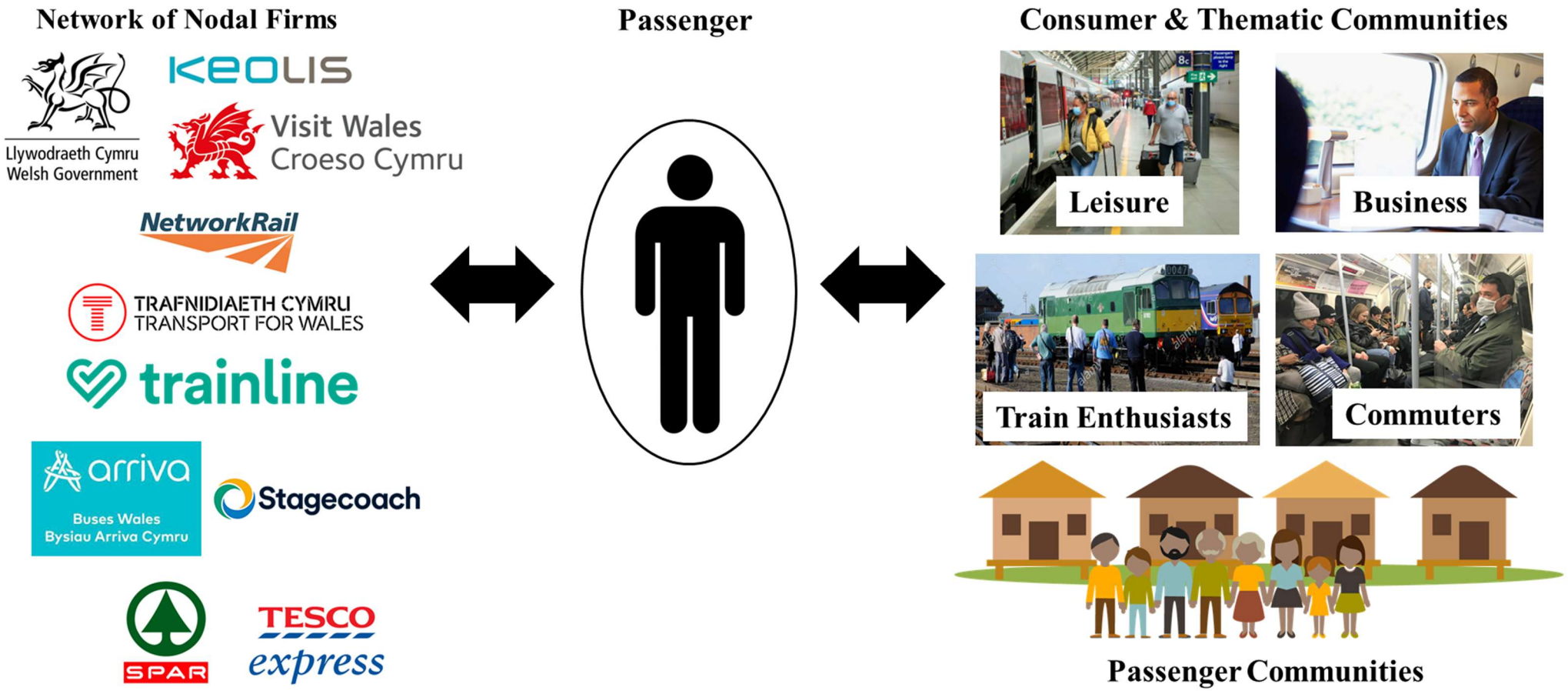
basis of co-creation (Vargo and Lusch, 2004), as well as its more recent focus on nested networks of resource integrating actors in service ecosystems (Lusch and Vargo, 2014).

In rail services, passengers not only interact with TOCs, but also other stakeholders (e.g. local shops, tourism centres), providers of other transport mediums (e.g. bus operators) and passenger communities (Figure 13) (Alexander and Jaakkola, 2011; 2014). Thinking of the customer's perspective, Prahalad and Ramaswamy (2004, p54) understood the service experience as an experience environment, one which holds "the capacity to accommodate a wide range of context-specific experiences". These contexts include all products, services, interfaces, service modalities and communities a customer encounters whilst using services, as these are the "environments that facilitate a total experience for consumers" (Prahalad and Ramaswamy, 2004, p54).

Within this research, mechanisms that support idiosyncratic experiences for customers during value creation are known as experience enablers. Enablers of granularity, extensibility, linkages and evolvability support idiosyncratic value creation. Granularity is defined here as giving "consumer[s] the ability to interact with the experience environment at any desired level of specificity" (Prahalad and Ramaswamy, 2004, p61). Extensibility entails exploring how "technologies, channels or modes of delivery can allow consumers to experience established functions in new ways" (Prahalad and Ramaswamy, 2004, p64). In rail services, such technology offers TOCs feedback whilst rewarding passengers (Nunes et al. 2014) and, for example, can offer flexible payment methods for passengers (Transport for Wales, 2020b).

Linkages reflect a recognition by providers that service events for customers connect in different ways, differing from granularity in that it focuses on the temporal stages of customers' service use. TfW has made a concerted effort to support linkages between service events in terms of passengers' first and last miles (Five Year Strategy for Transport in Wales, 2022). Evolvability denotes "learning from co-creation experiences and using it to develop experience environments" to better meet customers' preferences and needs (Prahalad and Ramaswamy, 2004, p66). Arguably, evolvability in rail services occurs at a slower pace through co-design, which enables TOCs to shape value offerings around passengers' needs (Nalmpantis et al. 2019; Gebauer et al. 2010). Later in the thesis, the concept of experience enablers is applied to offer managerial recommendations that support passengers' value creation and increase satisfaction.

Figure 13. Prahalad and Ramaswamy's (2004) concepts of experience networks and nodal firms to illustrate passengers' experience environment



Source: this study

Shifting the discussion from value creation to co-creation, it is worth noting that Bharti, Agrawal and Sharma (2015) have developed a conceptual framework of co-creation in services consisting of five pillars (Figure 14), identified via thematic content analysis of over 180 studies. Firstly, Bharti et al. (2015, p594) addressed interactive environments, which act as the "heart of value co-creation" since resource integration is contextualised to both providers and service ecosystems (Lusch and Vargo, 2014). The first and second sub-dimensions of this pillar are interaction and relational norms, which are accompanied by role exchange and information sharing. These sub-dimensions are congruent with research focusing on back-office processes that aid co-creation by archiving customer information (Ballantyne and Varey, 2006; Prahalad and Ramaswamy, 2004). Bharti et al. (2015) included role clarity as a sub-dimension of interaction environments, which is consistent with Verleye's (2015) finding that clarity in the customer's role contributes to co-creation.

Bharti et al. (2015) included within interactive environment the sub-dimensions of dialogue and communication, a stance that aligns with the D.A.R.T model of co-creation, which also includes dialogue (Albinsson et al. 2016). For Bharti et al. (2015, p586), these sub-dimensions "hold together the entire process of value co-creation", while SDL research has underlined the importance of shared language and terminology for supporting exchanges between actors (Lusch and Vargo, 2014). An interesting sub-dimension of this pillar is encounter prototyping. This resonates with Prahalad and Ramaswamy's (2004) experience enabler of evolvability, as providers can use encounter prototyping to continuously develop value offerings to better meet customers' needs.

Bharti et al.'s (2015) second pillar comprises operant and operand resources, which respectively maintain providers competitive advantages over competition (Vargo and Lusch, 2008) and act as vehicles for intangible resources (Vargo and Lusch, 2004). In this pillar, the sub-dimension of relationship acts as the "backbone of any partnership or engagement process" between various actors (Bharti et al. 2015, p587). Capabilities denote skills and knowledge, or the know-how enabling goal achievement. Next, the technology sub-dimension focuses on how technological infrastructure "facilitates the value co-creation process through the creation of customer databases" (Bharti et al. 2015, p588), a natural extension of Prahalad and Ramaswamy's (2004) emphasis on archiving customer knowledge to support future decision-making. Network, the fourth sub-dimension, permits co-production, wherein value networks are dictated by the competences, relationships and information sharing of networked actors (Lusch and Vargo, 2014). Fifth, customer

communities stress the collective process that is co-creation, in line with the service logic notion that it emerges from collective social process (Grönroos and Voima, 2013; Grönroos and Gummerus, 2014). The final sub-dimension, trust, supports mutual collaboration during co-creation, a component that Romero and Molina (2011) have argued to be significantly more important to online contexts.

The third pillar proposed by Bharti et al. (2015) is co-production, which represents customer-provider interactions that support service delivery and development (Vargo and Lusch, 2004; Ranjan and Read, 2014). The first and second sub-components of customer participation and involvement are necessary for co-creation (Yi and Gong, 2013) and illustrates how customer's form operant resources from service consumption (Vargo and Lusch, 2004) respectively. Bharti et al. (2015) highlighted the third sub-component of partnerships and engagement enables communication, commitment and trust during co-production, whilst the fourth sub-component of interdependency relates to the inter-connectivity of actors during co-creation (Lusch and Vargo, 2014).

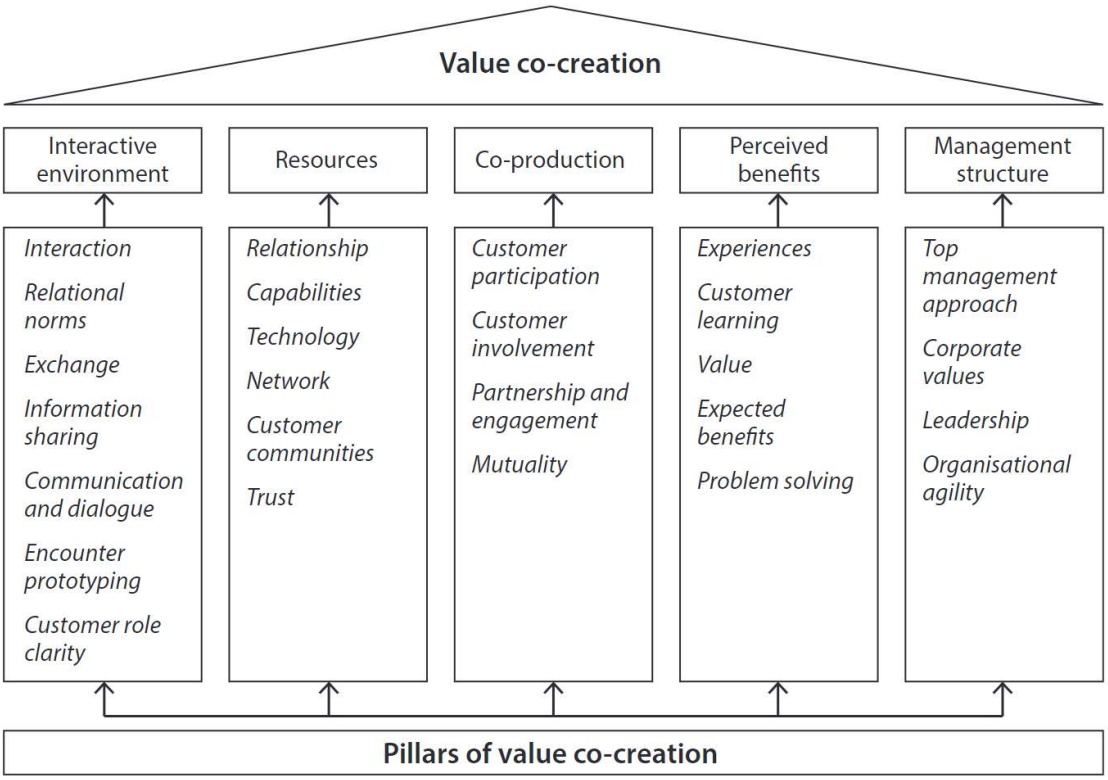
The fourth pillar is perceived benefits, and its first sub-component is experience, a crucial component to value creation (De Keyser et al. 2015). Customer learning forms the second sub-component of perceived benefits as customers' must learn to use and maintain value offerings to fulfil their value-in-use (Vargo and Lusch, 2004). The third, value, aligns with SDL's sixth and tenth FPs, which propose, respectively, that customers are always value creators and value is uniquely determined by beneficiaries (Vargo and Lusch, 2004; 2008). Customers' expected benefits form the fourth sub-component, which agrees with Verleye's (2015) suggestion that expected benefits moderate the relationship between individual and overall co-creation experiences. Problem-solving, the final component, can form an important aspect of the co-creative process (Prahalad and Ramaswamy, 2004).

The last pillar of management structure corresponds to Prahalad and Ramaswamy's (2004) recommendation that providers adopt a velcro-style approach to service personnel reconfiguration. The first sub-dimension is top management adopting a customer-orientated approach, congruent with Ballantyne and Varey's (2006) emphasis on networked knowledge exchanges. The next is leadership, which allows nodal firms to leverage other providers in the experience network to extend competency bases (Prahalad and Ramaswamy, 2004). Corporate values is third, as corporate values and ethics promote trust and bonding between customers and providers. The fourth and final, organisational agility, focuses on providers

adapting to market conditions to leverage co-creation opportunities. This sub-dimension resonates with arguments from research championing velcro-style team management and internal knowledge exchanges during co-creation (Prahalad and Ramaswamy, 2004; Ballantyne and Varey, 2006).

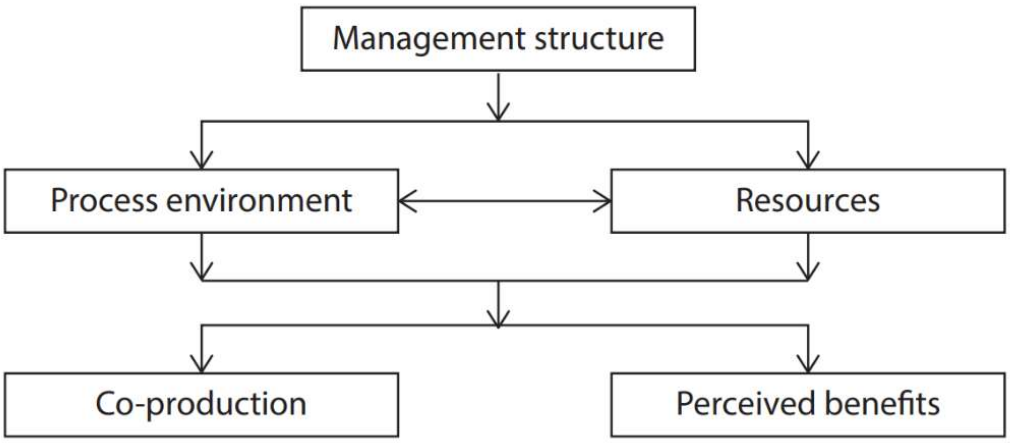
Bharti et al. (2015) applied a Delphi analysis to examine inter-relationships between pillars and found that the extent to which providers adopt co-creation is largely influenced by management structures, which support the pillars of process environments (i.e. interaction environments) and resources. For both pillars, Bharti et al. (2015) found agreement between scholars and practitioners that management structures incapable of sharing information, engaging in customer dialogue, or leveraging operand and operant resources struggle to support co-creation. Furthermore, interaction environments and resources feed into the pillars of co-production and perceived benefits. In the former, operant and operand resources — alongside the interaction environments that house them — form the basis of co-production (Vargo and Lusch, 2004; Lusch and Vargo, 2014). For operand resources, Bharti et al. (2015) contend that resources and interactive environments (i.e., process environment) help to motivate parties to engage in co-creation in terms of expected benefits (Figure 15).

Figure 14. Conceptual framework of the pillars of value co-creation in services



Source: Bharti et al. (2015, p584)

Figure 15. Interlinkages of different pillars of value co-creation



Source: Bharti et al. (2015, p594)

Reflecting on Bharti et al.'s (2015) pillars of co-creation in services, with respect to the scarce public transport research on co-creation, offers some insights for the thesis. For Bharti et al.'s (2015) second pillar of resources, and specifically the sub-dimension of customer communities, public transport research in rail services heralds the importance of passenger communities during co-creation. These communities can contribute operant resources like insights for service development and real-time feedback that supports co-creation (Alexander and Jaakkola, 2011; Nunes et al. 2014). Additionally, these contributions are particularly apparent in the engagement behaviours of co-developing and augmenting, which allow passengers to modify value offerings to better meet their idiosyncratic usage needs and enable TOCs to tailor service functions around passengers' expectations, respectively (Jaakkola and Alexander, 2014; Brodie et al. 2016).

This engagement has also been noted to facilitate problem-solving in public transport, which reflects Bharti et al.'s (2015) fifth sub-dimension of the percieved benefits pillar (Figure 14). In rail services, Gebauer et al. (2010) has noted the utility of incorporating passengers into TOCs problem-solving process (e.g., for reporting and finding lost property) to increase passengers' satisfaction. Additionally, public transport research on co-recovery (i.e., passengers and transport providers co-creating service recovery) has shown passengers' engagement in the problem-solving process increases passengers' satisfaction with recovery outcomes during severe but not minor delays (Roggeveen et al. 2011).

The discussion now turns to co-creation research in services that has adopted a customer-centric perspective. Seeking to understand where the customer perspective lies, in terms of co-creation activities, Tommasetti, Troisi and Vesci (2017) have applied SDL to develop a conceptual model of co-creation oriented around the customers' perspectives (Figure 16). Tommasetti et al. (2017) conceptualised customer's co-creation activities as a higher order reflective construct consisting of cerebral activities; cooperation; information research and collation; a combination of complementary activities; changes to habits; co-production; and co-learning and connection. For cerebral activities, Tommasetti et al. (2017, p935) describe the activity as "compris[ing] mental attitudes that consumers have toward potential all-round involvement in service delivery". This would include positive attitude, tolerance, expectations and trust. Tolerance is the "customer['s] willingness to be patient when the service delivery does not meet [their] expectations of adequate service" (Yi and Gong, 2013, p1281). Much earlier, Prahalad and Ramaswamy (2004) ranked tolerance as a significant player in co-creation in terms of the extent customers tolerate the co-creative process.

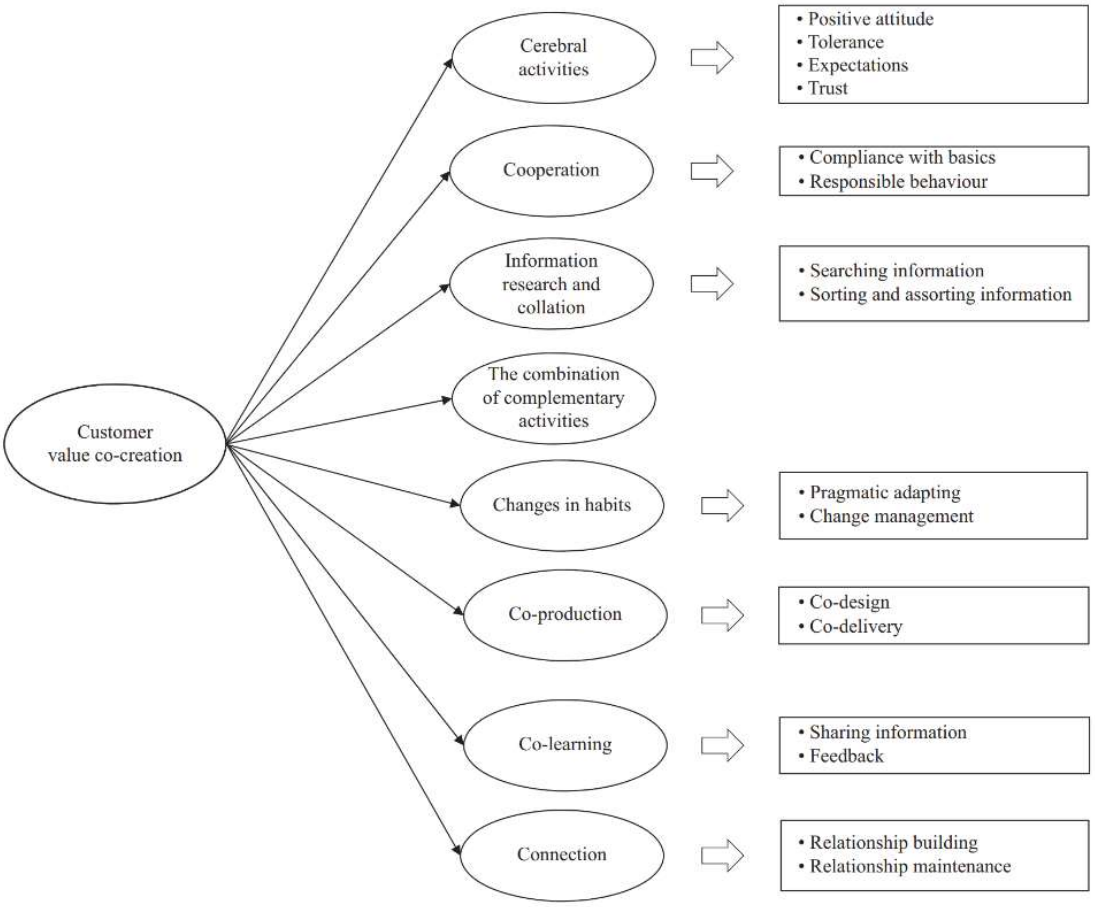
The sub-component of expectations relates to customer's "positive expectations about relationships with providers [that] can make consumers more proactive in the generation of value" (Tommasetti et al. 2017, p936). This sub-component that relates well to the transparency dimension of the D.A.R.T model, as this dimension promotes transparency to enable accurate customer expectations during co-creation (Albinsson et al. 2016). The last sub-component of trust represents the "foundation for establishing strong links with providers and for potential loyalty" (Tommasetti et al. 2017, p936) and forms a valuable resource from the providers' perspectives as well (Bharti et al. 2015).

The second cooperation activity is the customer's compliance with a provider's basic demands and responsible behaviour from customers during service usage. Yi and Gong (2013) have incorporated these sub-components, either specifically (i.e. responsible behaviour) or indirectly (i.e. personal interaction), to conceptualise customers' co-creation behaviours. Information research and collection involves searching for and sorting information (McColl-Kennedy et al. 2012). The activity has been further disaggregated to include customers' preliminary research in terms of what is required "to obtain the necessary data to clarify service requirements and consumption modalities" (Tommasetti et al. 2017, p937).

The co-creative activity of combining complimentary activities relates to "user involvement in further activities" to "increase their engagement and to intensify the opportunities for interaction" (Tommasetti et al. 2017, p939). The co-creative activity of habit changes represents the extent "users are willing to modify their behaviors" relative to the "degree of participation in the consumption experience" (Tomasetti et al. 2017, p939). This dimension denotes pragmatic adapting, as "individuals adapt their role to the changed circumstances created by service provision" (Tommasetti et al. 2017, p940). Changes in management are also involved, which reflect "how consumers react to the impact of the service on their lives" (Tommasetti et al. 2017, p940). This dimension mirrors CDL's focus on how customers incorporate service use into their everyday lives (Heinonen et al. 2013; Heinonen and Strandvik, 2015). Tommasetti et al. (2017) argues this sub-dimension has a greater bearing on co-creation when customers' value creation involves continuous provider interactions.

Tommasetti et al. (2017) conceive of the sixth activity of co-production in terms of supporting service delivery and co-designing value offerings, in line with prior SDL research (Vargo and Lusch, 2016; Osborne et al. 2016). The seventh, co-learning, reflects customers actively collecting information from external sources to providers. These sources can be social in nature, in line with social value co-creation of service logic (Grönroos and Voima, 2013). The first sub-component of sharing information is grounded in the idea that the value creation processes of social actors can become intertwined (Grönroos, 2017) and the second, feedback, forms a provider's value-in-use (Grönroos and Voima, 2013). The last dimension of this activity is connection, which relates to the "effective relations between participants involved in the process" (Tommasetti et al. 2017, p492). During co-creation, connections can offer providers access to public and private resources (Vargo and Lusch, 2011). This activity can in turn be broken down into building and relationship maintenance.

Figure 16. Measurement framework for customer value co-creation activities



Source: Tomasetti et al. (2017, p935)

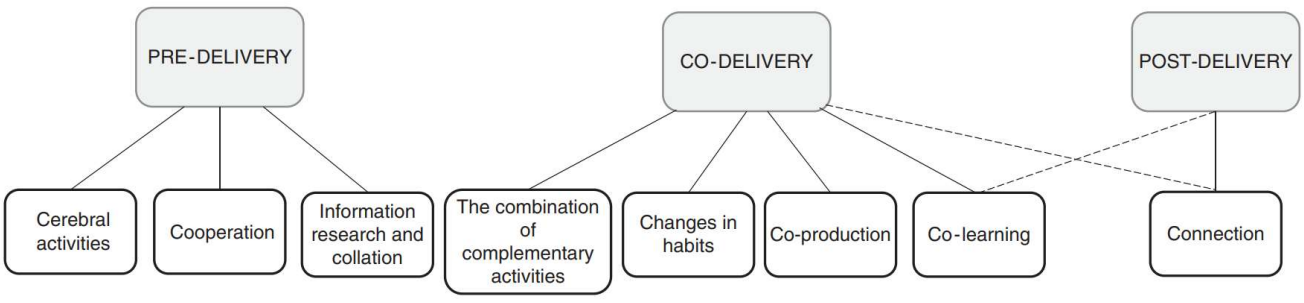
Reflecting on Tommasetti et al.'s (2017) co-creative activities with respect to public transport research offers insights for the thesis. With regards to the co-creative activity of cooperation, Echeverri and Skålén (2011) have emphasised the importance of passengers' cooperating with service personnel, in the form of acknowledging and abiding by service procedures during the interaction practices of informing and charging, respectively, to support co-creation in bus services.

For the activity of combining complimentary activities, research in rail services has noted the importance of passengers' engaging in supplementary activities to enhance their interactions with TOCs (Alexander and Jaakkola, 2014). Alexander and Jaakkola (2014) showcase this activity from rail passengers during the engagement behaviour of mobilising, as passengers' orchestrated interactions with stakeholders to enhance their interactions with TOCs and gather community support for common causes.

Lastly, for the co-creative activity of co-learning, Lu et al. (2015) has noted passengers engaged in knowledge sharing after journeys to offer travel advice to online followers and generate social value for themselves, resonating with the sub-dimension of information sharing. Additionally, Nunes et al. (2014) and Stelzer et al. (2015) have promoted the importance of passenger feedback for TOCs as passengers offered real-time updates on service delivery (e.g., on driver competency, carriage cleanliness, etc) and reported service errors, respectively. On this note, Alexander and Jaakkola (2014) also present the importance of passenger feedback via the engagement behaviour of co-developing. This engagement behaviour benefited passengers by promoting services more closely aligned with their usage needs and TOCs by supporting the product market fit of rail services on offer (Alexander and Jaakkola, 2014). This last point emphasises the double dividends of co-creation in rail services, specifically, as it can benefit both passengers and TOCs simultaneously, a point voiced by Gebauer et al. (2010).

Tomasetti et al. (2017) also examined co-creation activities with regards to stages of service use (i.e. pre-delivery, co-delivery and post-delivery) (Figure 17). During pre-delivery, customers' co-creation activities tend to enable positive attitudes (cerebral activity) whilst meeting the basic requirements to use services (cooperation) and performing preliminary information searchers (searching information). During service use, described as co-delivery, customers make use of complementary activities and change daily habits to use services (at a pragmatic or deeper level in their everyday lives). During this stage, customers may co-produce value offerings, support service delivery or offer feedback to providers and social actors. Tomasetti et al. (2017) also suggest that during post-delivery co-creation activities tend towards building and maintaining relationships with providers, noting that this stage may entail co-delivery, as customers offer feedback on their service use, which contributes to co-creation via co-learning.

Figure 17. Value co-creation activities divided into three provision phases



Source: Tommasetti et al. (2017, p944)

3.3 Value co-creation in public-transport services

At present, there is limited academic research that has specifically explored value co-creation in public transport services. Gebauer et al.'s (2010) case study of the Swiss Federal Rail Service (SBB) has examined how the TOC supported passengers' value creation and service experiences to increase users' satisfaction, which acted as the impetus for this thesis. Echeverri and Skålén (2011) have also examined both co-creation and co-destruction in public services and focused on how customer-personnel interactions contributed to both phenomena. Due to the lack of literature, a thorough discussion of the specifics of both papers will be useful at this juncture.

Gebauer et al.'s (2010) case study has outlined the numerous strategies implemented by the SBB for enhancing rail passengers' value creation and service experiences. These strategies were retrospectively inferred via passenger testimonials and market reports to increase passenger satisfaction and SBB's operational performance (e.g., number of passenger trips).

For customer experience, Gebauer et al. (2010) detail how SBB improved late night passengers' experiences by installing improved lighting systems at stations. SBB also enhanced their existing rail city concept by supporting passengers' pre- and post-service experiences through various initiatives (e.g., Click and Drive; CarSharing; Park and Rail; RailTaxi; Rent a Bike and Bike Parking). These initiatives offered holistic support, a practical application that finds affinity with conceptual interpretations of customer experience (Kuppelwieser and Klaus, 2014) and supports the experience enabler of linkages between service events (Prahalad and Ramaswamy, 2004). Each initiative was designed to support passengers' different preferences, which in turn draws on the experience enabler of granularity as well (Prahalad and Ramaswamy, 2004), to increase passenger satisfaction.

For customer engagement, SBB enacted several strategies for improving passengers' engagement with rail services beyond transactions. The TOC implemented a free hotline for receiving passenger feedback and began actively reaching out to over 2,000 passengers per month. In response to passenger feedback, SBB deployed a homecoming service for passengers that missed their last trains due to transport delays. When this service was unavailable, free taxis or hotels were offered. For co-design, SBB created a single contact point to liaise with other organisations, thus enabling the TOC to organise rail services

alongside major event organisers and to facilitate co-designing rail services around attendees' needs.

Specifically for disabled passengers, SBB co-designed its MobilPlus app alongside disability organisations. This offers disabled passengers convenient access to travel information (e.g. disability-friendly taxis, disabled access) tailored specifically to their individual needs. For its travel card initiatives, SBB engaged passenger communities to co-design travel schemes, culminating in its travel card finder system, as well as a point-to-point ticketing system that allows regular passengers to purchase pre-paid weekly tickets for specific journeys. This speaks to research that champions the operant resources that passenger communities contribute to co-creation in rail services in terms of feedback for service development (Alexander and Jaakkola, 2011; Nalmpantis et al. 2019).

SBB also implemented several simple but effective self-service related strategies. The TOC installed baskets on carriages for passengers to dispose of and collect free newspapers, as well as bespoke travel cards, similar to TfW's smartcard schemes (Transport for Wales, 2020c). They also installed more self-service machines throughout their network that supported various payment methods, thus paying attention to the granularity of passengers' preferences. Finally, they implemented several mobile travel applications, similar to TfW's own mobile travel application (Transport for Wales, 2021c). To support problem-solving, SBB leaned on self-service mechanisms, highlighting the double dividends of supporting self-service in rail services for TOCs. An easy to use lost-property system allowed passengers to quickly report lost-property and personalised barcodes expedited the return of lost items.

SBB also reformed its procedures for assisting customers with ticket refunds by creating a database of annual travel cards accessible to ticket conductors. This stopped passengers from purchasing unnecessary tickets in the event of a lost or forgotten travel card, a measure that resonates with Prahalad and Ramaswamy's (2004) recommendation for providers to archive customer information to support service delivery and development. In response to overcrowding on carriages, the TOC implemented NaviGo, a mobile application that tracks seating capacity, like TfW's Capacity Checker (Transport for Wales, 2020b). Transport for London has piloted a similar scheme that monitors passenger traffic through Wi-Fi usage (Transport for London, 2017) and Nunes et al. (2014) have shown the value of leveraging passenger's real-time feedback for monitoring rail services.

The discussion now focuses on Echeverri and Skålén (2011), which has examined how different interaction practices contribute to value co-creation and co-destruction in bus services. By analysing qualitative interviews with passengers and drivers, the study found that the practices of informing, greeting, charging, delivering and helping contribute to value co-creation and co-destruction (Figure 18). The analysis understood these practices as comprised of procedures (e.g. explicit rules, principles), understandings (e.g. knowledge of what to say and do, know-how) and engagements (ends and purposes that actors are committed to). Congruent approaches to procedures, understandings and engagements by passengers and drivers led to co-creation and incongruence led to co-destruction.

For the practice of informing, Echeverri and Skålén (2011, p16) found passengers' initial interaction with drivers entailed "shar[ing] information regarding issues related to the service – in our case, timetables, prices, traffic jams, etc". Congruent dialogue, which aligned with cultural norms, supported co-creation, whereas co-destruction occurred when dialogue included language not aligning with cultural norms and as passengers showed ignorance for boarding procedures. Wider marketing research emphasises the importance of this interaction practice during co-creation, as customers' initial information sharing forms a necessary behaviour for co-creation to commence (Yi and Gong, 2013) and as customers continuously cooperate with service personnel (Tomassetti et al. 2017).

The practice of greeting referred to verbal and non-verbal communications between passengers and drivers. During value co-creation, Echeverri and Skålén (2011, p19) found the "co-creative potential of this practice is realized when mutual greeting behaviour is in line with organizational instructions and cultural norms". Thus, co-creation emerged from this practice by both passengers and drivers holding congruent understandings of acceptable greetings. During co-destruction, incongruence emerged from "divergent understandings and more or less conflicting procedures" in terms of appropriate greetings (Echeverri and Skålén, 2011, p20). SDL has noted the significance of shared language between actors for supporting exchanges (Lusch and Vargo, 2014) and Bharti et al. (2015) has included communication and dialogue as a sub-dimension of interactive environments that drive co-creation.

The study shows the practice of delivering entails "extensive interaction, especially in situations involving service breakdowns" (Echeverri and Skålén, 2011, p21) as delivery reflects the core value offering (i.e. of personal transportation). Curiously, the study found it was not necessarily the failure of providers delivering services (e.g. in the contexts of

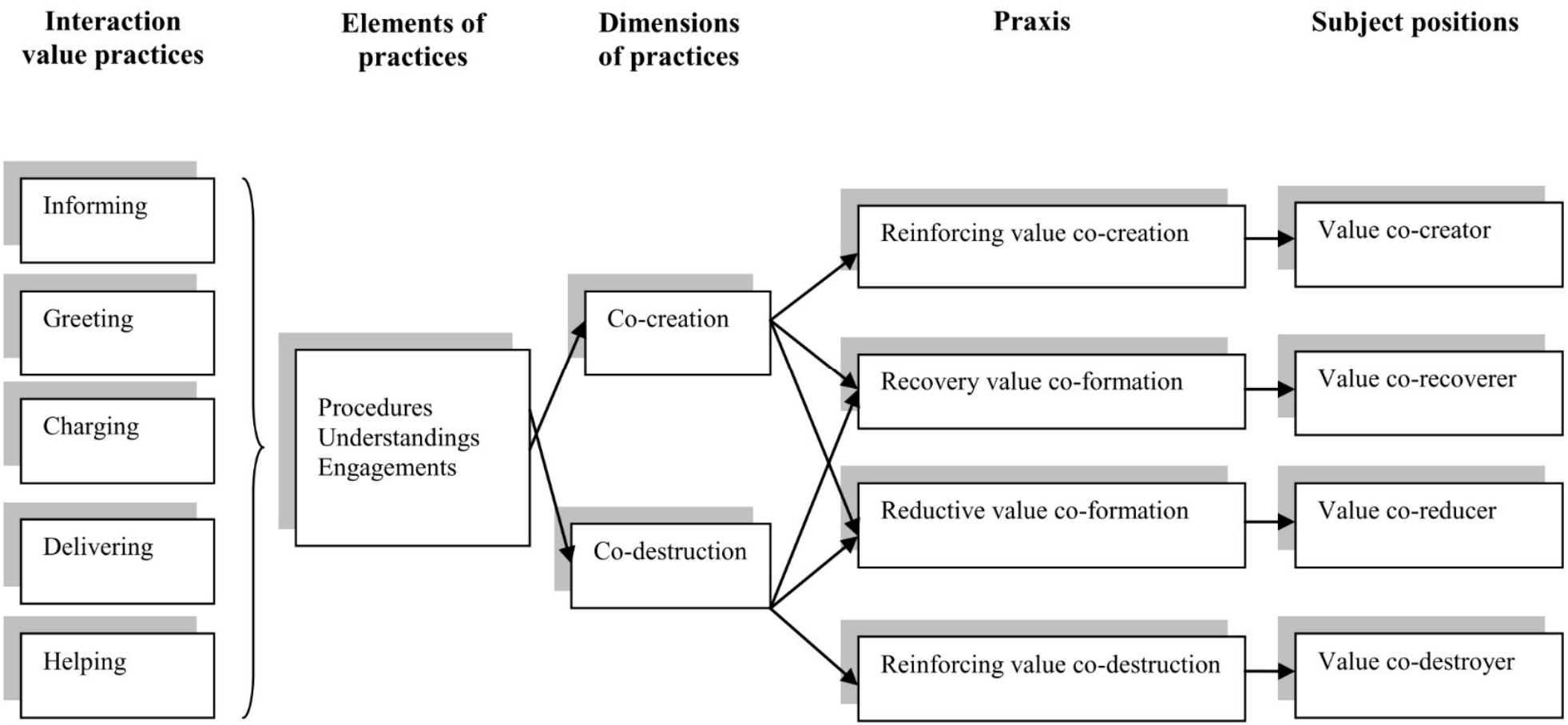
breakdowns) that led to co-creation or co-destruction; but the ways in which service failures were then addressed was of equal importance. During breakdowns or traffic, mutual understanding from passengers and personnel in terms of adapting accepted practices was enough to support co-creation (Echeverri and Skålén, 2011). In contrast, failure to adapt these practices, or strict adherence to procedures, often led to co-destruction. This was particularly apparent when procedures failed to account for service contexts or passengers' experiences. This finding notably aligns with public transport research on co-recovery, which shows the contexts of service delay (i.e., length and cause of delay) moderates the extent co-recovery increases passengers' satisfaction with recovery outcomes (Roggeveen et al. 2011).

The practice of charging entailed the "interactive procedure of paying, checking, and issuing tickets, in which both customers and drivers are involved" (Echeverri and Skålén, 2011, p23). This practice led to co-creation when "the procedure of charging is explained, understood and accepted" by passengers as personnel offered a supportive attitude (Echeverri and Skålén, 2011, p23). Conversely, co-destruction emerged when incongruent understandings of payment methods were present, particularly regarding the use of machines (e.g. coin collectors, card readers).

The practice of helping refers to personnel assisting passengers. Although at first this may lead to co-creation, Echeverri and Skålén (2011) found it to potentially elicit co-destruction. From the passenger's perspective, drivers that showed willingness and proactivity to help most often elicited co-creation. For the driver, passengers who showed attention to rules for travel most often elicited co-creation. Co-destruction occurred, however, when parties held incongruent understandings of operating procedures or failed to account for contextual factors. For example, the authors noted that co-destruction emerged when passengers felt they did not need assistance, and so it was not necessarily the "absence of help, rather the way it is conducted" that led to co-creation or co-destruction (Echeverri and Skålén, 2011, p26). The notion that it is the nature of interactions that determines co-creation, rather than the presence of interactions themselves, resonates with Grönroos (2011) that highlights interactions only act as platforms for favourably influencing customers' value creation.

Overall, Echeverri and Skålén (2011) offer valuable insights on how co-creation and co-destruction emerges in public transport. The discussion now pivots to research focusing on co-design and co-recovery in public transport services.

Figure 18. Relationship between practices, elements of practice, dimensions of practice, praxis and subject positions



Source: Echeverri and Skålén (2011, p42)

3.4 Co-Design and co-recovery in public transport services

Public transport research has examined co-creation in two notable service processes: co-design and co-recovery (Gebauer et al. 2010; Mitchel et al. 2015; Bowen et al. 2022; Roggeveen et al. 2011). Co-creation during co-design is the primary focus in this thesis, but co-recovery features too, albeit to a lesser extent, as both contribute to increasing passenger satisfaction in public transport (Gebauer et al. 2010; Roggeveen et al. 2011). In public services, Osborne, Nasi and Powell (2021) have argued that co-design is a manifestation of co-production, and earlier research has outlined how co-design, as a manifestation of co-production, helps to tailor value offerings to end-users' needs (Osborne, Radnor and Strokosh, 2016).

In rail services, co-design allows passengers to collaborate with TOCs and it "assists customers' to use or reconfigure their value-creating resources more effectively" (Gebauer et al. 2010, p517). Mitchell et al. (2015) have explored the co-designing of sustainable transport solutions in both bus and train services, structured in terms of the stages of initial engagements via iterative email surveys; selecting passenger cohorts; cohort pre-screening to allocate passengers to usage frequency; story creation to form a narrative; problem solving and context setting through group interviews; problem understanding to co-design solutions; and, finally, reflecting on potential solutions.

In analysing co-design whilst developing travel applications for bus passengers, Zimmerman et al. (2011) found passengers offered important feedback on issues ranging from broken seats to operational errors like incorrect onboard announcements. Hildén et al. (2018) have also described how co-design can be implemented in bus services to tailor digital travel applications to passengers' needs. Through engagement workshops and context cards, the authors identified the underlying themes of offering accessible travel information, entertainment, supporting C2C interactions between passengers, offering multiple channels of communications with TOCs and establishing more auxiliary services. The theme of supporting interactions between passengers resonates with the concept of social value co-creation (Grönroos and Voima, 2013). Furthermore, the theme of offering multiple communication channels echoes Prahalad and Ramaswamy's (2004) experience enabler of granularity, as communication channels may be tailored to match each passenger's communication preference.

In the Philippines, Perez, Clarice and Tiaglo (2021) have illustrated the significant role of co-design in public transport and, like Mitchel et al. (2015), detailed its different stages. Perez et al. (2021) delineated co-design in terms of the stages of understanding, defining, diverging (i.e. where passengers discuss alternatives developed during co-production), deciding, prototyping and validating. In the northeast of England, Bowen et al. (2022) have illustrated how co-design can be applied on a large scale in rail services through a variety of digital and physical passenger channels. Bowen et al. (2022) found co-design was facilitated by TOCs and national research organisations using collaborative recording channels (i.e. JigsAudio, Bootlegger) alongside mass digital platforms for collecting feedback (e.g. ThoughtCloud, bespoke websites seeking feedback). The above frameworks (Mitchell et al. 2015; Perez et al. 2021; Bowen et al. 2022) offer transport operators a valuable and actionable guide for how co-design may be harnessed to make service improvements that to better meet passengers' needs.

Outside active public transport services, co-design has been used to support service development. Nalmpantis et al. (2019) have applied a multi-criteria decision analysis to examine how passengers in Greece, Italy, the Netherlands and Germany viewed potential service improvements. By surveying passengers on their perceived value of possible service improvements in terms of feasibility, utility and innovativeness, they found passengers arrived at a consensus. Passengers valued utility most highly, then feasibility and innovativeness. Oliveria, Bruen, Birrell and Cain (2019) have applied the same approach in UK rail services. Having interviewed over 300 rail passengers, they found passengers ranked automated compensation schemes the highest and pre-ordered special services the lowest.

Public transport research has also found co-recovery, which reflects customers co-creating solutions to service failure (Dong et al. 2008; Tronvoll and Edvardsson, 2019), potentially increases passengers' satisfaction with recovery outcomes (Roggeveen et al. 2011). Outside public transport, Tronvoll and Edvardsson (2019) have applied SDL to examine factors that drive co-recovery from a customer's perspective in retail services. The study found the themes of competence, control, communication, clock (time) and cost drove customer's engagement in co-recovery. Subsequently, their study developed an empirical model of co-recovery which centralises customers' perceived control.

Tronvoll and Edvardsson (2019) argued that the three stages of creating, coordinating and reassuring constitute co-recovery. Providers must first provision customers with the

necessary resources to obtain favourable recovery experiences (i.e. creating), followed by coordinating resources through an interactive process to enable co-recovery (i.e. coordinating). Providers should then reassure customers about the favourable service recovery experience by offering supporting updates and being receptive to feedback for improving recovery procedures.

In public transport, Roggeveen et al. (2011) have explored co-recovery in airline services using scenario-based experiments, building on prior co-recovery research by Dong et al. (2008), and using vignettes to survey respondents on their perceptions of the co-recovery process. The study found co-creation improves passengers' satisfaction of recovery outcomes even when service failure was not attributed to passengers. Roggeveen et al. (2011) also found the relationship between co-recovery and passenger satisfaction was moderated by the severity of service failure (i.e. the length of delay). From its analysis, the study found co-recovery improved passengers' post-recovery evaluations when delays were severe but not short.

Roggeveen et al. (2011) extended its analysis to examine whether co-recovery may ever harm passenger's post-recovery outcomes. Indeed, when passengers perceived collaborations negatively during less severe delays, co-recovery harmed post-recovery valuations. This led the authors to recommend that transport providers be "aware of their customers' perceptions of co-creation efforts" as they may ask for additional compensation (Roggeveen et al. 2011, p782). Thus, in public transport, although co-recovery offers transport providers an effective tool for supporting service recovery, its impact on customers' evaluations depend on context (i.e. severity of service failure of nature of collaboration).

Having reviewed research on co-creation in services from a provider's and a customer's perspective, as well as on the application of co-creation to co-design and co-recovery in public transport, the thesis will ground its later managerial implications in this literature to offer strategic options for supporting passengers' value creation and increasing satisfaction. The next chapter focuses on the thesis's conceptual model and how it was developed.

Chapter Four - Conceptual Model Development

Chapter Four - Conceptual Model Development

4.1 Introduction

The thesis examines holistic value creation, as a summation of passengers' separate value creation processes, in relation to customer experience, passenger satisfaction, and engagement behaviours in rail services. Holistic value creation comprises the processes of co-production; positive value-in-use; value co-creation; independent value creation; social value co-creation and negative value-in-use. Together, these form the customers' value creation sphere (Grönroos and Voima, 2013), which the thesis refers to as holistic value creation. Although each process forms a significant part of customers' value creation, the relative contributions of each process to holistic value creation is empirically unknown.

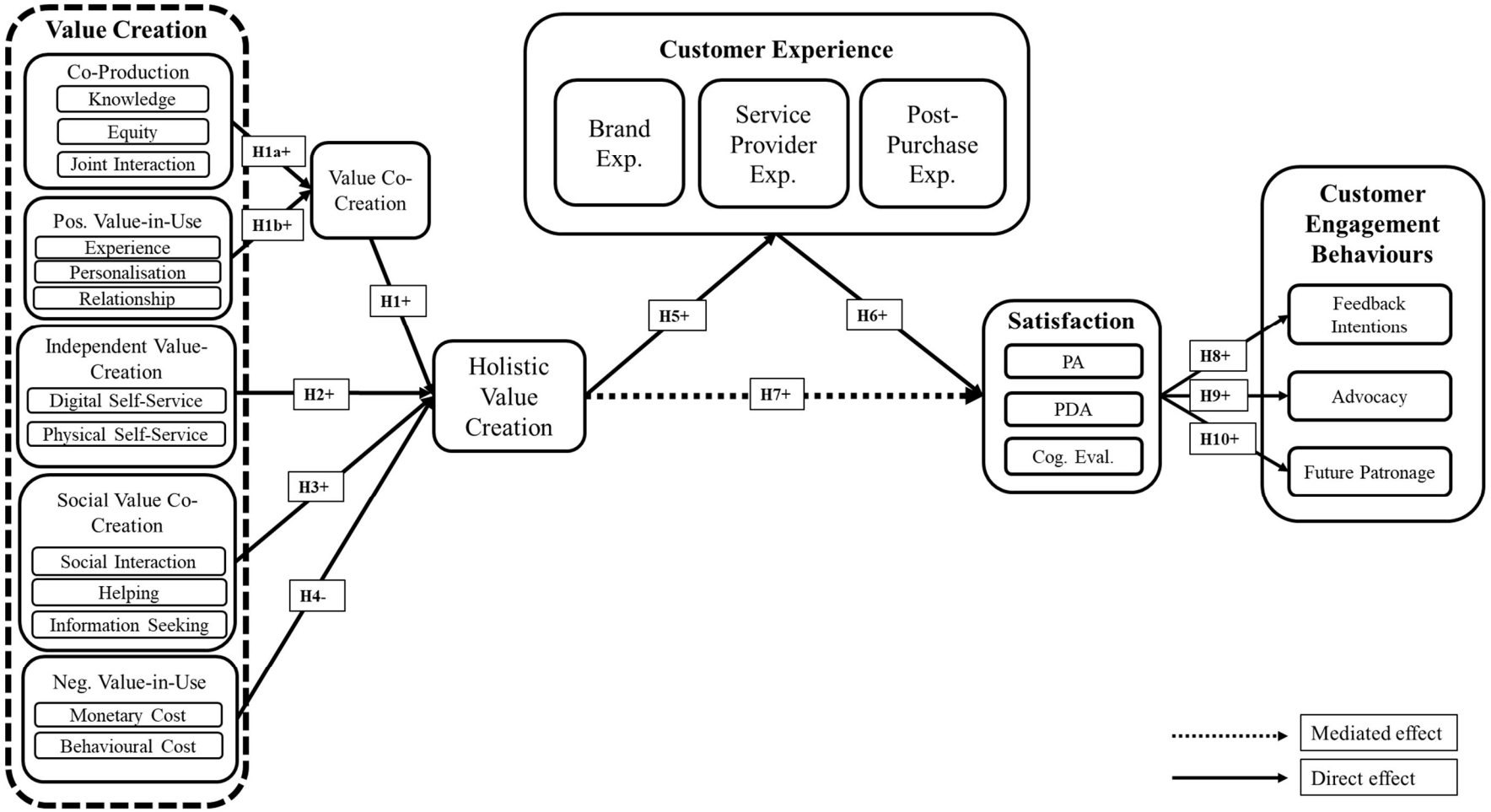
Marketing research has taken a segregated approach to examining the relationships between value creation, customer experience, satisfaction, and engagement behaviours (Akesson et al. 2014; De Keyser et al. 2015; Kuppelwieser et al. 2021; Solakis et al. 2021). However, at present, it has yet to consider value creation holistically or take a comprehensive approach to examining the inter-relationships between these constructs. This gap is also present in public transport research (Alexander and Jaakkola, 2014; Lu et al. 2015; Gürler and Erturgut, 2018; Ittamalla and Kumar, 2021), which has not considered value creation holistically, or comprehensively explored its relationships with passengers' service experiences, satisfaction, and engagement behaviours. The thesis aims to fill these gaps in marketing and public transport research.

The conceptual model developed by the thesis uses the Gronroos-Voima value model (Grönroos & Voima, 2013) (Figure 5) to understand passengers' holistic value creation. Additionally, the model incorporated the constructs of customer experience (Lemon and Verheof, 2016; De Keyser et al. 2020), passenger satisfaction (Ollsson et al. 2012) and the three customer engagement behaviours of feedback intentions, advocacy and future patronage (Yi and Gong, 2013; Vivek et al. 2014; Alexander and Jaakkola, 2014). This was undertaken to offer an integrative approach to understanding rail passengers' behaviour.

This chapter is divided into seven sections. The introduction section summarises the structure of the chapter. The second section discusses holistic value creation and its four components: value co-creation (which comprises co-production and positive value in use), independent value creation, social value co-creation, and negative value-in-use. Section three reviews research on customer experience highlighting the scarcity of this literature in public transport. It also addresses the relationship between holistic value creation and customer experience. Section four reviews research on customer and passenger satisfaction. Next, section five focuses on the relationship between customer experience and customer satisfaction, and section six focuses on the relationship between holistic value creation and customer satisfaction, mediated by customer experience. The final and seventh section introduces the concept of customer engagement and specifically customer engagement behaviours, focusing on the relationships between passenger satisfaction and three engagement behaviours: feedback intentions, advocacy and future patronage.

At present there is no single operationalised model that incorporates these constructs. The study aims to develop a comprehensive yet parsimonious model for understanding passengers' value creation in relation to customer experience, passenger satisfaction and customer engagement behaviours (Figure 19). Given the scale of the model, additional figures are presented throughout the chapter, for each section, to support clarity.

Figure 19. Conceptual model of the study



Source: Own illustration of conceptual model developed by the thesis. Note: Positive Activation (PA), Positive Deactivation (PDA), Cognitive Evaluation (Cog. Eval)

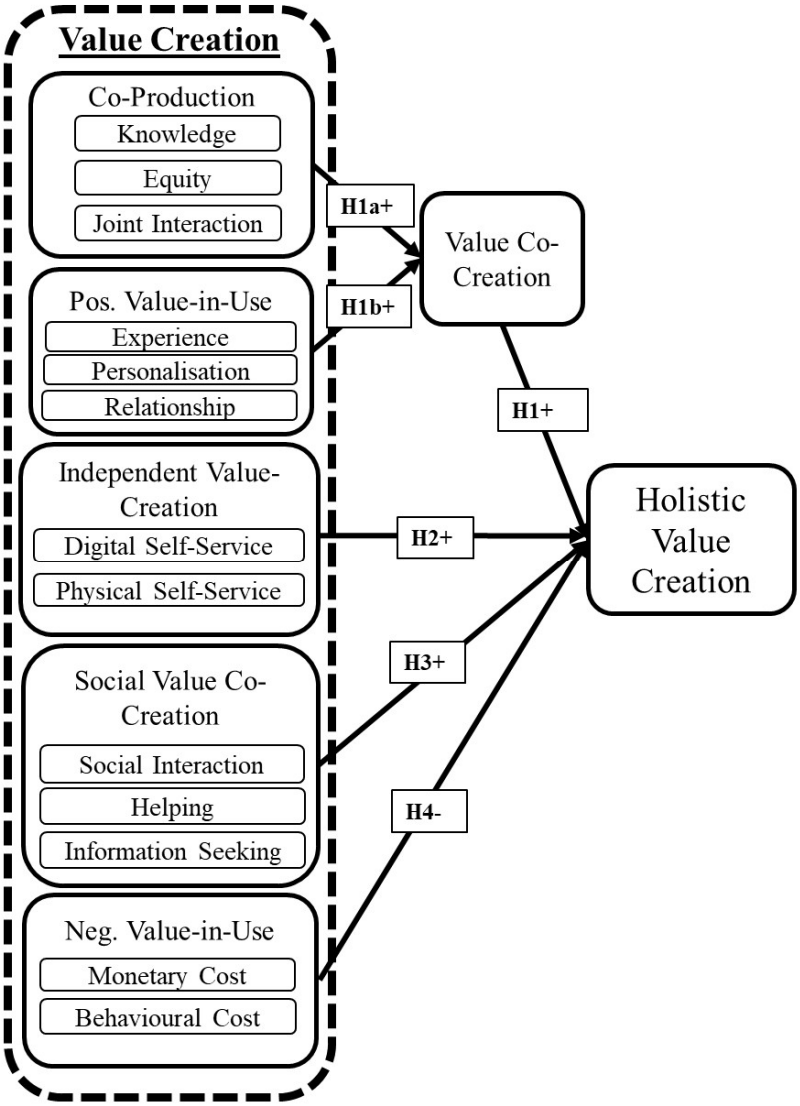
4.2 Conceptualising holistic value creation

As discussed in Chapter 2, research places a heavy focus on value co-creation (Vargo and Lusch, 2014), which comprises customer-providers interactions that co-produce value offerings and the experiential value that emerges for customers during use (Ranjan and Read, 2014). In service logic, this is referred to as joint value co-creation and resides within the overlap between a providers' and customers' value creation spheres (Grönroos and Voima, 2013). Customers' value creation can also emerge explicitly within their own value creation sphere, in the absence of provider interactions, during independent value creation and social value co-creation (Gronroos and Voima, 2013; Grönroos and Gummerus, 2014). Independent value creation emerges during lone resource use and occurs when customers take on a dominant role during resource integration (Mcosker et al. 2014).

Social value co-creation emerges as the value creation processes of focal and other customers intertwine to co-create value (Grönroos and Gummerus, 2014). This process can emerge under numerous contexts and interaction typologies and can lead to both positive and negative value outcomes for focal customers (Heinonen et al. 2018; Pandey and Kumar, 2021). Lastly, value does not always emerge positively, but can also emerge negatively, leaving customers feeling worse off from using services (Sweeney et al. 2018; Medberg and Gronroos, 2020). This has been coined negative value-in-use by service logic (Grönroos and Voima, 2013) and represents a sacrifice or cost for customers (Plewa et al. 2018) that can emerge under various dimensions (Lero-Werolds, 2019).

From a theoretical perspective, the above processes form customers' value creation sphere overall (Grönroos and Voima, 2013), which is referred to by the thesis as holistic value creation. At present, the relative contributions of each value creation process to customers' holistic value creation is empirically unknown. At this point in the discussion, it is worth noting the thesis focuses on the customers' value creation sphere. As such, the thesis does not examine the providers' value creation sphere, where value facilitation occurs through resource provisioning (Grönroos, 2011) and only potential value-in-use resides (Grönroos and Voima, 2013; Grönroos, 2017). The thesis conceptualised holistic value creation in terms of: value co-creation (i.e., co-production and positive value-in-use); independent value creation; social value co-creation and negative value-in-use (Figure 20).

Figure 20. Conceptual model focusing on holistic value creation and its lower-order value creation processes

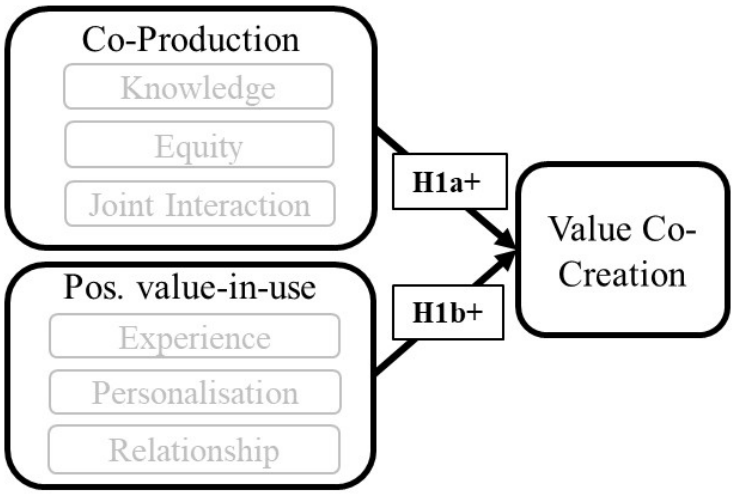


4.2.1. Conceptualising value co-creation

It will be helpful to start by conceptualising the first component of holistic value creation, i.e., value co-creation, since Chapter 2 reviewed research on the construct. Value co-creation is a set of "joint activities by parties involved in direct interactions, aiming at contributing to the value that emerges for one or both parties" (Grönroos, 2012, p1520). SDL has conceptualised co-creation from an economics perspective (Vargo and Lusch, 2004; 2008) and within the larger service ecosystem (Lusch and Vargo, 2014). The paradigm's initial version of FP6 describes a core dynamic of co-creation as customers co-produce value offerings by "learn[ing] to use, maintain, repair and adapt" them (Vargo and Lusch, 2004, p11). The fundamental nature of this dynamic is clear from the fact the FP is retained by

SDL's second axiom (Vargo and Lusch, 2014). SDL has conceptualised value co-creation as comprising the constructs of co-production and positive value-in-use (Figure 21) (Ranjan and Read, 2014) and this conceptualisation is discussed in the subsequent sections (4.2.1.1 & 4.2.1.2).

Figure 21. Conceptual model focusing on value co-creation



In service logic, co-creation has been conceptualised from a marketing perspective in terms of customer-provider interactions (Grönroos, 2011). In contrast with both, CDL has conceptualised co-creation from a customer's perspective (Heinonen et al. 2010; Heinonen et al. 2013) and added the novel dimension of presence that expanded its temporal and spatial parameters (Heinonen and Strandvik, 2015). The chapter will now consider previous research on co-creation with regards to customers' holistic value creation.

From the service logic perspective, Grönroos (2017) highlights that co-creation forms part of customers' overall value creation when direct and dialogical interactions are present. Such interactions enable providers to move from value facilitators, through resource provisioning, to value fulfillers (Grönroos, 2011). These interactions do not inherently form co-creation, but instead act as "platform[s] for favourably influencing the customers' usage process and value creation" (Grönroos, 2011, p290). Thus, when such interactions are positively leveraged, providers may become active co-creators of value alongside customers, leading co-creation to positively contribute to value creation for customers (Grönroos and Voima, 2013). In public transport, co-creation has been noted to enhance passengers' value creation (Gebauer et al. 2010), providing interactions between passengers and service

personnel are harmonious, whilst inharmonious interactions can lead to co-destruction (Echeverri and Skålén, 2011) (Chapter 3).

A noteworthy conceptual development of co-creation, in relation to holistic value creation, comes from Heinonen and Strandvik' s (2015) dimension of presence. Heinonen and Strandvik (2015) propose asynchronous co-creation, whereby providers may monitor and tailor resource offerings to customers' needs without explicit interactions. Although it falls outside of service logic's explicit definition of co-creation, the notion of asynchronous co-creation gestures to the wide range of contexts from which customer-provider interactions emerge and may contribute to customers' overall value creation.

In summary, research in SDL, service logic and CDL have emphasised the influential ways in which co-creation positively contributes to holistic value creation (Ranjan and Read, 2014; Grönroos and Voima, 2013; Heinonen and Strandvik, 2015), and this is also present in public transport services (Gebauer et al. 2010; Echeverri and Skålén, 2011). Thus, the thesis hypothesised:

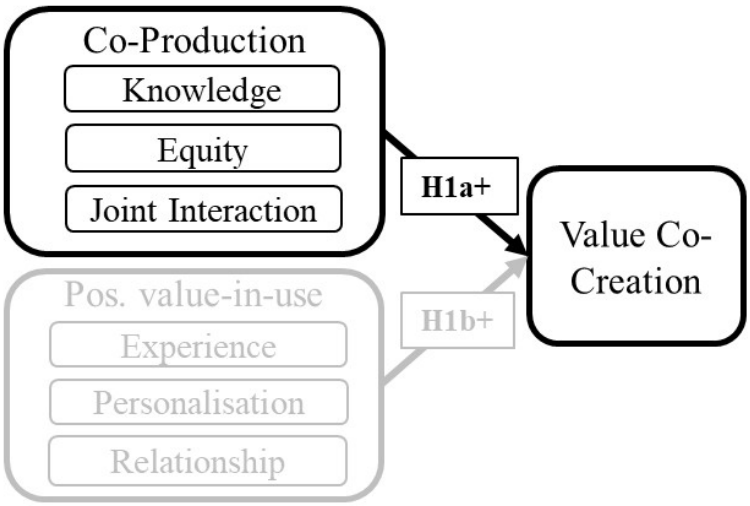
H1: Value co-creation will positively relate to holistic value creation

4.2.1.1 Conceptualising co-production

Co-production has been conceptualised in various service settings. In financial services, it has been defined as "constructive customer participation in the service creation and delivery" through cooperative interactions (Auh et al. 2007, p361). In hospitality services, it has been described as reflecting one polar end of a continuum, compared to co-creation, as customers "can assist the company in the service-provision process" by interacting with service environments (Chathoth et al. 2013, p14).

Early SDL research emphasised co-production in its sixth FP, that is "the customer is always a co-producer" (Vargo and Lusch, 2004), although this was later revised to imply that customers are always co-creators of value (Vargo and Lusch, 2008). Later SDL research has clarified co-production as referring to "the creation of the value proposition—essentially, design, definition, production, etc" (Vargo and Lusch, 2016, p8). Ranjan and Read (2014) conceptualised co-production using the constructs of knowledge, equity, and joint interaction, forming — respectively — the basis for transferring operant resources, empowering customers and supporting resource exchanges during co-creation (Figure 22).

Figure 22. Conceptual model focusing on co-production



Research has also examined co-production in public services, specifically. In public services, like transport, Public Service Dominant Logic (PSDL) has conceptualised co-production in terms of its voluntary and involuntary nature, with co-production arising from end-users voluntary engagement and involuntary value perceptions, respectively (Osborne et al. 2016). This research described customers' value perceptions as representing involuntary and pure co-production. In contrast, Vargo and Lusch's (2016) idea of the construct, in terms of designing, defining and producing value offerings, represents voluntary co-production from the perspective of end-users of public services (Table 7) (Osborne et al. 2016).

Table 7. Conceptual quadrants of co-production in PSDL

		Locus of co-production		Towards the co-creation (or co-destruction of value)
		Individual service	Service system	
Nature of co-production	Involuntary	Co-production	Co-construction	
	Voluntary	Co-Design	Co-innovation	

Source: Osborne et al. (2016, p645)

In service logic, co-production has been conceptualised in terms of customers' service use and resource integration (Grönroos, 2011; Grönroos, 2012) and this research has been extended to public services via public service logic (PSL) (Osborn, Nasi and Powell, 2020). Differing from Osborne et al. (2016) that used Public Service Dominant Logic, Osborne et al. (2020) applied public service logic to explore how public services are produced via

interactions with end-users during co-production and co-design. Osborne et al. (2020) shows that co-production can involve end-users supporting service delivery, in line with SDL's conceptualisation of the construct in terms of supporting service delivery (Vargo and Lusch, 2016). Interestingly, Osborne et al. (2020) also highlights the potential for co-production to promote end-users future service use with less assistance from providers. This point is illustrated in rail services, as co-creation has been shown to empower passenger communities and promote passenger's value creation with less assistance from TOCs (Alexander and Jaakkola, 2011). Lastly, Osborne et al. (2020) notes that co-design can enhance end users' value-in-use and value-in-context through citizen involvement, which reflects a sub-dimension of co-production, as highlighted in Chapter 3 (Bharti et al. 2015).

In public transport, Echeverri and Skålén (2011, p43) have shown the interaction practice of delivery supports co-creation and defined the practice as the "collaborative production of the transportation service". Although Echeverri and Skålén (2011) did not explicitly use the term co-production, this description aligns with SDLs and PSLs definition of co-production in terms of supporting service delivery (Vargo and Lusch, 2016; Osborne et al. 2020). As previously discussed, PSDL has argued co-production can also manifest via co-design, as end-users voluntarily interact with public service organisations to develop value offerings (Osborne et al. 2016) (Table 7). Given this, the discussion now turns to co-design as a form of co-production in public transport services, with respect to co-creation.

In Chapter 3, the discussion highlighted SBB's use of co-design to support passengers' co-creation in rail services (Gebauer et al. 2010). In the Philippines, Perez et al. (2021) have examined co-design in terms of different phases as passengers evaluated potential service improvements, which when implemented, supported co-creation in bus services. In Finland, Hildén et al. (2018) have studied both co-design and co-production whilst developing digital travel applications at passenger workshops to better identify passenger needs. Nalmpantis et al. (2019) have even stressed the significance of co-design outside of active public transport services, with passengers forming a consensus of ranked priorities for service improvements to develop better fitting public transport services. This research highlights the significant role of co-design, as a manifestation of co-production, during passengers' co-creation in public transport services.

Overall, research has examined co-production in terms of customers supporting service delivery and developing value offerings (Grönroos, 2011; Vargo and Lusch, 2016).

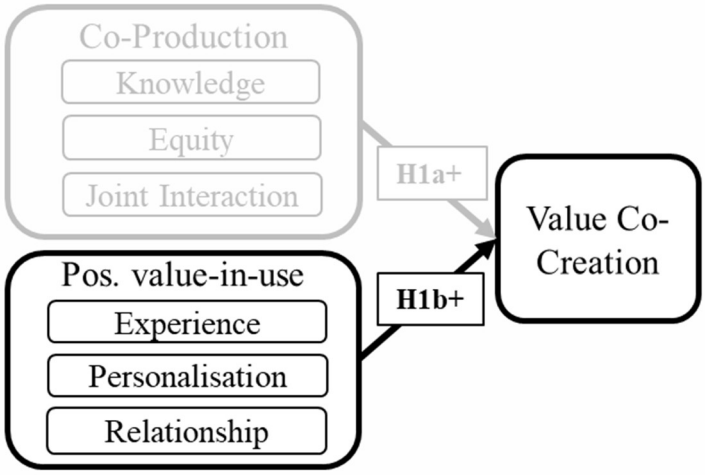
SDL research has examined co-production it in terms of the constructs of knowledge, equity and joint interaction (Ranjan and Read, 2014). In public services, research has argued co-production emerges in both voluntary and involuntary manners (Osborne et al. 2016) that contributes to end-users' value outcomes (Osborne et al. 2020). As co-production also supports passengers' co-creation in public transport specifically (Gebauer et al. 2010; Echeverri and Skålén, 2011; Mitchel et al. 2016; Hildén et al. 2018) the thesis hypothesised:

H1a: Co-production will positively relate to value co-creation

4.2.1.2 Conceptualising positive value-in-use

Early research conceptualised value-in-use as the "use of a product or service in a situation to achieve a certain goal or set of goals" (Flint et al. 1997, p170). In SDL, value-in-use has been conceptualised as "the sum of all the functional and emotional experience outcomes" after value offerings are filtered through customers' idiosyncrasies (Sandstrom et al. 2008, p120). More recently, Ranjan and Read (2014) have conceptualised positive value-in-use as representing the experiential value that emerges for customers during use, in terms of the constructs of experience, personalisation and relationship (Figure 23)(Chapter 2). CDL and service logic have conceptualised positive value-in-use as a process that accumulates in a dynamic, processual and longitudinal manner (Grönroos & Voima, 2013; Heinonen and Strandvik, 2015).

Figure 23. Conceptual model focusing on positive value-in-use



In service logic, positive value-in-use represents a process by which customers "feel or are better off than before" service consumption (Grönroos, 2008, p303). Later service logic

research defined the construct as "value that emerges, is created or realised by the customer during their usage of resources" (Sweeney et al. 2018, p1101) and has suggested it holds a close relationship with service quality (Medberg and Grönroos, 2020). In public services, PSL has examined the experiential value for end-users in terms of co-experience (i.e., value-in-use) and co-construction (i.e., value-in-context) (Osborne et al. 2020). Osborne et al. (2020) contended value-in-use emerges during the end-users' whole-life experiences and may be co-created through continuous interactions with public service organisations. This is in line with CDL research, which conceives of value-in-use more expansively in terms of "everything that a company does that the customer can use in order to improve his life or business" (Heinonen et al. 2010, p 543) and how providers may co-create value-in-use by being present in customers' everyday lives (Heinonen and Strandvik, 2015) (Chapter 2).

Ranjan and Read (2014) have argued value-in-use contributes to co-creation by generating memorable and idiosyncratic experiences for customers via iterative communication with providers, which relates to the constructs of experience, personalisation and relationship. Thus, value-in-use contributes to co-creation by enabling customers to "assess and determine the value of a proposition on the basis of their specificity of usage" (Ranjan and Read, 2014, p293). Grönroos's (2017) micro-analysis positioned value-in-use in the joint sphere of value creation, whilst indicating its characteristics during co-creation depend on the nature of interactions with providers. This perspective extends to public transport services, as transport operators can fulfil passengers' value-in-use when co-creative interactions are correctly leveraged (Gebauer et al. 2010; Echeverri and Skålén, 2011; Alexander and Jaakkola, 2011) (Chapter 3).

Overall, research has conceptualised positive value-in-use from a variety of perspectives (Sandstrom et al. 2008; Heinonen et al. 2013; Ranjan and Read, 2014; Grönroos, 2017) and shows how it can positively contribute to co-creation via the constructs of experience, personalisation and relationship (Ranjan and Read, 2014; Grönroos, 2017). In public services, PSL has argued experiential value for end-users emerges in their whole life experiences, which may include continued interactions with public service organisations (Osborne et al. 2020). This proposition extends to public transport, as passengers' value-in-use can include co-creative interactions with transport providers (Gebauer et al. 2010; Echeverri and Skålén, 2011). Thus, the thesis hypothesised:

H1b: Positive value-in-use will positively relate to value co-creation

4.2.2 Conceptualising independent value creation

Early service logic research argued customers can perform resource integration without interacting with providers, making them sole creators of value (Grönroos, 2006). Grönroos and Voima (2013, p143) described this process as independent value creation, since customers "create value independently of the service provider, in a one-sided process in which the customer interacts with the service provider's resources". As such, independent value creation emerges when there is "high levels of resource integration from the consumer, but negligible levels from the organisation" (McCosker et al. 2014, p3). During independent value creation, customers' behavioural and cognitive contributions most strongly relate to value outcomes (Zainuddin et al. 2016) and McCosker et al. (2014) argues self-service technology forms an appropriate context for examining the value creation process.

The thesis uses this latter point to conceptualise passengers' independent value creation during self-service. To highlight the contexts of passengers' independent value creation during self-service, the thesis applies De Keyser et al.'s (2020) touchpoint analysis. This shows passengers' independent value creation emerged from physical and digital self-service use (Table 8). Additionally, to offer a solid foundation for conceptualising independent value creation during self-service, a focused literature review was performed. This reviewed research in healthcare, retail, tourism and transport services, mainly from the paradigms of service logic and SDL (Table 9). From the touchpoint analysis and focused literature review, the thesis conceptualised passengers' independent value creation from self-service as positively contributing to holistic value creation (Figure 24). The discussion now reviews research on independent value creation during self-service, and later, focuses on public transport services specifically.

Table 8. Independent value creation from the perspective of De Keyser et al.'s (2020) touchpoint analysis applied to TfW's rail services

Pre-purchase	Purchase	Post-Purchase
Human Touchpoints	Human Touchpoints	Human Touchpoints
Physical Touchpoints	Physical Touchpoints	Physical Touchpoints
Digital Touchpoints • Capacity Checker (passive, pos / neg, short) • Timetable Info (passive, pos / neg, short) • TfW Travel App (passive, pos / neg, short / long)	• Station Signage (passive, pos / neg, short) • Connections to other Public Transport (passive, pos / neg, short / long) • Disabled Accessibility (e.g. ramps) (active, pos / neg, short / long) • ATM (Automated Ticket Machines) (active, pos / neg, short) • Wifi (passive, pos / neg, short) • Toilets (passive, pos / neg, short) • Station-Platform-Train Step (passive, pos / neg, short) • Car Parking (passive, pos / neg, short / long) • Additional Station Facilities (e.g. Shops) (active, pos / neg, short / long) • Ticket Gates (passive, pos / neg, short) • Cleanliness (Station, Platform, Train) (passive, pos / neg, short / long) • Comfort (Station, Platform, Train) (passive, pos / neg, short / long) • Service / Fare Ratio (passive, pos / neg, short / long) • Information Services (passive, pos / neg, short / long)	Digital Touchpoints • Delay Repay (Digital, active, neg, short) • unidirectional feedback mechanisms (e.g. happy / sad face buttons)
	Digital Touchpoints • Timetable Info (passive, pos / neg, short) • TfW Travel App (passive, pos / neg, short / long) • TfW Website (Travel Updates) (passive, pos / neg, short)	

Note: Nature: relates to context of customers' interactions with providers, ranging from interactions with service personnel (i.e., Human), interactions with physical resources (e.g., store environment) and digital resources (e.g., websites). Quality: relates to experiential quality of customer's interactions with service provider. Participation ranges from "passive" to "active", which reflect extent of activity of customer responses to stimuli. Valence ranges from positive to negative, and refers to the positive, neutral or negative nature of customer responses to stimuli. Timeflow refers to the timescale in which customer responses occur under, ranging from short (i.e., in the moment experiences) to long (i.e., extended experiences spanning the entirety of service use) (De Keyser et al. 2020).

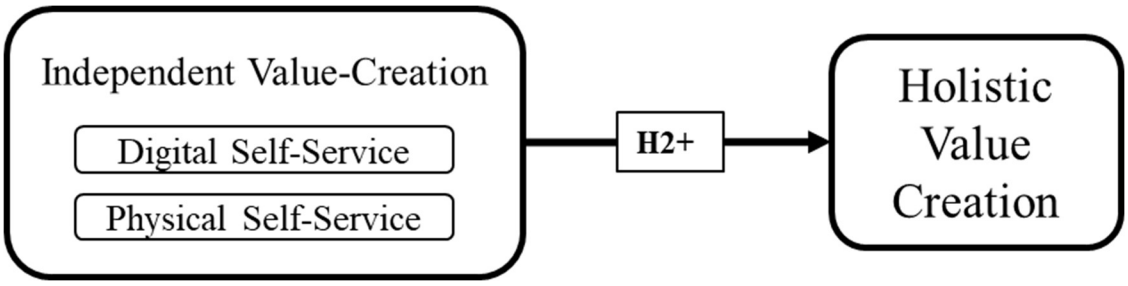
Table 9. Summary of reviewed research and salient findings used to conceptualise independent value creation during self-service use in the study

Reference	Theoretical Framework / Literature stream	Sample	Methodological approach	Main Result
Grönroos (2006)	SL	Conceptual	Literature review	Customers act as sole-creators of value by lone resource usage
Grönroos (2008)	SL	Conceptual	Literature review	Customers add their own skills to resources to become sole value creators (e.g., using ATM)
Grönroos and Voima (2013)	SL	Conceptual	Literature review	Individual (independent) value-in-use through indirect interactions with providers
Heinonen and Strandvik, (2015)	CDL	Conceptual	Literature review	Mental dimension of value-in-use / value creation Presence dimension of value creation from providers perspective
McColl-Kennedy et al. (2012)	SDL	20 healthcare patients & 8 clinical staff	Qualitative in-depth interviews & focus groups	Customers create value via self-activities (e.g., cerebral activities like sense making, positive thinking, emotional labour)
Holmqvist et al. (2020)	SL	17 luxury boutique customers	Qualitative ethnographic & in-depth interviews	Customers can create value independently after service consumption
McCosker, Zainuddin & Tam (2014)	Mixture of SL, SDL, Self-Service Technology	Conceptual	Literature review	Defined value self-creation as value creation undertaken solely by customers positions it on a continuum (i.e. delivery, co-creation, self-creation) Highlighted self-service technology as a theoretical framework for value self-creation
Zainuddin, Tam and McCosker (2016)	SL & SDL	378 self-screening healthcare patients	Quantitative surveys SEM	Overall behavioural contributions & consumer readiness most strongly related to value outcomes Functional & emotional value most strongly related to satisfaction

Reference	Theoretical Framework / Literature stream	Sample	Methodological approach	Main Result
Hilton and Hughes (2008)	SDL	Conceptual	Literature review	In B2C contexts, providers should consider alignments of customers' cognitive resources & self-service demands during co-production via self-service interfaces
Gebauer et al. (2010)	SL	Swiss rail passengers	Qualitative case study Content analysis & secondary market data	Details self-service ticketing in passengers' value creation in terms of automated ticket machines, digital travel applications, etc
Nunes et al. (2014)	SDL & public transport research	London rail passengers & TfL	Qualitative case study	Self-service ticketing used to leverage passengers' collective intelligence, gamifying engagement in rail services & offering TOCs real-time service delivery updates
Turner and Shockley (2014)	SDL	188 convenience store customers based in US	Quantitative approach CB SEM	Self-service design, customers' role ability and degree of stress significantly relate to value from self-service
Vakulenko, Hellstrom and Oghazi (2018)	SDL	Conceptual	Literature review	Highlighting of different value elements at pre, during and post-purchase experience stage
Kelly and Lawlor (2018)	SD:	133 tourists at airports and 32 tourists in tourism contexts	Qualitative in-depth interviews	Identified six self-service experiences in terms of value creation (accomplishments, supporting) and value destroying (lack of control, manipulation, discrimination, social tension)
Akesson et al. (2014)	SDL	60 furniture store customers	Qualitative in-depth interviews	Identification of informational, relational, organisational and technological drivers during self-service use

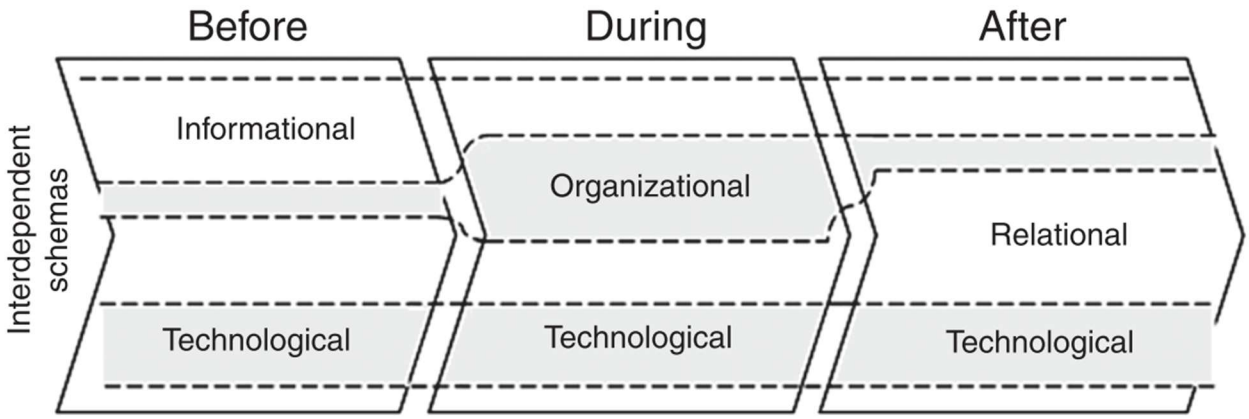
Source: this study

Figure 24. Conceptual model focusing on independent value creation



In SDL, Turner and Shockley (2014) have empirically modelled customer's independent value creation from self-service in retail stores. Interestingly, Akesson, Edvardsson and Tronvoll (2014) have observed customer's independent value creation from self-service in terms of experiential drivers in retail stores too. Akesson et al. (2014) showed informational, technological, organisational and relational drivers contributed to customers' independent value creation at different service stages (Figure 25). More recent conceptual research by Vakulenko, Hellstrom and Oghazi (2018, p517) has concluded customers' independent value creation from self-service "can be viewed as continuous linked processes, in which values are created at every stage of the [self-service] experience". This suggests customers' independent value creation during self-service may emerge within distinct services stages (Akesson et al. 2014) but also influences other service stages as well (Vakulenko et al. 2018). The above literature outlines the important role of customers' independent value creation during self-service during customers' overall value creation, and so, the discussion now focuses on public transport services.

Figure 25. Customer co-creation experiences before, during and after service use



Source: Akesson et al. (2014, p692)

In public transport, Lu, Geng and Wang (2015) have assessed passengers' experiences and value outcomes from independent value creation during self-service. Employing an exploratory methodology, Lu et al. (2015) found value outcomes emerged in terms of functional (i.e. convenience, informational and monetary) and hedonic (i.e. communication, social and identity) value dimensions. Functional value was associated with customer-provider interactions and emerged before or during use, whilst hedonic value was associated with C2C interactions and emerged during or after use.

A noteworthy insight, with respect to the role of independent value creation from self-service during passengers' value creation, comes from Carreria et al. (2013). This study noted bus passengers viewed self-service features as only supplementary to their journey experience, as self-service was perceived to add value, but not form a core service function. This suggests passengers may not perceive independent value creation from self-service as core to service functions whilst using public transport. Focusing on rail services, specifically, both Gebauer et al. (2010) and Nunes et al. (2014) have shown the importance of value from self-service for assisting passengers' travel experiences and value creation, as well as offering TOCs feedback, respectively.

In summary, the thesis applied De Keyser et al.'s (2020) touchpoint analysis to outline the experiential contexts of passengers' independent value creation during physical and digital self-service (Table 8). With respect to prior research, scholars from various service contexts have emphasised the important role of independent value creation from self-service during customers' value creation (Turner and Shockley, 2014; Zainuddin et al. 2016;

Vakulenko et al. 2018) (Table 9). As independent value creation from self-service has also been shown to support passengers' value creation in public transport (Gebauer et al. 2010; Nunes et al. 2014; Lu et al. 2015) the thesis hypothesised:

H2: Independent value creation from self-service will positively relate to holistic value creation

4.2.3 Conceptualising social value co-creation

Scholars have noted customers' value creation does not occur in a social vacuum (Heinonen et al. 2010) but rather extends to social contexts (Edvardsson et al. 2010) as they interact with other customers and social actors (Grönroos and Voima, 2013; Grönroos and Gummerus, 2014). Service logic refers to this process as social value co-creation, which occurs as focal customers' value creation becomes intertwined with those of other social actors (Grönroos and Voima, 2013; Grönroos, 2017). Using SDL's more macro perspective, Grönroos and Gummerus (2014, p221) have conceptualised the process as a summation of the "total process, to which multiple actors, including customers (or other users) and actors in their social ecosystem" influence the focal customer's value creation.

The thesis focuses on social value co-creation during the rail passenger's purchase experiences (i.e., during journeys). To conceptualise social value co-creation, the thesis applies De Keyser et al.'s (2020) touchpoint analysis to examine the experiential contexts of passenger's social value co-creation (Table 10). Additionally, to offer a solid foundation for conceptualising social value co-creation, a focused literature review was performed. This reviewed empirical research in tourism and transport services, as well as conceptual research, from literature using service logic and CDL as its theoretical framework (Table 11). The thesis conceptualised social value co-creation in terms of the constructs of social interaction, helping and information seeking, and proposed it positively contributed to holistic value creation (Figure 26). The discussion now focuses on research examining social value co-creation, and later, specifically within the contexts of public transport services

Table 10. Social value co-creation from the perspective of De Keyser et al.'s (2020) touchpoint analysis applied to TfW's rail services

Pre-purchase	Purchase	Post-Purchase
Human Touchpoints	Human Touchpoints	Human Touchpoints
• Friends, Family, Social Acquaintances (active / passive, pos / neg, short / long) • Passenger Communities	• Other Passengers (active / passive, pos / neg, short)	• Friends, Family, Social Acquaintances (active / passive, pos / neg, short / long)
Physical Touchpoints	Physical Touchpoint	
~	Adopt-A-Station Scheme (Physical, passive / active, pos / neg, short / long)	
Digital Touchpoints		
Customer Panel (Sgwrs) - C2C (Digital, active)		
Passengers' social media content (may / may not use TfW social media platforms) - Seeking / Sharing - Digital, active / passive, pos / neg, short / long)		

Note: Nature: relates to context of customers' interactions with providers, ranging from interactions with service personnel (i.e., Human), interactions with physical resources (e.g., store environment) and digital resources (e.g., websites). Quality: relates to experiential quality of customer's interactions with service provider. Participation ranges from "passive" to "active", which reflect extent of activity of customer responses to stimuli. Valence ranges from positive to negative, and refers to the positive, neutral or negative nature of customer responses to stimuli. Timeflow refers to the timescale in which customer responses occur under, ranging from short (i.e., in the moment experiences) to long (i.e., extended experiences spanning the entirety of service use) (De Keyser et al. 2020).

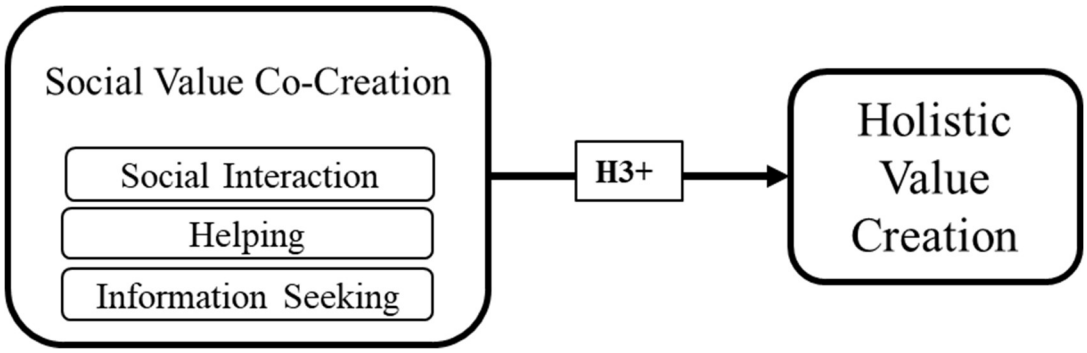
Table 11. Summary of reviewed research and salient findings used to conceptualise social value co-creation in the study

Reference	Theoretical Framework / Literature stream	Sample	Methodological approach	Main Result
Grönroos and Voima (2013)	SL	Conceptual	Literature review	Collective aspect of value-in-use
Grönroos (2017)	SL	Conceptual	Literature review	Possible social value from value co-creation, highlighting social media as a medium for this process
Grönroos and Gummerus (2014)	SL	Conceptual	Literature review	Value co-creation as a summation of value co-creation from multiple actors including in the social ecosystem
Uhrich (2014)	SL	32 team sports fans	Qualitative in-depth interviews	Classified C2C co-creation in terms of associating, dissociating, engaging, sharing, competing, intensifying, exchanging. Also within value sphere and interaction medium (digital / physical)
Holmqvist et al. (2020)	SL	Luxury boutique customers	Qualitative in-depth interviews	Empiracley evidenced social value co-creation pre, during & post-service usage
Heinonen et al. (2010)	CDL	Conceptual	Literature Review	Emphasised that value creation does not happen in a social vacuum
Pandey and Kumar (2020)	SL / SDL	10 customers of mixed service context	Qualitative in-depth semi-structure interviews	Highlighted hedonic, atmospheric, economic / utilitarian value as outcomes of C2C interactions
Pandey and Kumar (2021)	SDL / CDL	Conceptual	Literature Review	Integrative framework linking C2C interactions, moderating valence, value outcomes & role of providers
Rihova et al. (2013)	CDL	Conceptual	Literature	Proposed Social layers of C2C interactions (i.e. detached traveller, social bubble, temporary communities, neo-tribes)

Reference	Theoretical Framework / Literature stream	Sample	Methodological approach	Main Result
Reichenberger (2017)	SDL	76 European & American tourists	Qualitative in-depth interviews	Applied social layers to determine value outcomes for focal travellers
Rihova et al. (2018)	CDL	52 festival attendees	Qualitative observations & in-depth interviews	Identified 18 forms of C2C interactions conceptualised along private / public & autotelic / instrumental
Lu, Geng and Wang (2015)	SDL / CX	19 Bus and taxi passengers	Qualitative in-depth semi-structured interviews	Use of self-service technology enabled social value via online C2C interactions during and after service usage
Gebauer et al. (2010)	SL	Swiss rail passengers	Qualitative case study Content analysis & secondary market data	Reported negative social value co-creation with TOC implementing anti-social behaviour hotline
Heinonen, Jaakkola and Negnova (2018)	CDL	Conceptual	Literature review	Positive / negative C2C interaction typologies and value outcomes Integrative framework of C2C co-creation
Carreira et al. (2013)	Public Transport / CX	49 bus passengers in Scotland (22 tourist, 27 personal transportation)	Qualitative in-depth interviews	Social environment reported as determinant of passengers' experience, varying between passengers' journey purposes
Ittamalla and Kumar, 2021	Public Transport / CX	788 undergraduate students in India	Mixed methods – qualitative interviews followed by quantitative CFA & SEM	Developed Holistic Passenger Experience (HFX) scale incorporating social environments as emotional component outside provider's control

Source: this study

Figure 26. Conceptual model focusing on social value co-creation



In sporting events, Uhrich (2014) has applied service logic to conceptualise social value co-creation as emerging via the practices of associating and dissociating, engaging, sharing, competing, intensifying and exchanging. Uhrich (2014) categorised interactions to the joint and customer value spheres, along with their interaction platform (i.e. physical or digital). While the focus was on sporting events, Uhrich (2014) observed that C2C interactions emerged as attendees used public transport. This is congruent with the thesis's application of De Keyser et al.'s (2020) touchpoint analysis, which highlighted passengers may interact with other social actors via online platforms (Table 10).

Scholars have defined social value co-creation as "value which is socially constructed and embedded in the customers' social practices" (Pandey and Kumar, 2020, p135) and has noted providers may potentially moderate these practices (Pandey and Kumar, 2021). In CDL, Rihova et al. (2013) examined C2C interactions in tourism services across different social layers (i.e. detached customers, social bubbles, temporary communities, and ongoing neo-tribes). Reichenberger (2017) extended this analysis to examine travellers' value outcomes and found communitas level interactions (i.e., interactions that extended beyond explicit service use) offered value on longer timeframes via enhanced lived experiences for travellers. In contrast, social bubble interactions (i.e., those confined to service use) mostly offered atmospheric and practical value, though Reichenberger (2017) notes value outcomes differed around travellers' prosocial attitudes.

In rail services, this layering may be applied in terms of passengers' journey purpose. Lone commuters may represent detached customers, whereas those travelling in groups can be thought of as social bubbles. Likewise, leisure passengers travelling further distances may reflect temporary communities and passenger communities ongoing neo-tribes.

Rihova et al. (2018) write about social value co-creation in music festivals along the continuums of autotelic (i.e. means in themselves) versus instrumental and public versus private (Figure 27). Theoretical research by Heinonen, Jaakkola and Negnova (2018) presents an extensive list of both positive and negative C2C interactions and their value outcomes. Based on this analysis, Heinonen et al. (2018) developed an integrative model incorporating drivers, interaction typologies and value outcomes during C2C interactions (Figure 28). More recently, Pandy and Kumar (2020) have empirically evidenced hedonic, atmospheric and economic value outcomes during social value co-creation.

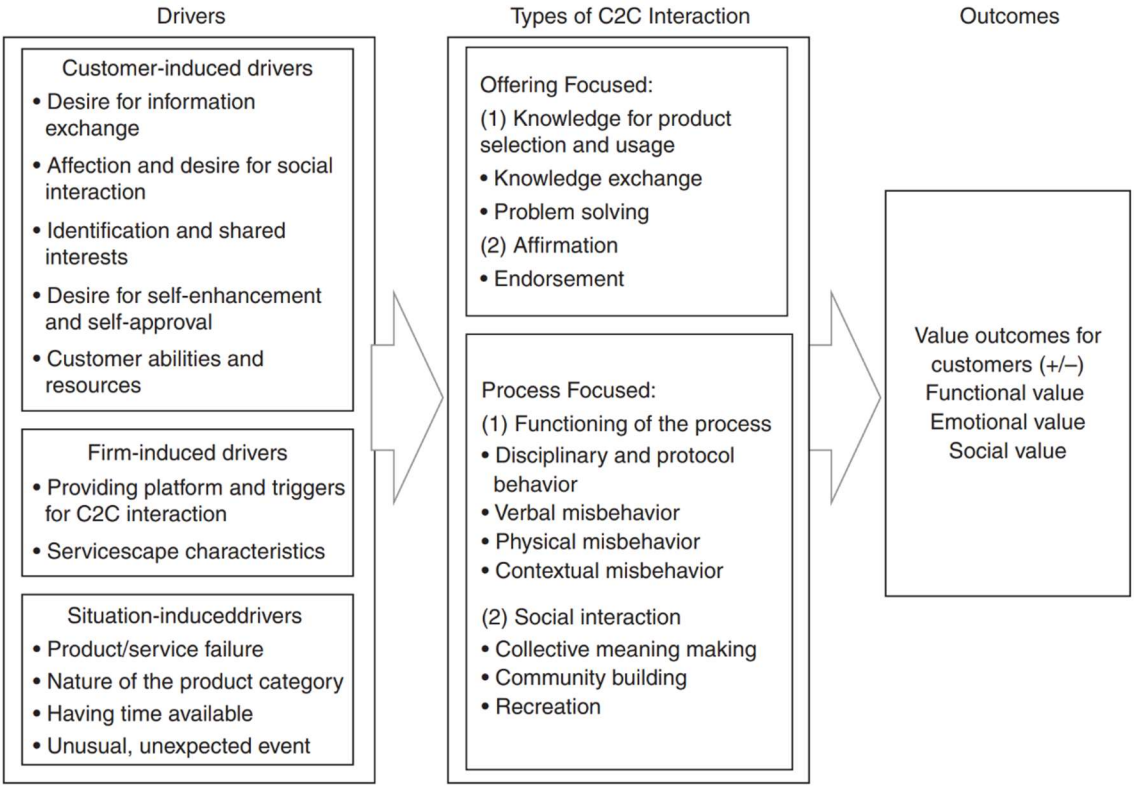
This thesis, meanwhile, conceives of social value co-creation in terms of public and instrumental interactions (Rihova et al. 2018), orientated around offerings that support knowledge exchanges (Heinonen et al. 2018). These interactions are inside the provider's line of visibility (Heinonen et al. 2010) and so may be potentially moderated by TOCs. Under these rationales, the thesis conceptualised social value co-creation in terms of the constructs of social interaction, helping and information seeking, which is discussed further in Chapter 5. The discussion now turns to public transport research on social value co-creation and C2C interactions during value creation.

Figure 27. 2x2 matrix of C2C interactions and value outcomes

	Autotelic	Instrumental
Private	Communicating – Affective, Social Sharing – Affective, Social Confiding – Affective	Insulating – Affective, Social Territoriality – Affective, Social Non-conforming – Affective, Social, Functional Collaborating – Affective, Social, Functional
Public	Conforming – Social, Network Acknowledging – Network Conversing – Network Relating – Affective, Network Initiating – Affective, Network Fun-making – Affective, Network Rekindling - Network	Advising – Functional, Network Helping – Affective, Functional, Network Trading – Functional, Network

Source: Rihova et al. (2018, p371)

Figure 28. Integrative framework C2C co-creation



Source: Heinonen et al. (2018, p721)

Public transport research is cognisant of, though has yet to thoroughly explore, the influential role of C2C interactions during passengers' value creation. Both Lu et al. (2015) and Gebauer et al. (2010) consider social value co-creation and co-destruction in terms of passengers offering online travel updates to others and TOCs implementing anti-social behaviour hotlines, respectively. In line with Heinonen et al.'s (2018) integrative framework, Xu, Yap and Hyde (2016) found interactions between airline passengers in online complaint forums supported knowledge exchanges and promoted information sharing. The role of C2C interactions has also been examined in rail services, specifically, with regards to passengers' journey experiences (Gebauer et al. 2010; Ittamalla and Kumar, 2021).

For example, social environments have been positioned as a driver of passengers' journey experiences (Ittamalla and Kumar, 2021) in both positive and negative valences (Stradling et al. 2007). Carreira et al. (2013) have noted passengers viewed social environments as adding additional value to service experiences, but were not a core service feature, though passengers' attitudes to social environments varied between their purpose of journey. This is congruent with Reichenberger's (2017) situational analysis of social bubble

interactions that found C2C interactions elicited atmospheric value for travellers. As previously stated, though public transport research has yet to thoroughly examine C2C interactions during passengers' value creation, existing literature does allude to the role of social environments and C2C interactions in passengers' service experiences. This offers some basis for hypothesis development in the thesis.

In summary, the thesis applied De Keyser et al.'s (2020) touchpoint analysis to outline the experiential contexts of passenger's social value co-creation (Table 10). Prior research has highlighted the various typologies and contexts in which social value co-creation can contribute to holistic value creation (Table 11). The thesis opted to conceptualise passenger's social value co-creation during purchase experiences (i.e., during journeys), and in terms of the constructs of social interaction, helping and information seeking, which is discussed further in Chapter 5. In public transport, specifically, social value co-creation can contribute to passenger's value creation (Gebauer et al. 2010; Carreira et al. 2013; Lu et al. 2015; Ittamalla and Kumar, 2021) and so the thesis hypothesised:

H3: Social value co-creation will positively relate to holistic value creation

4.2.4 Conceptualising negative value-in-use

Negative value-in-use can be thought of as a sacrifice (Medberg and Grönroos, 2020) or cost (Plewa et al. 2015) that leaves customers feeling worse off from using a service (Grönroos and Voima, 2013). Earlier research by Zeithaml (1988) distinguishes customer sacrifices in terms of tangible and intangible (i.e. behavioural) costs. More recent research on negative value-in-use suggests it can be broken down into dimensions like money, time and effort, emotional and lifestyle costs (Sweeney et al. 2018). Sweeney et al. (2018, p1091) describe monetary costs as an "expense" and time and effort costs as the "level of time and effort" that emerges for customers when engaging with providers. Plewa et al. (2015, p580) term emotional costs as the "level of emotional investment that is required when dealing" with providers.

The above research positions negative value-in-use as a diminishing factor in customers' value creation, but falls short of offering a more comprehensive view of how it emerges. A recent literature review by Leroi-Werelds (2019) has contributed to filling this gap by showcasing the wide variety of value typologies negative value can emerge under

(Table 12). The thesis opted to conceptualise passenger's negative value-in-use in terms of monetary costs, and emotional and time effort costs as behavioural costs. This captured tangible and intangible sacrifices for passengers, and the thesis posits negative value-in-use negatively relates to holistic value creation (

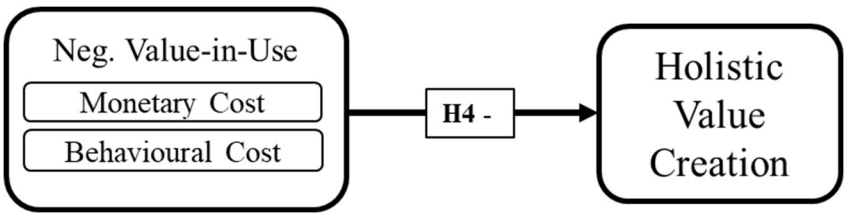
Figure 29).

Table 12. Updated typology of customer value in terms of negative value

Negative Value	The (perceived) extent to which the object...
Price	is expensive
Time	requires time to prepare, use, understand, etc
Effort	requires effort to prepare, use, understand, etc
Privacy risk	can result in a loss of privacy
Security risk	can result in security issues such as losing personal information to criminals or hacking
Performance risk	can result in a loss of performance: the object does not perform as expected or intended
Financial risk	can result in a loss of money
Physical risk	can result in health issues or injuries
Ecological costs	has a negative impact on environmental well-being (e.g. pollution)
Societal costs	has a negative impact on societal well-being. This can involve issues such as child labour, poor working conditions, etc

Source: Leroi-Werelds (2019, p661)

Figure 29. Conceptual model focusing on negative value-in-use



In public transport, research on negative value-in-use is scarce, though the extant research on passenger sacrifices have shown they negatively relate to perceived value. Lai and Chen (2011, p321) defined passengers' perceived value as the "passenger's overall appraisal of the value of the service provided, based on their assessment of what is received (benefits) and what is given (cost or sacrifice)". This value-based perspective on public transport shows passenger sacrifices negatively relate to perceived value during SEM (Wen et al. 2005; Sumaedi, Bakti and Yarmen, 2012). As negative value-in-use was conceptualised as tangible (i.e., monetary costs) and intangible (i.e., emotional, time and effort costs) sacrifices for passengers, the thesis hypothesised:

H4: Negative value-in-use will negatively relate to holistic value creation

4.3 Conceptualising customer experience

Customer experience has been found to increase passenger satisfaction in rail services (Gebauer et al. 2010; Ittamalla and Kumar, 2021) although public transport research on the construct is limited (Hutchinson, 2009; Carreira et al. 2013; Ittamalla and Kumar, 2021). In contrast, marketing research on customer experience has developed a large body of literature (Klaus, 2014; Lemon and Verhoef, 2016; De Keyser et al. 2020). This literature has considered customer experience from the customers' perspective, and has disaggregated it into the phases of anticipation, realisation and reflection (De Keyser et al. 2015). During value creation, De Keyser et al. (2015, p26) proposed the reflection stage entails a "judgement / sense-making of experienced events" as customers consider if they are better off following service use, mirroring the service logic conceptualisation of value-in-use (Grönroos, 2011).

Lemon and Verhoef (2016) have disaggregated customer experience from a provider's perspective in terms of pre, during and post-purchase experiences, a perspective only present in public transport research using qualitative methods (Carreria et al. 2013; Lu et al. 2015). Viewed in this way, Lemon and Verhoef (2016) highlight that mobile applications are a means of supporting customers' service experiences beyond direct provider interactions, a stance that agrees with Grönroos's (2008) argument that digital self-service allows providers to support customers' value creation beyond direct interactions.

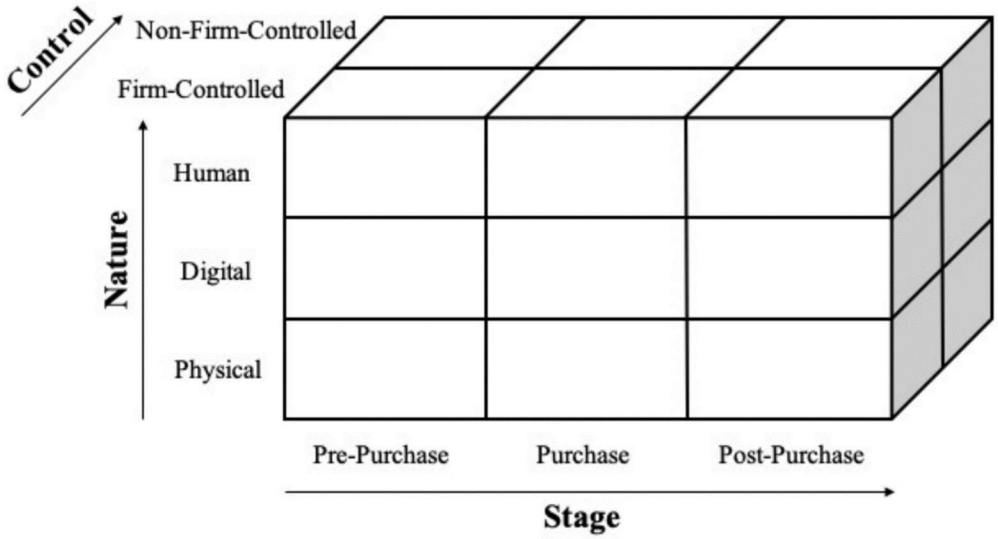
Klaus (2014) conceptualises customer experience in terms of brand, service provider and post-purchase experience, which aligns with the later conceptualisation of customer experience by Lemon and Verhoef's (2016) in terms of pre, during, and post journey stages. To define, brand experience reflects the "subjective internal consumer responses" to brand related stimuli (Brakus, Schmitt and Zarantonello, 2009, p52) and has been conceptualised it in terms of sensory, behavioural, intellectual and social dimensions (Brakus et al. 2009; Nysveen, Pedersen and Skard, 2012).

Service provider experience reflects all moments related to consumer choice, ordering, paying, pickup and delivery (Lemon and Verhoef 2016). Klaus (2014) writes about the construct in terms of personnel, policies, practices and servicescape, which influence customers' consumption experience. Post-purchase experiences, which come after purchasing

or consuming offerings, relate to service recovery, repurchase intentions and other forms of service engagement (Klaus, 2014).

The nomenclature used for customer experience refers to it forming through touchpoints embedded in wider contexts and featuring qualities that lead to value judgements (De Keyser et al. 2020). These touchpoints consist of human, digital and physical points of contact which span pre, during and post-purchase stages and differ in their loci of control (i.e. being orchestrated by firms or non-firm parties like customers or social actors) (Figure 30). Customer experience also consists of the qualities of participation, dimensionality, valence, ordinariness and time flow (De Keyser et al. 2020).

Figure 30. Touchpoint categories of customer experience nomenclature



Source: De Keyser et al. (2020, p44)

Public transport research typically uses service quality as its theoretical lens (Barabino and Francesco, 2016; Barabino et al. 2020). Some studies have attempted to examine passengers' service experience, although this still leans on service quality dimensions. Stradling et al. (2007) applied factor analysis to over 900 responses from bus passengers in Scotland to identify important service experiences. Passengers were asked to rate the extent they endorsed 68 pre-established items chosen from prior public transport research and invited write responses to aid the study's analysis. Stradling et al. (2007) identified the following underlying factors in passengers' experiences: safety; service

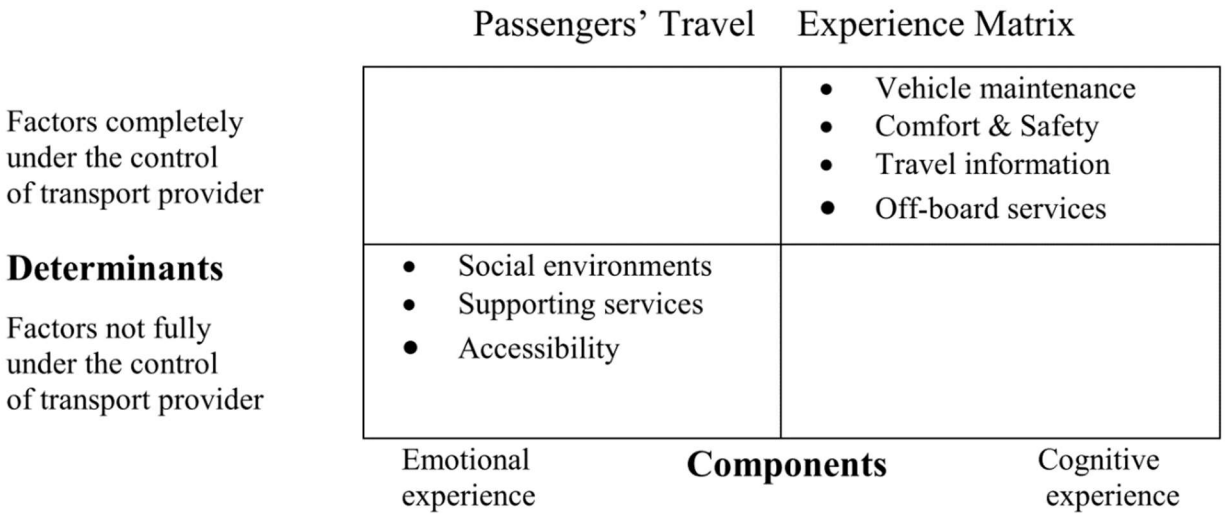
provision; misconduct from other passengers; affordability; disability access and self-image. Hutchinson's (2009) literature review of public transport research on passengers' experiences has shown similar findings.

Both Stradling et al. (2007) and Hutchinson (2009) highlighted topics more closely associated with service quality than those examined by marketing research on customer experience. However, a noteworthy insight from Stradling et al. (2007) comes from passengers' write-in responses on their ideal journey experience. This ideal journey experience "involves being transported while switched off" in a manner that is "smooth, tranquil [and] undisturbed" and "pleasurable without being ecstatic" (Stradling et al. 2007, p290). This experience would represent an entirely ordinary experience under De Keyser et al.'s (2020) nomenclature and diverges from marketing research that tends to focus on positive experiences being extraordinary (Caru and Cova, 2003).

Carreira et al. (2013), meanwhile, has attempted to examine passengers' travel experience from a holistic perspective. The study interviewed 49 bus passengers from across Europe and grouped their services experiences in terms of core trip conditions (i.e., comfort, safety and wait time) and supplementary services (i.e., off-board environment, travel information, self-service and social environment). In hedonic passengers that travelled for leisure purposes, service experiences tended to relate to trip conditions. In contrast, in utilitarian passengers that travelled for functional purposes like commuting, service experiences related to both trip conditions and supplementary services.

More recently, Ittamalla and Kumar (2021) have developed the Holistic Passenger Experience (HPX) scale to measure rail passengers' service experience. After identifying 20 determinants of passengers' experiences, the study interviewed 45 undergraduate students in India. Following item purification and validation stages, Ittamalla and Kumar (2021) developed the HPX scale that measured passengers' cognitive and emotional experiences (Figure 31). The HPX scale held acceptable internal consistency and explained 45% of variation in passenger satisfaction. Although insightful for the thesis, the scale arguably relies heavily on dimensions associated with service quality in public transport (e.g. TRANSQUAL, P-TRANSQUAL) (Barabino and Francesco, 2016; Barabino et al. 2020; Bakti and Sumaedi, 2015) and rail services (Eboli and Mazzulla, 2014).

Figure 31. Holistic passenger experience matrix

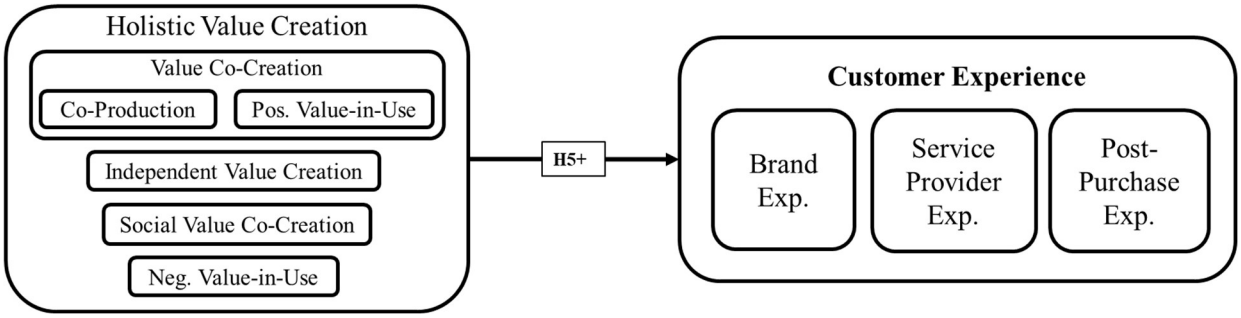


Source: Ittamalla and Kumar (2021, p9)

4.3.1 Value creation & customer experience

The discussion now shifts to examining the relationship between holistic value creation and customer experience. As holistic value creation is a novel higher-order construct developed by the thesis, the discussion focuses on how its lower-order value creation processes relate to customer experience, and specifically, brand, service provider and post-purchase experiences (Figure 32).

Figure 32. Conceptual model focusing on holistic value creation and customer experience



The discussion begins by examining the relationships between lower-order value creation processes and brand experience. With respect to value co-creation, research has outlined how co-production and positive value-in-use relates to brand experiences. Harris

(2007, p102) notes that customers' interactions with employees "who enact the attributes of the brand" contribute to "ultimately foster[ing] customer experience" and Carlson (2019) has proposed the concept of value-in-the-brand-page-experience in online services. Research has not specifically examined independent value creation during self-service in terms of brand experiences. However, it has shown attitudes associated with self-service like ease of use, reliability and control supports brand experience (Morgan-Thomas and Veloutsou, 2013; Chen et al. 2014; Ong, Salleh and Yusoff, 2015).

Focusing on social value co-creation, social networking, brand use and community engagement are fundamental to value creation in brand activities (Shau et al. 2009) and C2C interactions support brand experiences in hospitality services (Lin and Wong, 2020). Furthermore, Nysveen et al. (2012) has expanded brand experience to incorporate a social dimension measuring C2C interactions. Lastly, for negative value-in-use, which represents costs for customers (Sweeney et al. 2018) research has alluded to the costs associated with brand engagement (Hollebeek, 2011; Hollebeek, Glyn and Brodie, 2014) that impair engagement, potentially diminishing brand experiences (Simon, Brexendorf and Fassnacht, 2013).

Next, the discussion examines the relationships between lower-order value creation processes and service provider experiences. With respect to value co-creation, Lemon and Verheof's (2016) includes customer-personnel interactions and customisation as drivers of service provider experiences, which relate to the constructs of joint interaction and personalisation that make up co-production and positive value-in-use, respectively (Ranjan and Read, 2014). Additionally, research has positioned customer-provider relationships as foundational to service experiences (Palmer, 2010), which relates to construct of relationship that makes up positive value-in-use (Ranjan and Read, 2014). For independent value creation during self-service, Akesson et al. (2014) shows self-service drives customers' service provider experience in retail. In public transport, specifically, self-service enables ticket purchases and accessing travel information during journeys (Gebauer et al. 2010; Lu et al. 2015).

Focusing on social value co-creation, Grove and Fisk (1997) have shown other customers' rule adherence and sociability contributed to usage experiences in amusement parks. Similar findings have been shown in mass service contexts, tourism services, and sporting events, with C2C interactions contributing to focal customers' service provider

experiences and value creation (Huang and Hsu, 2009; Kim and Choi, 2016; Koenig-Lewis; Asaad and Palmer, 2018). In terms of negative value-in-use, Lemon and Verhoef (2016) incorporates the act of payment as a driver of purchase experiences, whilst research has highlighted the constructs of price and monetary costs to influence customers' overall service experience (Verhoef et al. 2009; De Keyser et al. 2020). Additionally, in public transport, Carreria et al. (2013) outlines negative emotions, arguably reflecting emotional costs, as a distinct experiential component during passengers' service provider experience.

Lastly, the discussion examines the relationships between lower-order value creation processes and post-purchase experiences. With respect to value co-creation, Roggeveen et al. (2011) has shown passengers can co-produce service recovery during post-purchase experiences in public transport. Additionally, regarding positive value-in-use, research has proposed the concept of value in post-use in terms of after sales activities, though further research is needed to validate the concept (Jain, Aagia and Bagdare, 2017).

For independent value creation during self-service, research has noted relational and technological drivers to shape retail customers' post-purchase experiences (Akesson et al. 2014) that emerge under various value typologies (Saarijavi, Kuusela and Rintamaki, 2013). In rail services, independent value creation during self-service can enhance passengers' post-purchase experiences through initiatives like mechanisms for retrieving lost property (Gebauer et al. 2010) and rewarding feedback via retail vouchers (Nunes et al. 2014).

Focusing on social value co-creation, Xu, Yap and Hyde (2016) have categorised interactions between passengers after journeys to several interaction typologies and Lu et al. (2015) notes passengers shared travel updates to online followers after journeys. Lastly, with respect to negative value-in-use, Rajaguru (2016) has shown airline passengers' perceived value for money, reflecting the inverse of monetary costs, contributes to post-purchase experiences. Additionally, Schoefer and Diamantopoulos (2009) identifies customers' emotional costs under the dimensions of discontent and concern during post-purchase experiences of service recovery.

Overall, research has pinpointed the different ways in which lower-order value creation process contributes to customer experience and specifically brand, service provider and post-purchase experiences. As holistic value creation was conceptualised as a combination of these processes, the thesis posits these relationships will be present between

holistic value creation and customer experience as higher-order constructs. As such, the thesis hypothesised:

H5: Holistic value creation will positively relate to customer experience

4.4 Conceptualising customer satisfaction

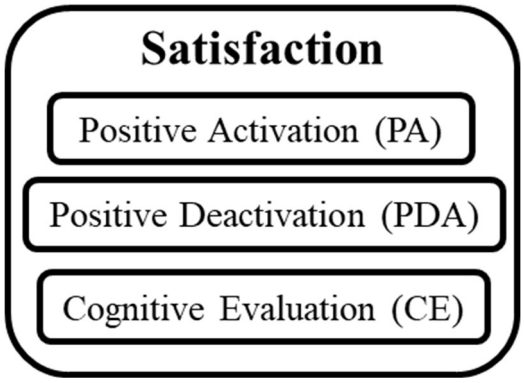
Early research conceptualised customer satisfaction under the expectation-disconfirmation paradigm (Oliver, 1981; Oliver, 1997) where satisfaction is driven by the difference between what was expected and received (Oliver, 1981). Customer satisfaction was in essence a judgement that a product or service offers a "pleasurable level of consumption-related fulfilment including levels of under- or over fulfilment" (Oliver, 1997, p13). Positive differences between perceptions and expectations elicit positive disconfirmation and satisfaction, whilst negative differences elicit negative disconfirmation and dissatisfaction (Oliver, 1981). A complementary avenue of research, the Value-Percept Disparity Theory, proposed that satisfaction reflects emotional responses to consumption experiences (Westbook and Reilly, 1983) that can be positive or negative (Westbrook, 1987). Work based on this approach has emphasised customer satisfaction reflects an emotional response, whilst cognitive comparisons only form a component of the "affective state of satisfaction" (Parker and Mathews, 2001, p39).

The cognitive-affective approach offers a hybrid of these paradigms. Cato and Garcia (2007) have empirically examined this approach in sporting events and found arousal, pleasure and disconfirmation acted as independent factors during satisfaction. In transport services, passenger satisfaction has been conceptualised under this hybrid approach. Ollsson et al. (2012) conceptualised passengers' satisfaction with travel services using two affective dimensions (i.e. positive activation and positive deactivation) and one cognitive dimension (i.e. cognitive evaluation). Friman et al. (2013) shows this conceptualisation to be psychometrically sound, with the study's analysis showing passengers' satisfaction consisted of three distinct underlying constructs, as detailed above. Both affective and cognitive dimensions of passenger satisfaction have been noted in the scarce research on passenger's journey experiences (Carreira et al. 2013; Ittamalla and Kumar, 2021).

This conceptualisation of passenger satisfaction has been established by public transport research (Ollsson et al. 2012; Friman et al. 2013; Ittamalla and Kumar, 2021) and

incorporates the cognitive-affect approach proposed in marketing (Cato and Garcia, 2007). As such, the thesis conceptualised passenger satisfaction in terms positive activation (i.e., exciting), positive deactivation (i.e., calming) and cognitive evaluations (i.e., expectation disconfirmation) (Figure 33). To clarify, subsequent discussions on customer satisfaction and passenger satisfaction will be phrased with respect to their service contexts. As such, public transport research on satisfaction will refer to the construct as passenger satisfaction, whilst research on satisfaction outside the domain of public transport will refer to the construct as customer satisfaction.

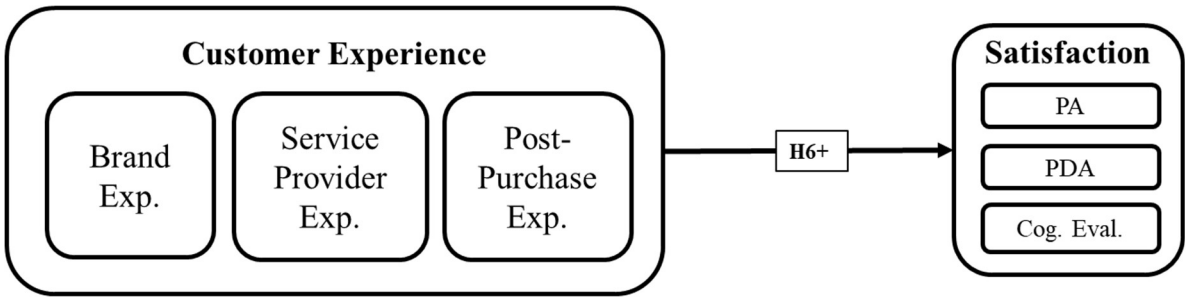
Figure 33. Conceptual model focusing on passenger satisfaction



4.5 Customer experience & customer satisfaction

The discussion now examines the relationship between dimensions of customer experience, in terms of brand, service provider and post-purchase experiences, and customer satisfaction (Figure 34).

Figure 34. Conceptual model focusing on relationship between customer experience and passenger satisfaction



Research has shown brand experience positively contributes to customer satisfaction via SEM in over one thousand customers of branded products ((Sahin, Zehir and Kitapachi, 2011; Baser, Cintamur and Arslan, 2015). In transport services, research has also evidenced a positive relationship between brand experience and passenger satisfaction. Ma and Ma (2022) have found brand experience positively related to airline passengers' satisfaction, although Pabla and Soch (2023) have shown brand love more strongly relates to passenger satisfaction than brand experience in airline services.

Service provider experiences can range from customers picking up, consuming offerings or having them delivered (Lemon and Verhoef, 2016). Scholarship on the topic emanates from the contexts of service personnel, policies, practices and servicescape (Klaus, 2014). Research has shown a positive relationship between these elements and customer satisfaction. With respect to service personnel, in airline, hotel and hairdresser services, Ekinci and Dawes (2008) have shown customer-employee interactions positively contributed to satisfaction whilst customers used services. In retail and travel, the extent to which service personnel are customer-orientated positively relates to customer satisfaction (Hennig-Thurau, 2004). This relationship is also evident in rail services, specifically, as a recent literature review by Ibrahim, Borhan, Yusoff and Ismail (2020) has identified customer service as a key driver of passenger satisfaction. This is congruent with service quality research in rail services that shows service personnel's behaviour is a determinant of passenger satisfaction (Geetika and Nandan, 2010; Agarwal, 2008).

For servicescape, in hospitality Chen, Chen and Lee (2013) have shown the quality of physical environments and personnel interactions positively relate to patron satisfaction. Lam et al. (2011) found dimensions of servicescape positively related to both affective and cognitive satisfaction in casino patrons. In public transport, Felleson and Friman (2008) interviewed almost 10,000 bus passengers across different European cities and found satisfaction was associated with 17 service attributes. Of these, three formed dimensions of servicescape in public transport (i.e. passenger safety, staff behaviour and comfort).

Post-purchase experience, which reflects customer evaluations after using services, has been looked at from the angles of service recovery, repurchase intentions and service engagement (Klaus, 2014). During service recovery, cognitive evaluations of the service recovery process positively relate to satisfaction in tourism services (Cheng, Gan, Imrie and Mansori, 2018). Congruent findings have been found in public transport services (Chang and

Chang, 2010). Interestingly, with regards to passengers' affective and cognitive processes, Wen and Chi (2012) have shown cognitive evaluations more strongly relate to passenger satisfaction than affective evaluations during service recovery in airline services. Though Wen and Chi (2012) did not explicitly examine passengers' cognitive and emotional experiences, their findings may suggest cognitive experiences hold a stronger bearing on passenger satisfaction, than affective experiences, during service recovery in transport services.

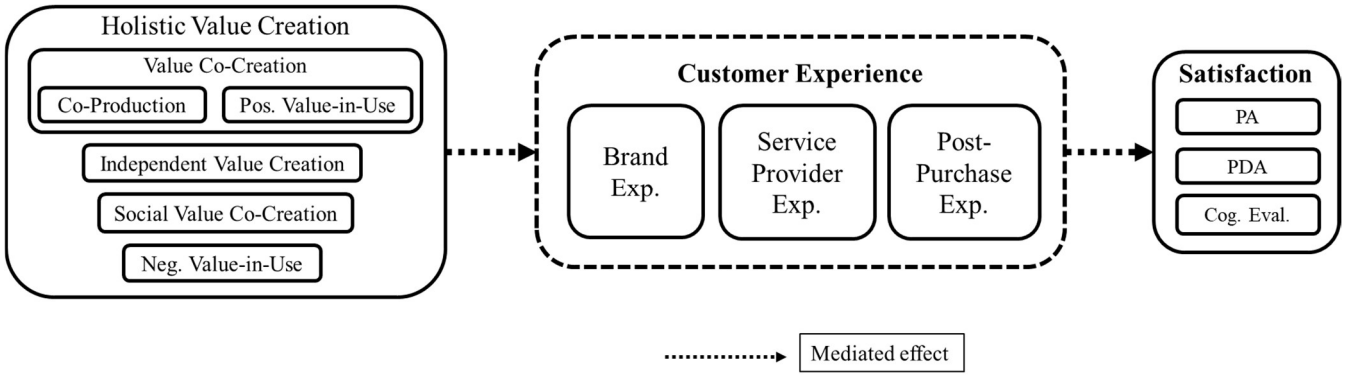
All three sub-dimensions of customer experience positively relate to customer satisfaction in various service settings. This relationship has also been found in public transport services. Thus, the thesis hypothesised:

H6: Customer experience will positively relate to passenger satisfaction

4.6 Value creation and customer satisfaction, mediated by customer experience

Research has highlighted a significant relationship between value creation and customer satisfaction, mediated by customer experience. As holistic value creation is a novel higher-order construct developed by the thesis, the discussion focuses on how its lower-order value creation processes relate to satisfaction, mediated by customer experience (Figure 35).

Figure 35. Conceptual model focusing on relationship between holistic value creation and passenger satisfaction, mediated by customer experience



Focusing on value co-creation, Solakis et al. (2021) has applied the D.A.R.T model of co-creation and found value creation has a large indirect effect on satisfaction via hotel patrons' experiences. In travel services Grissemann and Stokburger-Sauer (2012) has found similar findings, as customers' degree of co-creation — measured in terms of investing time, effort and energy — positively related to satisfaction, mediated by tourism experiences.

The relationship between value creation, passenger satisfaction and customer experience extends to public transport, and rail services, as well. Gebauer et al. (2010) have inferred value co-creation, self-service and interactions between passengers (i.e., social value co-creation) supported passenger satisfaction at each experience stage. However, these inferences were made retrospectively, and via passenger testimonials and industry reports, leaving the precise nature of these relationships underexamined in rail services.

With respect to independent value creation, Lu et al. (2015) showed that functional and hedonic value at each experience stage supports service experiences for bus passengers, though the study did not specifically examine passenger satisfaction. In rail services, Gebauer et al. (2010) have noted the significance of value from self-service for increasing passenger satisfaction, particularly during, pre- and post-rail experiences, as passengers searched for travel information and organised supplementary private transport (e.g., taxis, car hire, etc), respectively. These two studies highlight the influential role of independent value creation during self-service on passengers' journey experiences (Lu et al. 2015), with increased satisfaction from self-service being particularly mediated by pre and post experiences in rail services (Gebauer et al. 2010).

With respect to social value co-creation, Huang and Hsu (2009) have shown C2C interaction quality contributes to tourism experiences, with the experiences of relaxation and learning most strongly correlating with vacation satisfaction. Additionally, research has empirically shown customer experience partially mediates the relationship between social value and marketing outcomes for customers (Kuppelwieser et al. 2021). In rail services, specifically, Gebauer et al. (2010) have alluded to C2C interactions potentially increasing passenger satisfaction at different journey stages, though the study lacks a thorough examination of these relationships. Lastly, Ittamalla and Kumar's (2021) HPX scale has shown social environment, conceptualised as an emotional experience for rail passengers, positively contributes to satisfaction. However, Ittamalla and Kumar's (2021) arguably adopts

service quality, rather than customer experience, as its theoretical lens to draw this conclusion.

Overall, lower-order value creation processes positively relate to customer satisfaction, mediated by customers' service experience at different stages (Huang and Hsu, 2009; Grissemann and Stokburger-Sauer, 2012; Solakis et al. 2012). In public transport, scholarship notes the positive relationship between value creation processes and satisfaction, mediated by passengers' service experience at each journey stage (Gebauer et al. 2010; Lu et al. 2015; Ittamalla and Kumar, 2021). As the thesis conceptualised holistic value creation as a higher-order construct that combined lower-order processes, the thesis posits these relationships will be present between holistic value creation and passenger satisfaction, mediated by customer experience, as higher-order constructs. Thus, the thesis hypothesised:

H7: Holistic value creation will positively relate to passenger satisfaction, mediated by customer experience

4.7 Conceptualising customer engagement behaviours

Passenger satisfaction can positively relate to customer engagement in rail services (Gebauer et al. 2010). Early marketing research defined customer engagement as "behavioural manifestations that have a brand or firm focus, beyond purchase, resulting from motivational drivers" (Verhoef et. al. 2010, p248). Verhoef et al. (2010) proposed that behaviours like WoM, blogging and customer ratings represent customer engagement, to which Kumar et al. (2010) added transactional behaviours. The construct has been conceptualised in terms of cognitive, affective and behavioural facets (Vivek, Beatty and Morgan, 2012) and its focal points analysed (Vivek et al. 2014).

Islam and Rahman (2016) have reviewed over 60 empirical and conceptual studies on customer engagement and highlighted its behavioural dimension in terms of customer participation, labelled as customer engagement behaviours (CEBs). CEBs have been assessed in terms of their valence, modality, scope and nature, highlighting the diverse breadth of the construct (Van Doorn et al. 2010). A recent literature review of over 180 publications on CEBs by Barari et al. (2020) has described research on the topic as having evolved through functional, relational and transformational stages. Alone, Barari et al.'s (2020) literature review depicts the historic rise of CEBs as a construct within marketing, and the studies

weighty meta-analysis of over 150,000 data points shows CEBs positively relate to a provider's performance. Barari et al.'s (2020) findings emphasises the importance of CEBs to providers, which is indirectly shown in rail services via marketing reports (Gebauer et al. 2010).

In rail services, Jaakkola and Alexander (2014) have conceptualised CEBs in terms of augmenting value offerings, co-developing, influencing other actors and mobilising resources embedded in wider networks (Figure 36). The study defined CEBs as "the customer provision of resources during non-transactional, joint value processes that occur in interaction with the focal firm and/or other stakeholders" (Jaakkola and Alexander, 2014, p254). Among insights most apposite to the thesis, Jaakkola and Alexander (2014) offered definitions of each CEB (Brodie et al. 2016) (Table 13). The thesis opts to focus on the CEBs of influencing and co-developing, as the former is directed toward social actors (Islam and Rahman, 2016; Jaakkola and Alexander, 2014) and the latter enables TOCs to improve services (Gebauer et al. 2010; Nunes et al. 2014). As the thesis focused on passengers' everyday rail use, rather than the Adopt-A-Station scheme examined by Jaakkola and Alexander (2014), the CEBs of augmenting and mobilising were deemed less applicable.

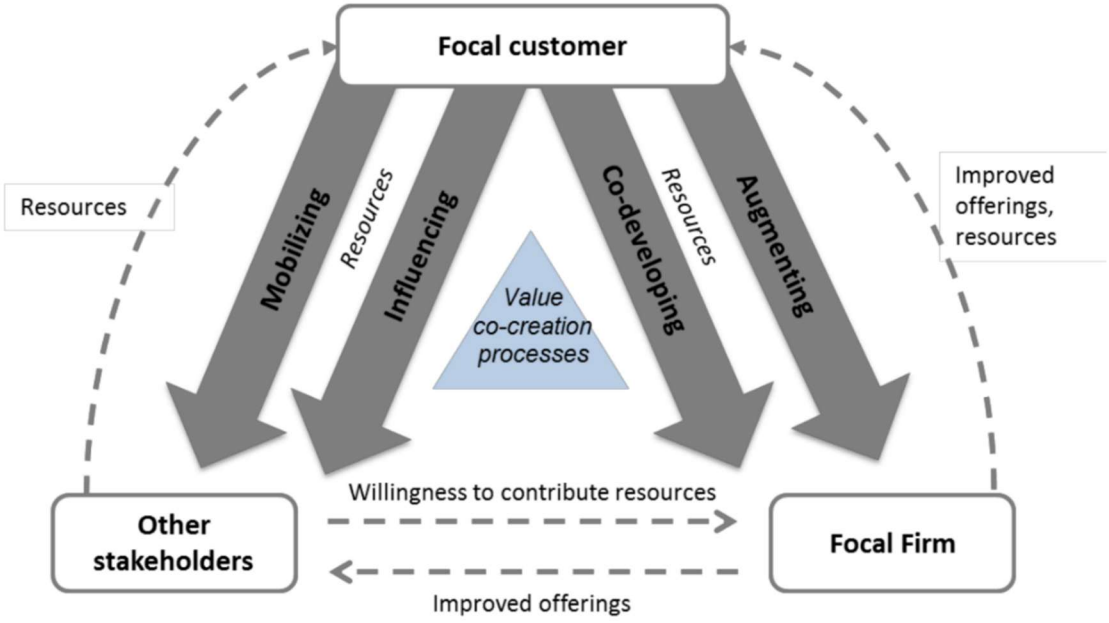
Jaakkola and Alexander (2014) described the CEBs of influencing and co-developing as passenger's affecting other actor's perceptions of TOCs and passengers' contributing to developing value offerings, respectively. To conceptualise influencing, the thesis reviewed research on WoM (Stoke and Lomax, 2002; Babin, Lee and Griffin, 2005) and opted to conceptualise influencing in terms of passenger's advocating for TfW. Research has outlined advocacy as representing a voluntary behaviour direct at social actors (Yi and Gong, 2013), congruent with Jaakkola and Alexander's (2014) definition of influencing (Table 13). To conceptualise co-developing, the thesis opted to focus on the CEBs initial stage of passengers contributing their knowledge and skills in the form of feedback. This aligns with Jaakkola and Alexander's (2014, p255) definition of co-developing in rail services, with respect to passenger's contributing "knowledge, skills, and time, to facilitate the focal firm's development of its offering" via feedback (Table 13).

Lastly, though not included in Jaakkola and Alexander's (2014) conceptualisation of CEBs in rail services, the thesis opted to include passenger's future patronage as an additional engagement behaviour. Future patronage refers to a customer's willingness to re-use a service in the future (Mathwick, Malhotra and Rigdon, 2001) and wider research on

customer engagement highlights the importance of commercially significant constructs, like future patronage, for industry practitioners (Vivek et al. 2014). As the thesis aims to offer practical insights, as well as commercial value, for TOCs, future patronage was included in the conceptual model to support this aim.

In summary, the thesis conceptualised passengers' engagement behaviours in terms of the constructs of feedback intentions, advocacy and future patronage, and sought to examine how passenger satisfaction relates to these engagement behaviours (Figure 37).

Figure 36. How CEBs contribute to value co-creation between different stakeholders



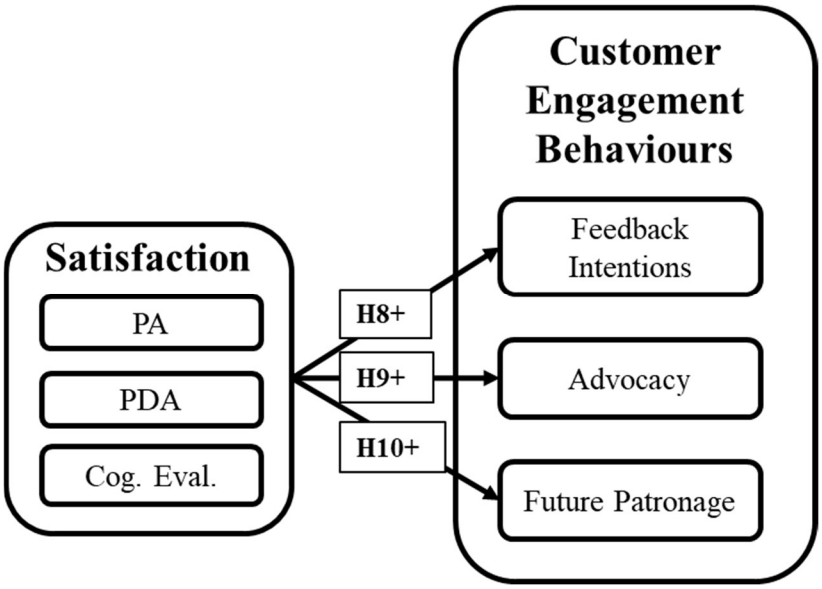
Source: Brodie et al. (2016, p13)

Table 13. CEB definitions in rail services

Type of CEB	Definition
Augmenting behaviour	Customer contributions of resources such as knowledge, skills, labour, and time, to directly augment and add to the focal firm's offering beyond that which is fundamental to the transaction
Co-developing behaviour	Customer contributions of resources such as knowledge, skills, and time, to facilitate the focal firm's development of its offering
Influencing behaviour	Customer contributions of resources such as knowledge, experience, and time to affect other actors' perceptions, preferences, or knowledge regarding the focal firm
Mobilizing behaviour	Customer contributions of resources such as relationships and time to mobilize other stakeholders' actions toward the focal firm

Source: Collated from Jaakkola and Alexander (2014, p255) and Brodie et al. (2016, p12)

Figure 37. Conceptual model focusing on relationships between passenger satisfaction and engagement behaviours



4.7.1 Conceptualising co-developing as feedback intentions

To conceptualise co-developing, the thesis focused on passengers contributing their time, effort and knowledge to TOCs in the form of feedback. This aligned with Jaakkola and Alexander's (2014) definition of co-developing as a CEB in rail services, with regards to passenger's contributing their knowledge, skills and time to assist TOCs with improving rail services (Table 13). The thesis positioned feedback intentions as an outcome variable in the model, congruent with other engagement behaviours. The discussion now focuses on the role of passenger feedback in public transport services, and later, the relationship between passenger satisfaction and feedback intentions.

In bus services, Zimmerman et al. (2011) has noted the importance of passenger feedback for developing digital travel applications and Hildén et al. (2018) has used passenger feedback to identify the important themes of: accessible travel information, entertainment, supporting C2C interactions and providing multiple passenger-provider interaction channels. Similarly, Stelzer et al. (2015) highlights the importance of passenger feedback, and specifically automated feedback mechanisms, for expediting service recovery and tailoring service improvements in bus services. In rail services, specifically, Gebauer et al. (2010) has placed high importance on passenger feedback for enabling TOCs to improve rail services around passenger's needs. This is congruent with Alexander and Jaakkola's

(2014) finding that the CEB of co-developing grants passenger's access to rail services that better met their needs.

With respect to satisfaction, research has suggested the relationship between satisfaction and feedback intentions holds nuance. For example, Söderlund, (1998) has shown dissatisfied customers are more likely to report negative feedback than satisfied customers are to report positive feedback. Contrastingly, in nursing homes Verleye, Gemmel and Rangarajan (2013) have found customers' affect, directed at providers, negatively relates to feedback intentions, highlighting the role of affect during the satisfaction-feedback intentions relationship. In transport services, specifically, research has shown passenger satisfaction, operationalised in terms of cognitive evaluations and affective components like in the thesis, positively related to feedback intentions, though this research adopted service quality as its theoretical lens (Saha and Theingi, 2009).

Overall, research shows passenger feedback plays an important role in improving public transport services (Zimmerman et al. 2010; Gebauer et al. 2010; Hildén et al. 2018) and has shown passenger satisfaction positively relates to feedback intentions (Saha and Theingi, 2009). Thus, the thesis hypothesised:

H8: Passenger satisfaction will positively relate to feedback intentions

4.7.2 Conceptualising influencing as advocacy

The thesis conceptualised the CEB of influencing in terms of passengers' advocacy behaviours, which is directed at social actors (Yi and Gong, 2013). This aligns with Jaakkola and Alexander's (2014, p255) description of influencing in terms of as "customer[s] provid[ing] word of mouth or blogging about their experiences with certain products or firms" and "customers recommending certain products or firms" (Table 13).

The discussion now examines the relationship between passenger satisfaction and advocacy, though research on word-of-mouth (WoM) was reviewed as it represented a form of influencing in rail services (Jaakkola and Alexander, 2014). With respect to WoM, early research has suggested a non-linear u-shaped relationship between customer satisfaction and the construct, with highly dissatisfied and highly satisfied customers showing the strongest WoM (Anderson, 1998). However, more recent research has found customer satisfaction positively and linearly relates to WoM in hospitality (Stoke and Lomax, 2002; Babin, Lee and Griffin, 2005) and energy utility services (v. Wangenheim and Bayón, 2007).

With respect to advocacy, specifically, research has outlined a similar relationship between customer satisfaction and customers advocating for service providers. Urban (2005) has positioned satisfaction at the bottom of a conceptual pyramid that leads to customers' advocating for providers. In telecommunications, Roy (2013) has shown a positive relationship between advocacy and satisfaction during SEM, though the study positioned advocacy as antecedent to satisfaction.

The discussion now focuses on public transport services, and how passenger satisfaction relates to WoM, though to the best of the authors knowledge public transport research has yet to examine the satisfaction-advocacy relationship, specifically. Research has shown a positive relationship between passenger satisfaction and WoM in high-speed rail (Chou et al. 2014; Dölarslan 2014) and airline services (Saha and Theingi, 2009; Suki, 2014), though research using a theory of mind approach has found no direct satisfaction-WoM relationship in public transport services (Yuda Bakti et al. 2020). With respect to the thesis's focus on value creation, Gürler and Erturgut (2018) have found passenger satisfaction partially mediates the perceived value-WoM relationship in airline services, though this research does not consider the role of customer experience in this relationship like the current thesis.

In summary, customer satisfaction plays an influential role in customers' WoM and advocacy across various service settings (Anderson, 1998; Stoke and Lomax, 2002; Babin et al. 2005; Urban, 2005). This relationship has also been evidenced in public transport services, with passenger satisfaction positively relating to WoM (Saha and Theingi, 2009; Dölarslan, 2014; Suki, 2014) that may logically extend to advocacy as a form of influencing. Thus, the thesis hypothesised:

H9: Passenger satisfaction will positively relate to advocacy

4.7.3 Conceptualising future patronage

Future patronage refers to a customer's willingness to consider re-using a service in the future (Mathwick, Malhotra and Rigdon, 2001). In restaurant services, conceptual research underscores the role of satisfaction in patrons' future patronage (Bowden, 2009a/b) and empirical research shows satisfaction to be a greater predictor of future patronage than service quality (Fen and Liam, 2004). In both mobile provider and tourism services, empirical research using SEM shows satisfaction positively relates to customers' behavioural loyalty and future patronage (Roy, 2013; Chen and Chen, 2010). Regarding cognitive and affective

aspects of satisfaction, Lam, Chan, Gong and Lo (2011) have found both positively related to patron's future patronage, but not patrons' desire to stay in, casinos.

In public transport, research has found a congruent relationship between passenger satisfaction and future patronage. In airline services, Saha and Theingi (2009) have shown passenger satisfaction positively relates to repurchase intentions and Shah, Syed, Imam and Raza (2020) have shown service quality (i.e., a cognitive evaluations) partially mediates the satisfaction-patronage relationship. In highspeed rail, Dölarslan (2014) and Wu, Lin and Hsu (2011) have shown satisfaction positively relates to re-purchase intentions in Turkey and Taiwan, respectively. This connection is also present in passengers' general attitudes to public transport use. Using a theory of planned behaviour model, Fu and Juan (2016) have found satisfaction positively related to passengers' intent to re-use public transport in over 2,500 respondents in China, with this relationship being mediated by attitudes towards using public transport and habitual use.

Overall, customer satisfaction plays an important role in customers' future patronage (Bowden, 2009a/b; Fen and Liam, 2004) which is also present in public transport services (Saha and Theingi, 2009; Dölarslan, 2014; Wu, Lin and Hsu, 2011). Thus, the thesis hypothesised:

H10: Passenger satisfaction will positively relate to future patronage

In closing, Chapter 4 covered the conceptual model developed by the thesis, which connected value creation, customer experience, passenger satisfaction and three engagement behaviours (i.e., feedback intentions, advocacy and future patronage). From this model, the thesis seeks to achieve its research aims of estimating holistic value creation as a combination of lower-order value creation processes (i.e., H1 – 4). Additionally, it examines the relationship between holistic value creation and passenger satisfaction, whilst considering the role of customer experience in this relationship (i.e., H5 – 7), and the relationships between passenger satisfaction and three engagement behaviours (i.e., H8 – 10). Supplementary to this, the thesis examined the role of customer experience in the relationship between holistic value creation and engagement behaviours. To achieve these aims, the thesis proposed the research questions of:

Q1) How do the different value creation processes undertaken by passengers relate to holistic value creation?
Q2) How does their holistic value creation relate to passenger satisfaction and what is the role of customer experience in this relationship?
Q3) How does passenger satisfaction relate to customer engagement behaviours?

By answering these questions, the thesis contributes to filling gaps in services marketing research on value creation and consumer behaviour, as well as public transport research. These contributions are as follows. The thesis develops an empirically validated model connecting value creation, customer experience, passenger satisfaction and engagement behaviours, which represents its first and major contribution. With respect to value creation, the model estimates holistic value creation as a novel higher-order construct, whilst examining the relative contribution of each lower-order process, which represents its second and third contributions. Given the scarcity of research on value creation in public transport, the thesis's focus on passengers' value creation, specifically, represents its fourth contribution.

The thesis's examination of customer experience during the value-satisfaction and value-engagement relationships represents its fifth contribution. With regards to public transport research, in particular, the thesis conceptualises customer experience in terms of experience stages and examines the conceptual order of value creation and customer experience with respect to passenger satisfaction. These represent the sixth and seventh contributions of the thesis, respectively. Lastly, the thesis examines the relationship between passenger satisfaction and three engagement behaviours (i.e., feedback intentions, advocacy and future patronage), which have not been examined by public transport research within the contexts of value creation. This represents the eighth contribution of the thesis.

The discussion now turns to Chapter 5, which focuses on the thesis's methodology, operationalising constructs and survey development.

Chapter Five - Methodology

Chapter Five - Methodology

5.1 Introduction

Chapter 5 reviews the methodology of the thesis. A research methodology allows researchers to align methodological processes with research questions. Overall, these methodological processes relate to the research philosophy, logic and reasoning, qualitative and quantitative methods, research design and data collection and analysis used to answer research questions (Saunders, Lewis, Thornhill, 2019). Chapter 5 is divided into twelve sections: an introduction; discussion of the thesis's philosophical paradigm, reasoning and logic; the choice of research method and research design; survey methods; sampling, sampling procedures and data collection; survey development; how survey measures were developed; the use of screening, background and demographic questions in the thesis; pre-testing survey measures; the thesis's approach to data analysis; ethical considerations; and, finally, a summary of the methodology.

5.2 Research philosophy

Research philosophies are defined as a "system of beliefs and assumptions about the development of knowledge" that determine how researchers interpret reality (ontology), study this reality (epistemology) and the role of their own values in the research processes (axiology) (Saunders et al. 2019, p130). Ontology can range from objectivism to subjectivism, where reality either exists objectively and subjectively, as proposed by research philosophies like positivism and social constructionism, respectively (Kraus, 2005). Epistemology reflects "what constitutes acceptable, valid and legitimate knowledge" and ranges from objective to subjective perspectives (Saunders et al. 2019, p133). Axiology reflects the extent to which the researcher's own value frameworks influence the research process and ranges from value-free (e.g. statistical analysis) to value-bound methods (e.g. qualitative analysis) (Table 14).

Table 14. Philosophical assumptions of ontology, epistemology and axiology as a multidimensional set of continua

Assumption	Questions	Objectivism	Subjectivism
Ontology	• What is the nature of reality? • What is the world like? • For example: - What are organisations like? - What is it like being in organisations? - What is it like being a manger or being managed?	Real External One true reality (universalism) Granular (things) Order	Nominal / decided by convention Socially constructed Multiple realities (relativism) Flowing (processes) Chaos
Epistemology	• How can we know what we know? • What is considered acceptable knowledge? • What constitutes good quality data? • What kinds of contribution to knowledge can be made?	Adopt assumptions of the natural scientist Facts Numbers Observable phenomena Law-like generalisations	Adopt the assumptions of the arts and humanities Opinions Written, spoken and visual accounts Attributed meanings Individuals and contexts, specifics
Axiology	• What is the role of values in research? Should we try to be morally neutral when we do research, or should we let out values shape research? • How should we deal with the values of research participants?	Value-free Detachment	Value-bound Integral and reflexive

Source: Collated from Saunders et al. (2019, p135)

Positivism, critical realism and social constructionism are three commonly used research philosophies (Alvesson and Skolberg, 2009). Positivism is based on the principle of phenomenalism where only knowledge confirmed by the senses is confirmed definitively (Bryman, 2016) and explains "human behaviour in terms of cause and effect" (May, 2008, p15). Social constructionism focuses on "how we understand and even perceive the world" and how these perceptions are often a consequence of language (Burr, 2017, p1). In contrast with these two philosophies, critical realism offers a middle ground between philosophies related to empiricism and relativism (e.g. positivism and social constructionism) as it combines "modified naturalism" with the "necessity of interpretive understanding of meaning in life" (Sayer, 2000, p3). In social sciences, researchers who use critical realism are "neither

monothetic (that is law-seeking) nor idiographic (concerned with documenting the unique)", as in positivism and social constructionism (Sayer, 2000, p3).

Positivism assumes concepts exist independently of researcher's observations and make up a single comprehensible reality (Healy and Perry, 2000). The philosophy is comprised of four principles: determinism, empiricism, parsimony, and generality. In determinism, the universe does not "behave capriciously" but instead events are causally linked. In empiricism, certain types of knowledge can only derive from "verifiable observations or direct experiences" and parsimony proposes concepts should be explained as succinctly but comprehensively as possible. In generality, enquiries should begin with "observations of the particular" to develop generalisations applicable to parent populations (Cohen et al. 2000, p10-12). Mouly (1978) proposed that for positivism initial enquiries should be experience based, then data organised to support clarity and accompanying quantitative measures used to examine phenomenon. Research in SDL (Vargo and Lusch, 2008; 2014) and service logic (Grönroos, 2011; Grönroos and Voima, 2013) is often positivist.

Social constructionism focuses on "how reality is socially constructed" (Alvesson and Skoldberg, 2009, p29) and has been applied to develop the concept of value-in-social-context (Edvardsson et al. 2010). CDL has focused on the social construction of value, as a customer's "value assessment is part of [their] social reality" (Heinonen et al. 2010, p10). Although insightful, the paradigm's subjective ontology and epistemology does not align with the aim of this thesis to develop generalisable strategies to support passengers' value creation and increase satisfaction.

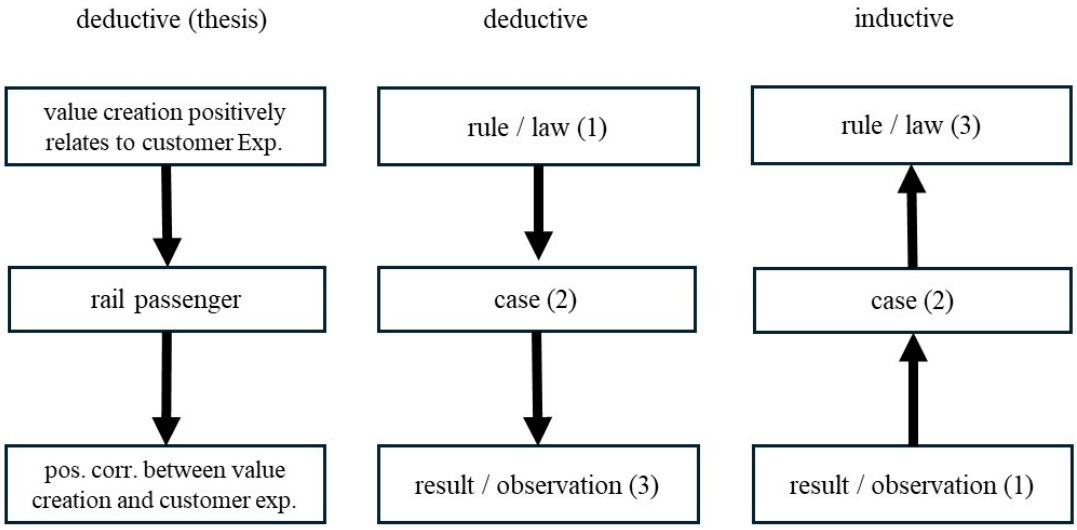
The thesis adopts positivism as its research philosophy under the following rationales. The thesis seeks to infer generalisable conclusions from its conceptual model that offer both scholarly and commercial insights on rail passengers' behaviours. In support of this aim, the thesis based its enquiries on passengers' experiences and examined them quantitatively through SEM, which aligns with the positivist principles of empiricism and determinist, respectively. Additionally, as service logic commonly adopts positivism, thesis's use of positivism ensures its operationalisation of the Grönroos-Voima value model holds ontological, epistemological and axiological assumptions that align with wider service logic research.

5.2.1 Logical reasoning

Research philosophies use different forms of logical reasoning to understand the relationships between theory and research. Positivism applies the top-down approach of deductive reasoning wherein the "argument moves from general principles to particular instances" and "proceeds from the general (the rule), through the subsumption of the singular case under the rule, to the assertion of the particular (the result)" (Fischer, 2001, p366). Deductive reasoning consists, therefore, of a "major premise based on a self-evident proposition" and a "minor premise concerning a particular case", logically subsumed by the former (Mouly, 1978, p8). Although it is not necessarily content creating, deductive reasoning is truth-conserving — as conclusions derive from analytically true premises — which makes it popular with positivist researchers for deriving generalisable conclusions (Fischer, 2001) (Figure 38).

In contrast, inductive reasoning follows a bottom-up approach as research begins with a "particular instance or instances and concludes with general statements and principles" (Williamson, Burstein, McKemmish, 2002, p332). Thus, "the premises (the initial basis) are observational statements, and an inferred conclusion" is produced that is content increasing but not truth-conserving, given inferences cannot be proved universally (Fischer, 2001, p 366). As the thesis applies pre-established theories on value creation to offer generalisable conclusions, it employs deductive reasoning (Figure 38).

Figure 38. Figure of deductive and inductive reasoning with example of deductive reasoning in the study



Source: Fischer (2001, p367) with examples from thesis overlayed left.

5.3 Research methods

Methodology represents the processes researchers apply to investigate their interpretation of reality. Positivist researchers often use quantitative measures, following deductive reasoning to test hypotheses (Williamson, Burstein, McKemmish, 2002). These measures tend to be psychometric scales (e.g. Likert-scales, semantic differential scales, etc) and statistical analysis that are independent of the researcher's interpretations. In contrast, qualitative methods commonly follow inductive reasoning and are useful for examining subjective perceptions of reality (Saunders et al. 2019). This thesis uses the quantitative methods of Likert and semantic differential scales to quantify passengers' experiences, value creation, satisfaction and engagement behaviours. A structural equation model (SEM) helps examine the relationships between constructs, which will be discussed later in the chapter.

5.3.1 Research design

In marketing, research designs reflect the "procedures necessary for obtaining the information needed to structure or solve marketing research problems" and can be grouped into exploratory or conclusive categories (Malhotra, 2007, p78). Exploratory research designs aim to generate insights, often through qualitative methods and small sample sizes, whilst conclusive research designs aim to test specific hypotheses via quantitative methods and large sample sizes (Iacobucci and Churchill, 2010). In marketing, conclusive research designs can be causal (e.g. experimental) or descriptive (e.g. cross-sectional or longitudinal). Descriptive research designs describe concepts, or the extent to which marketing variables relate to each other, and often use secondary data, surveys, panels or observational data (Malhotra, 2007).

In contrast, causal research focuses on examining relationships in terms of cause and effect and often uses experimental designs to infer causality (Malhotra, 2007). In marketing, the use of causal research designs increased in 1980s and 1990s (Hulland, Chow and Lam, 1996) and most commonly used longitudinal time frames (Baines, Fill, Rosengren and Antonetti, 2017). The thesis adopts a descriptive research design to assess the relationship between value creation and passengers' service experiences, satisfaction and engagement, rather than attempting to infer causality.

5.4 Survey method

Over the past decade, 20 to 60% of the studies published in three mainstream marketing journals have used surveys (Hulland, Baumgartner and Smith, 2017). The primary benefit of surveys is their uniformity. Respondents are presented with constructs in the same order, although items can be randomised to mitigate sequencing effects. Structured surveys offer researchers more control over survey lengths, making data collection easier, in contrast with unstructured surveys (Iacobucci and Churchill, 2010).

Traditionally, marketing research has administered surveys face to face, or via the telephone and mail (Roster, Rogers, Albaum and Klein, 2004) although administering surveys via the internet makes tabulation, analysis and standardisation easier (Burns and Bush, 2002). Comparing face to face and internet methods highlights their advantages and disadvantages (Table 15). Face to face surveys lend themselves well to in-depth interviews, but can be costly (Fowler, 2014). In contrast, internet surveys are often cheaper, and cost savings can be passed onto respondents through incentives (Fielding, Lee and Blank, 2016), although generating respondent engagement and mitigating percieved privacy issues can be a challenge (Evans and Mathur, 2005; Fowler, 2014) (Table 15).

Table 15. Advantages and disadvantages of personal interviews and internet surveys

	Advantages	Disadvantages
Personal interviewing	Some sample designs that can be implemented best by personal interview (e.g., in-depth interviews)	More costly than the alternatives methods.
	Probably the most effective way of enlisting cooperation from most populations.	Trained staff that are geographically near respondents needed
	Answering respondent questions, probing for adequate answers, and respondents accurately following complex instructions or sequences	The total data collection period is likely to be longer than telephone procedures.
	Can include observations, visual cues, and self-administered sections	Some populations more accessible by some other mode.
	Rapport and confidence building with interviewer	
Internet surveys	Low unit cost of data collection.	Limited to samples of Internet users.
	Potential high speed of returns.	Need for comprehensive address lists.
	Self-administered and computer assisted instrument.	Challenges of enlisting cooperation (depending on sampled groups and topic).
	Like mail surveys, providing time for thoughtful answers, checking records, or consulting with others.	

Source: Summarised from Fowler (2014, p71-73)

The thesis opted to distribute surveys via the internet, as this offered a cost effective and expedient method for collecting the large sample size needed. Research has defined online surveys as "computerized questionnaires (i.e. digital format instead of paper), which rely on some ICT network to mediate the survey process" (Fielding et al. 2016, p145). More specifically, surveys distributed online via webpages have been defined as "computerized self-administered questionnaires, stored on a specific computer connected to the Internet (i.e. *server*), which respondents access via a web browser" and this type of online survey rose to prominence alongside the development of modern web browsers (Callegaro, Manfreda and Vehovar, 2015, p5). Scholars have noted the appropriateness of using online surveys for gathering large sample sizes despite the methods limitations (Evans and Mathur, 2005; Fowler, 2014; Fielding et al. 2016) and these have been mitigated through appropriate measures in the thesis (

Table 16).

Table 16. Limitations of online surveys and mitigating actions taken in the thesis

Weakness of online surveys	Actions taken in study
Low Response Rate	Large distribution channels used to compensate expected low response rate
Potential for low engagement by respondents	Respondents informed of incentive (i.e., £5 shopping voucher) after starting survey to increase completion rates. Reference to incentive not included in messages promoting survey.
Privacy Issues	No personal information gathered, anonymised codes used, data storage GDPR compliant
Variations in technological / internet experience of respondents	UK's Office for National Statistics: 99% & 54% of 16–44 and 75+ year olds respectively had used internet within at least 2 weeks (Prescott, 2021) 92% of adults (aged 16–75+) held minimum digital literacy (Serafino, 2019)
Sample selection & implementation	Sample selection follows quota-sampling to align with TfW Wales demographic passenger information
Perceptions of Junk Mail	Distributed & promoted through official organisations (e.g. TfW, Transport Focus, etc), mitigating respondents' perceptions of survey as junk mail

Note: Limitations of online surveys identified by research (Evans and Mathur, 2005; Fowler, 2014; Fielding et al. 2016) and actions taken to mitigate these limitations in the thesis.

5.5 Sample and sampling procedure

A sample is "a sub-group of the population selected for inferences about the population parameters" and it is appropriate for large target populations (Malhotra, 2007, p335). During sampling, researchers must choose a "source or list of sample units from which a sample is drawn" (i.e. a sampling frame) and must be wary of sampling frame errors (i.e. discrepancies between sources and target populations) (McNabb, 2014, p81). To mitigate sampling frame errors, researchers can refine the definition of target populations, use weighting schemas or screen respondents. The thesis chose to screen respondents in terms of whether respondents were aged eighteen or older and had used TfW's rail services in the past.

Next, researchers must choose to define the elements, sampling unit, extent and time-period to form sub-samples. Elements are the "object about which or from which the information is desired" (Malhotra, 2007, p336) that reside within a sampling unit (e.g. households). As passengers were queried directly, both elements and sampling units were individual passengers. Extent relates to the geographical boundaries of these elements or sampling unit. In the study, this was defined in terms of geographical (i.e. within Wales) and as TfW's rail services extend into England a relational criterion (i.e., TfW Rail's passengers) was used as well. Lastly, the time frame of the study was 15th October 2022 to 15th March 2023 to mitigate the impact of rail strikes on responses. The study aimed to acquire approximately 400 responses.

Next, researchers must choose probabilistic or non-probabilistic sampling techniques. Probabilistic sampling involves randomly choosing respondents, with the most common techniques being simple random sampling (SRS), systematic sampling, stratified sampling and cluster sampling. Non-probability sampling relies upon the "personal judgement of the researcher rather than chance to select sample elements" (Malhotra, 2007, p340) and the most common techniques are convenience, judgemental, quota and snowball sampling. Convenience sampling is the least expensive and time-consuming and so was used in thesis's pilot data collection. Quota sampling follows a more systematic approach as quotas "ensure that the composition of the sample is the same as the composition of the population" for certain characteristics (Malhotra, 2007, p344). This approach has the benefit of forming sub-samples in line with important characteristics of a target population, whilst expediting data collection in a cost-effective manner compared to probabilistic sample (Malhotra et al. 2007). Thus, quota sampling was used for main data collection by the thesis.

At present, no sampling frame exists to identify the composition of TfW's passengers outside the TOC's passenger experience data. As such, the thesis used the TOCs passenger experience data to inform its use of quota sampling. More specifically, the thesis used the proportion of commuter, leisure and business passengers shown by the TOCs data to form its quotas. This was chosen over other criteria, such as the regions passengers lived, as the composition of commuter, leisure and business passengers holds commercial importance to TfW. As the thesis aimed to offer commercial insights for TfW, quotas were based around the proportion of commuter, leisure and business passengers present in the TOCs passenger experience data.

5.5.1 Data collection

Researchers use primary or secondary data sources. Primary research happens when "research [is] conducted for the first time" and involves a "collection of data for the purpose of a particular project" (Baines et al. 2019, p72). In contrast, secondary research involves "gaining access to the results of previous projects" and can be more cost effective (Baines et al. 2019, p72). In general, marketing research has used roughly an even balance between primary and secondary data sources (Morgan et al. 2019). As this thesis examines the specific context of passengers' rail use, it uses primary data sources.

Researchers must also decide whether to use quantitative or qualitative surveys. Marketing research has generally used quantitative methods, with almost half of publications between 1993 and 2002 across three mainstream journals using only quantitative measures (Hanson and Grimmer, 2007). Qualitative and quantitative measures tend to differ in their time frames, orientation toward exploratory research versus theory testing and in the role of the researcher's interpretations during analyses (Queirós, Faria and Almeida, 2017) (Table 17). This thesis uses quantitative measures for data collection to offer generalisability whilst operationalising its conceptual model.

Table 17. Differences between quantitative and qualitative research methodologies

Dimension	Quantitative research	Qualitative research
Focus on understanding the context of the problem	Smaller	Bigger
Dimension of group studies	Smaller	Bigger
Proximity of the research to the problem being studied	Smaller	Bigger
Scope of the study in time	Immediate	Longer range
Researchers point of view	External	Internal
Theoretical framework and hypothesis	Well structures	Less structured
Flexibility and exploratory analysis	Lower	Higher

Source: Queirós, Faria and Almeida (2017, p371)

5.5.2 Procedures for data collection

The study initially distributed surveys via internal networking platforms to Cardiff University, social media and professional networking platforms (Appendix 1). During main data collection, surveys were distributed through contact channels directly managed by TfW Rail (e.g. Customer Panel - Swgrs) and peripheral rail services (e.g. Traveline Cymry), rail consultancy firms (e.g. Transport Focus) and passenger community partnerships (Appendices 2 – 11). Data collection was performed using the survey platform Qualtrics and surveys were distributed in both English and Welsh (Appendix 12). Several higher education institutes promoted TfW Rail's initial distribution as well (Table 18). Survey items were presented as a continuous list, with breaks dividing items with respect to value creation, customer experience, passenger satisfaction and customer engagement behaviours.

Table 18. List of different distribution channels including geographical regions and agreement to directly distribute or promote the survey

Distribution Channel	Direct	Promote	Geographical Region
TfW's social media (Facebook, Twitter)	✓		All Wales
TfW's professional networks (LinkedIn)	✓		All Wales
TfW's customer panel (Swgrs)	✓		All Wales
TfW's accessibility panel	✓		All Wales
Traveline Cyrmu (Facebook, LinkedIn)	✓		All Wales
Rail Future	✓		All Wales
Transport Focus	✓		All Wales
Conwy Valley & North-West Wales Coast Community Rail Partnership	✓		North-West Wales
Groundworks North Wales	✓		North-East Wales
Shrewsbury-Aberystwyth Community Rail Association (SARPA)	✓		Mid-East / Border to Mid-West Wales
Heart of Wales Community Rail Partnership	✓		Central Mid-Wales to South-West Wales
South-West Wales Connected Community Rail Partnership	✓		South-West Wales
Cardiff University (PhD cohort)	✓	✓	South-East Wales
University of South Wales		✓	South-East Wales
Swansea University		✓	South-West Wales
Bangor University		✓	North-West Wales
Aberystwyth University		✓	Mid-West Wales

5.6 Survey development

Survey development began with a broad review of conceptual research on value creation; co-creation in public transport; customer experience; customer satisfaction; passenger satisfaction; customer engagement and customer engagement behaviours (Chapters 2 – 4). Next, a literature review of appropriate scales for operationalising constructs was performed and feedback from the pilot study was used to refine survey items (Table 19).

Table 19. Overview of the steps taken to develop the survey used in the study

Overview of step taken to develop the final survey in the study		
Method	Topics covered	Period
Literature Review of conceptual research	SDL; service logic; CDL; joint value co-creation; co-production; positive value-in-use; independent value creation; self-service; social value co-creation; negative value-in-use; co-creation in public & rail transport services; customer experience; passenger experience; customer engagement; customer satisfaction, passenger satisfaction, co-design; feedback intentions; advocacy and future patronage	Mid Sept 2019 – Aug 2021
Literature review of operationalised scales	Co-production, positive value-in-use, social value co-creation, independent value creation, self-service, negative value-in-use, customer experience, customer engagement, customer engagement behaviours; customer satisfaction, passenger satisfaction; feedback intentions; advocacy and future patronage	Sept 2021 – May 2022
Amendments to prior scales	Scales modified to rail service contexts: Co-production; positive value-in-use, value from self-service technology; value from self-service technology; monetary cost, emotional cost, time and effort cost, C2C interactions; information seeking; helping, perceived value, EXQ-revised; satisfaction with travel scale, feedback intentions; advocacy; future patronage	May 2022 – July 2022
Pilot data collection	Survey & Instrument refinement	Mid July – End of July 2022
Main data collection	Distributed through passenger channels	November 2022 – March 2023

5.6.2 Pilot study

Pilot testing is an important stage of survey development as it enables surveys to be tested on real-world populations on issues ranging from comprehension to layout (Iacobucci and Churchill, 2010). Saunders et al. (2019) has suggested a minimum sample size of 10 for pilot studies, although research has recommended a sample size of 10 to 30 for internet surveys

(Hill, 1998). In the thesis's pilot study, respondents were recruited by convenience and snowball sampling through respondent referrals, social media and professional networking platforms (Twitter, LinkdIn, Cardiff Universities' internal Microsoft Teams). The pilot study recruited 36 respondents, producing an acceptable end sample size (N = 19), with responses having a mean duration of 18.6 minutes. The sample consisted of more females (57%) than males (33%), a bias also present in TfW Rail's passenger experience data (Females = 55%, Males = 45%). All reflectively measured constructs held acceptable internal consistency (Hair et al. 2014) except for Time and Effort Costs (.277) (Table 20).

Feedback from the pilot study was implemented as follows. Firstly, respondents reported ambiguity and overly formal terminology in some items, leading to contextual information and removal of jargon to support respondents' comprehension. Secondly, non-completion rates were mitigated by shortening the survey by simplifying the "About Journey" and demographics sections and using a shortened version of the STS. Section markers (e.g. Part 1) and routing were added to help respondents gauge their progress and mitigate response burden by only presenting appropriate items. Additionally, to further support completion rates, the decision was made to offer respondents a £5 Love2Shop retail voucher to compensate for the time taken to finish the survey. This may have generated engagement from respondents for the purpose of obtaining the voucher, although this potential was mitigated by not referencing the incentive on messages promoting the survey, reducing this potential. Use of the incentive was deemed necessary given: the survey length of over 125 questions; the high attrition rate for respondents finishing surveys in the pilot study; and the importance of having complete responses for the analysis.

Lastly, semantic differential scales in the STS were originally presented in alternating orders to mitigate potential acquiescence bias. However, this created confusion in respondents that responded in line with other survey scales (i.e. left being most negative, right being most positive). Therefore, the scaling of the STS was amended to be congruent with all other survey scales.

Table 20. Internal consistency of reflectively measured constructs during pilot study

Construct	Cronbach's alpha
Brand experience	.807
Service provider experience	.915
Post-purchase experience	.868
Value from digital self-service	.861
Value from physical self-service	.905
Helping	.775
Information seeking	.675
Monetary costs	.963
Emotional costs	.853
Time and effort costs	.277
Perceived value	.792
Positive deactivation	.679
Positive activation	.904
Cognitive evaluation	.946
Feedback intentions	.844
Affective commitment	.870
Advocacy	.975

5.7 Survey measures

The thesis uses Likert and semantic differential scales to measure constructs. Likert-scales measure the degree to which respondents agree or disagree with declarative statements (Russel, 2010). These scales can be influenced by acquiescence bias, as respondents tend to agree regardless of their actual attitudes, particularly when statements are positively framed (Friborg, Martinussen and Rosenvinge, 2006). A semantic-differential scale measures respondents' attitudes based on an ordered continuum of adjectives (e.g. very angry to very happy) (Russel, 2010) and this was used to measure passenger satisfaction via the satisfaction with travel (STS) scale (Friman et al. 2013; Olsson et al. 2012). All other constructs were measured using a Likert-scale.

5.7.1 Co-Production

The thesis uses Ranjan and Read's (2014) co-production scales, with modifications, to operationalise co-production. The scale consisted of the sub-dimensions of knowledge, equity and interaction, measured using 4 items each along a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Applying De Keyser et al.'s (2020) touchpoint analysis (Appendix 13) showed that passengers' co-producing interactions occurred in three

forms. These occurred as they interacted with TfW at an organisational level (e.g. during digital communications), at a localised level with personnel (e.g. at stations) or at both levels. Therefore "party" was modified with respect to passengers' interaction contexts (Table 21). Only one item, E4, was omitted as TfW holds the dominant role during value creation because they facilitate value through resource provisioning (Alexander and Jaakkola, 2011). Passengers cannot hold an equal role in determining service outcomes and, as such, this item was inappropriate for the service context.

An alternative approach to operationalising value co-creation was the D.A.R.T model (Albinsson et al. 2016). However, this model measures customers' attitudes during co-creative initiatives specifically, rather than during typical service use. It does not distinguish between the two components of co-creation (i.e. co-production and positive value-in-use). Thus, Ranjan and Read's (2014) scale of co-production was deemed more appropriate for the thesis.

Table 21. Original and final survey items for co-production constructs of knowledge, equity and joint interaction

Modifications made to co-production scale in the study		
Knowledge		
Original Scale	Modifications	Scales used in the study
1) The party was open to my ideas and suggestions about its existing products or towards developing a new product	"party" modified to "TfW" – receptiveness to feedback devised at organisational level	TfW was open to my ideas and suggestions about existing rail services or developing new rail services.
2) The party provided sufficient illustrations and information to me	"party" modified to "TfW" - service information prepared at organisational level	TfW provided enough illustrations and information to me (e.g. route maps, timetables, signage, etc).
3) I would be willingly spare time and effort to share my ideas and suggestions with the party in order to help it improve its products and processes further	"party" modified to "TfW or personnel" – feedback received at both organisational and local level	I would be willing to spare time and effort to share my ideas and suggestions with TfW or personnel to improve rail services.
4) The party provided suitable environment and opportunity to me to offer suggestions and ideas	"party" modified to "TfW" – feedback friendly service as environments devised at organisational level	TfW offered a suitable environment and opportunity to give suggestions and ideas.
Equity		
1) The party had easy access to information about my preferences	"party" modified to "TfW or its personnel" – passenger information occurs at organisational and localised level	TfW or its personnel had easy access to information about my preferences (e.g. how I have used or like to use rail services).
2) The processes at this party are aligned with my requirements (i.e. the way I wish them to be)	"party" modified to "TfW" – service processes devised at organisational level	TfW's rail services are how I wish them to be.
3) The party considered my role to be as important as its own in the process	"party" modified to "TfW" – incorporation of passengers into services devised at organisational level	TfW considered my role to be as important as its own during rail services.

4) We shared an equal role in determining the final outcome of the process	Omitted as inappropriate for rail service context	N/A
Interaction		
1) During the process I could conveniently express my specific requirements	"party" modified to "TfW or its personnel" - passenger enquiries occur at both organisational and localised level	I could conveniently state what I need(ed) during dialogue with TfW or its personnel.
2) The party conveyed to its consumers the relevant information related to the process	"party" modified to "TfW's personnel" – service information most often conveyed at localised level	TfW's personnel gave passengers the relevant information during dialogue.
3) The party allowed sufficient consumer interaction in its business processes (product development, marketing, assisting other customers, etc.)	"party" modified to "TfW or its personnel" – allowing for passenger interactions devised at both organisational and localised level	TfW or its personnel allowed enough interactions with passengers during dialogue (i.e. for improving rail services, marketing, etc).
4) In order to get maximum benefit from the process (or, product), I had to play a proactive role during my interaction (i.e., I have to apply my skill, knowledge, time, etc.)	"party" modified to "TfW or its personnel" as dialogical interactions occur at both organisational and localised level	To get the most from rail services I had to actively engage in dialogue with TfW or its personnel (i.e., I have to apply my skills, knowledge, time, etc.)

Source: this study

5.7.2 Positive value-in-use

Ranjan and Read's (2014) value-in-use scale was used with modifications to operationalise passengers' positive value-in-use (Table 22). The scale consisted of the sub-dimensions of experience (measured using 3 items), personalisation (4 items) and relationship (3 items). Each construct was measured by a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly disagree). Alternative approaches were considered. Sweeney et al. (2018) operationalise positive value-in-use in terms of expertise, education, convenience and motivation, but within the predominantly knowledge processing service context of financial planning. This differs significantly from the predominantly people-processing context of rail services, where mental engagement is less important during service use. Additionally, although expertise (i.e. of rail providers) and convenience (i.e. of rail services) are appropriate for the thesis, these are associated with Ranjan and Read's (2014) constructs of relationship and experience (Medberg and Grönroos, 2020). Thus, the thesis opted to use Ranjan and Read's (2014) positive value-in-use scale to operationalise the construct.

Table 22. Original and final survey items of positive value-in-use constructs of experience, personalisation and relationship

Modifications made to positive value-in-use scale in the study		
Original Scale	Modifications	Scales used in the study
Experience		
1) It was a memorable experience for me (i.e., the memory of the process lasted for quite a while)	"the process" modified to "rail services"	It was a memorable experience for me that lasted quite a while.
2) Depending upon the nature of my own participation, my experiences in the process might be different from other consumers		Depending upon my own participation, my experiences of rail services might differ from other passengers'.
3) It was possible for a consumer to improve the process by experimenting and trying new things		It was possible for a passenger to improve rail services by experimenting and trying new things.
Personalisation		
1) The benefit, value, or fun from the process (or, the product) depended on the user and the usage condition	"the user" and "consumer" modified to "passenger"	The benefit, value, or fun from rail services depended on the passenger and their usage.
2) The party tried to serve the individual needs of each of its consumers		TfW tried to serve each passenger's individual needs.
3) Different consumers, depending on their taste, choice, or knowledge, involve themselves differently in the process (or, with the product)		Different passengers, depending on their preferences or knowledge get involved differently in rail services.
4) The party provided an overall good experience, beyond the "functional" benefit the process (or, with the product)	"the process (or, with the product" modified to "rail services"	TfW provided an overall good experience, beyond the functional benefit of rail services.
Relationship		
1) The party's extended facilitation is necessary for consumers to fully enjoy the process (or, the product)	"extended facilitation" modified to "assistance" to use passenger-centric terminology	TfW's assistance is necessary to fully enjoy rail services.
2) I felt an attachment or relationship with the party	"the party" modified to "TfW and its personnel" or just "TfW" depending of item's context	I felt an attachment or relationship with TfW and its personnel.
3) There was usually a group, a community, or a network of consumers who are a fan of the party		There was usually a group, community, or network of passengers who are fans of TfW.
4) The party was renowned because its consumers usually spread positive word about it in their social networks		TfW is renowned because its passengers usually speak positively about them.

Source: this study

5.7.3 Independent value creation

The thesis modifies Shockley and Turner's (2014) value of self-service scale to operationalise independent value creation (Table 23). De Keyser et al.'s (2020) touchpoint analysis showed that digital and physical self-service captures passengers' independent value creation (Appendix 14). The scale was modified to measure passengers' value from these mediums of self-service. Each was measured using four items along a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly disagree). Contextual examples were given to support comprehension.

Zainuddin et al. (2016) operationalised value creation from self-service in terms of value outcomes, but their scale did not incorporate customers' interactions with resources. As service quality and value-in-use have been linked (Medberg and Grönroos, 2020), models like SSTQUAL (Lin and Hsieh, 2011) and other measures of service quality for self-service use (Narteh, 2015; Orel and Kara, 2014) were likewise considered. However, since the thesis focuses on value creation, rather than service quality, these alternatives were considered inappropriate. Thus, the thesis adopts Shockley and Turner's (2014) value of self-service scale to operationalise independent value creation since their scale incorporated value from self-service as customers interacted with resources.

Table 23. Original and final survey items for independent value creation of value from digital self-service and value from physical self-service

Modifications made to value from self-service scale in the study to operationalise independent value creation		
Original Scale	Modifications	Scales used in the study
Value from Self-Service		Digital Self-Service
	Preparatory sentence added to avoid repetition of "The self-service kiosk lets me"	Overall, the digital self-service functions (Travel apps, Capacity Checker, Wi-Fi, etc):
1) The self-service ordering kiosk lets me get exactly what I really want with my food/beverage order	"Overall" added to measure passengers general, not journey-specific, assessment of self-service features	Gives me the rail services I want.
2) The self-service ordering kiosk lets me get my food/beverage in a timely manner.	"digital self-service functions (Travel apps, Capacity Checker, Wi-Fi, etc)" used to contextualise items to IVC during digital self-service	Let me use rail services in a timely manner.
3) The self-service kiosk lets me get better quality food and beverages.		Let me use rail services better.
4) I like using the self-service ordering kiosk.		Overall, I like using the digital self-service functions (Travel apps, Capacity checker, Wi-Fi, etc) throughout my rail journey.
		Physical Self-Service
	"physical self-service functions (Ticket machines, automated gates, car parking, signage, announcements, etc)" used to contextualise items to IVC during physical self-service	Overall, the physical self-service functions (Ticket machines, automated gates, car parking, signage, announcements, etc)
1) The self-service ordering kiosk lets me get exactly what I really want with my food/beverage order		Gives me the rail services I want.
2) The self-service ordering kiosk lets me get my food/beverage in a timely manner.		Let me use rail services in a timely manner.
3) The self-service kiosk lets me get better quality food and beverages.		Let me use rail services better.
4) I like using the self-service ordering kiosk.		Overall, I like using the physical self-service functions (Ticket machines, automated gates, car parking, signage, announcements, etc) throughout my rail journey.

Source: this study

5.7.4 Social value co-creation

To operationalise social value co-creation and examine interactions between passengers, the thesis uses De Keyser et al.'s (2020) touchpoint analysis (Appendix 15). Ranjan and Read's (2014) interaction and Yi and Gong's (2013) information seeking and helping scales are used, with modifications. Items 1 and 2 of interaction were omitted, as other passengers would not be expected to convey service information or meet the exact needs of focal passengers. Items 3 and 4 were retained as they measured conceptually important aspects of social value co-creation: the supportive role of providers and customers' proactive engagement (Heinonen et al. 2018; Reichenberg, 2017). Interaction originally used a 7-point scale but this was amended to a 5-point scale to be congruent with information seeking and helping scales. Psychometric research in marketing comparing 5-, 7- and 10-point increments has found no scale point to be any less desirable during CFA or SEM (Dawes, 2008). Thus, the decision was justified to mitigate response burden by using the same Likert scale for all constructs measuring social value co-creation.

Yi and Gong's (2013) information seeking and helping scales were used to operationalise social value co-creation under the following rationale. Social value co-creation can occur under various contexts (Pandey and Kumar, 2020). The thesis therefore operationalises social value co-creation in terms of passenger interactions that directly supported rail use and enabled knowledge exchanges (Heinonen et al. 2018). Although a simplified dichotomy, focal passengers can be recipients or offering parties during knowledge exchanges. Yi and Gong's (2013) model of co-creation behaviours has been used to examine social value co-creation on social media platforms (Zadeh, Zolfagharian and Hofacker, 2019), validating the scale for use in social contexts. As information seeking and helping examined focal passengers as recipients and offering parties, respectively, the scales were used to incorporate both aspects of social value co-creation in the thesis.

Alternatives approaches for operationalising social value co-creation were considered. Verleye (2015) measured social value during co-creation and Buonincontri et al. (2017) measured customers sharing service experiences with other customers in tourism services. However, these scales measured social value as an output, not during interactions, or measured aspects of social value co-creation outside those thesis's narrowed operationalisation (i.e., in term off passengers' using rail services). To operationalise social value co-creation, in terms of focal passengers receiving and offering knowledge exchanges,

the thesis adopts modified forms of Yi and Gong's (2013) information seeking and helping scales, as well as Ranjan and Read's (2014) interaction scale (Table 24).

Table 24. Original and final survey items of social value co-creation constructs of social interaction, helping and information seeking

Modifications made to interaction, helping and information seeking scales to operationalise social value co-creation in the study		
Interaction	Modifications	Social Interaction
1) During the process I could conveniently express my specific requirements	Item 1 & 2 inappropriate as other passengers are not expected to take on TOCs responsibility of processing service requests	-
2) The party conveyed to its consumers the relevant information related to the process		-
3) The party allowed sufficient consumer interaction in its business processes (product development, marketing, assisting other customers, etc.)	"consumer interaction" modified to "interactions between passengers"	TfW allowed sufficient interactions between passengers in its rail services (i.e. for service development, marketing, assisting other passengers, etc.)
4) In order to get maximum benefit from the process (or, product), I had to play a proactive role during my interaction (i.e., I have to apply my skill, knowledge, time, etc.)	Interactions specified to "with other passengers"	To get the most from rail services, I had to play a proactive role during my interactions with other passengers (i.e., I have to apply my skill, knowledge, time, etc.)
Helping		
1) I assist other customers if they need my help.	Item 1 removed as too similar to Item 2	-
2) I help other customers if they seem to have problems.	"other customers" modified to "other passengers"	I help other passengers if they seem to have problems.
3) I teach other customers to use the service correctly.	"service" modified to "rail service"	I teach other passengers to use rail services correctly.
4) I give advice to other customers.		I give advice to other passengers.
Information Seeking		
1) I have asked others for information on what this service offers.	"others" modified to "other passengers"	I have asked other passengers for information on what rail services offer.
2) I have searched for information from others on where this service is located.	"service" modified to "rail service"	I have searched for information from other passengers on where rail services are located.
3) I have paid attention to how others behave to use this service well.		I have paid attention to how other passengers behave to use rail services well.

Source: this study

5.7.5 Negative value-in-use

Sweeney et al.'s (2018) negative value-in-use scales were used, with modifications, to operationalise passengers' negative value-in-use (Table 25). The scale consisted of the sub-dimensions of monetary costs (3 items), emotional cost (3 items) and time and effort costs (2 items). Each construct was measured using a 5-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree). Of Sweeney et al.'s (2018) dimensions, only lifestyle costs were omitted. In marketing, the concept of lifestyle "encompass[es] both characteristic patterns of overt behavior and cognitive processes" ranging from personality traits to attitudes (Anderson and Golden, 1984, p406). Sweeney et al. (2018, p1091) define lifestyle costs as the "extent to which a change to the clients lifestyle emerges". Such changes, given the expansive nature of lifestyle as a concept, are inherently idiosyncratic to individual customers. Thus, this facet was omitted whilst operationalising passengers' negative value-in-use. In review, the thesis operationalised passengers' negative value-in-use in terms of monetary costs, and emotional and time effort costs that represented behavioural costs, which captured both tangible and intangible sacrifices for passengers.

Table 25. Original and final survey items of negative value-in-use of monetary costs, emotional costs and time and effort costs

Modifications made to negative value-in-use scale in the study		
Original Scale	Modifications	Scales used in the study
Monetary Costs		
1) My financial planner's service is expensive	"financial planner" modified to "TfW's rail service" or "TfW's rail services" depending on grammar	TfW's rail service is expensive
2) My financial planner charges too much		TfW's rail services charges too much.
3) My FP's service is highly priced		TfW's rail services are highly priced.
Emotional Costs (Behavioural Cost)		
1) Dealing with my FP is a stressful experience	"FP" modified to "TfW"	Dealing with TfW is a stressful experience.
2) I get stressed about seeing my FP		I get stressed about using TfW's rail services.
3) Dealing with my FP is confronting to me		Dealing with TfW or its personnel is challenging for me
Time and Effort Costs (Behavioural Cost)		
1) I spend a lot of time filling out forms in the financial planning process	"filling out forms" modified to "waiting or queuing" and "financial planning process" modified to "rail services"	I spend a lot of time waiting or queuing to use rail services.
2) I spend a lot of time organising paperwork in the financial planning process	"organising paperwork" modified to "filling out forms" and "financial planning process" modified to "TfW's rail services"	I spend a lot of time filling out forms to use TfW's rail services.

Source: this study

5.7.6 Perceived value

The construct of percieved value was used by the thesis to measure convergent validity in formative constructs, and as such, was not included in the conceptual model. Vivek et al.'s (2014) perceived value scale was used with modifications to operationalise passengers' overall perceived value and was measured using three items. The construct was measured using a 5-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree) (Table 26). The construct of perceived value was chosen as it measured passengers' value perceptions in terms of what is given and received (Flint, Woodruff and Gardial, 2002) and should significantly relate to passengers' lower-order value creation processes and holistic value creation. Thus, percieved value was used to examine convergent validity in formative value creation constructs. This aligns with Ranjan and Read's (2014) use of a theoretically related reflective construct for assessing convergent validity in co-production and positive value-in-use scales. Assessing convergent validity in the model's formative constructs is discussed further in Chapter 7.

Table 26. Original and final survey items of perceived value

Modifications made to perceived value scale in the study	
Original Scale	Scale used in the study
1) ___ has a lot of advantages resulting from it.	I see lots of advantages to using TfW's rail services.
2) I like ___ because it benefits me in the end.	I like TfW's rail services because it benefits me in the end.
3) It's relevant to my needs.	TfW's rail services are relevant to my needs.

Source: this study

5.7.7 Customer experience

Kuppelwieser and Klaus's (2021) revised Experience Quality scale (EXQ) was used with modifications to operationalise passengers' experiences of rail services (Table 27). The EXQ scale consisted of the sub-dimensions of brand experience (7 items), service provider experience (11 items) and post-purchase experience (7 items). Each construct was measured along a 7-point Likert scale ranging from 1 (strongly agree) to 7 (strongly disagree). Kuppelwieser and Klaus's (2021) B2C version was used because passenger-provider interactions represent a B2C context. The revised EXQ scale was developed to measure customer experience in services where alternative or competing providers exist. However, as

no alternative or competing rail providers exist in Wales, items referring to competition or alternative providers were omitted. The EXQ has been used to examine customer experience in hotel, retail, automotive and hedonic and utilitarian services (Choo et al. 2018; Deshwal, 2016; Roy, 2018; Imhof and Klaus, 2019), testifying to its versatility.

An alternative approach, using the Holistic Passenger Experience (HPX) scale (Ittamalla and Kumar, 2021) was considered but deemed inappropriate. Although the scale was developed for rail services specifically, it uses constructs associated with service quality in public transport research (Barabino and Francesco, 2016; Eboli and Mazzulla, 2014; Bakti and Sumaedi, 2015). Both the HPX and TRANSQUAL models measure passengers' perceptions of cleanliness, waiting time, comfort, additional services, travel information and additional services (Eboli and Mazzulla, 2014; Ittamalla and Kumar, 2021). Research has argued service quality and value-in-use to be closely aligned, with the former potentially acting as a proxy measure of the latter (Medberg and Grönroos, 2020). Thus, using the HPX scale may have undermined the internal validity of the thesis's conceptual model, whilst also creating potential multi-collinearity issues. This last point holds particular weight due to the intimately linked nature of value creation, customer experience and customer engagement (De Keyser et al. 2015). Therefore, the EXQ-revised scale was chosen to operationalise passengers' service experience to support the model's internal validity and mitigate potential collinearity issues.

Table 27. Original and final survey items for customer experience constructs of brand experience, service provider experience, post-purchase experience constructs

Modifications made to EXQ scale in the study		
Pre-Purchase Experience (brand experience)		
Original Scale	Modifications	Scales used in the study
1) COMPANY has a good reputation.	"Company" modified to TfW	1) TfW has a good reputation.
2) I am confident in COMPANY's expertise.		2) I am confident in TfW's expertise.
3) COMPANY gives independent advice (on which product/service will best suit my needs).	"independent" modified to "effective" as TfW cannot be independent of their own services	3) TfW and its personnel gives effective advice on how to make rail services best suit my needs (e.g. advice on train times, railcards, etc).
4) I choose COMPANY not because of the price alone.		4) I use TfW not only because of the price.
5) The people who work at COMPANY represent the COMPANY brand well.		5) The personnel who work at TfW represent their brand well.
6) COMPANY's offerings have the best quality.		6) TfW's rail services are good quality.
7) COMPANY's offerings are superior.	Omitted as no superior rail providers in Wales	N/A
During Purchase Experience (service provider experience)		
1) COMPANY advises me throughout the process.		1) TfW and its personnel advises/advised me throughout their services (e.g. advice on train times, railcards, journey disruption, etc).
2) Dealing with COMPANY is easy.		2) Dealing with TfW is easy.
3) COMPANY keeps me informed.		3) TfW keeps me informed.
4) COMPANY demonstrates flexibility in dealing with me.		4) TfW is flexible when dealing with me.
5) At COMPANY I always deal with the same forms and/or same people.		5) I always deal with the same people at TfW.
6) COMPANY's personnel relate to my wishes and concerns.		6) TfW's personnel can relate to my wishes and concerns.
7) The people I am dealing with (at COMPANY) have good people skills.		7) The personnel I deal with at TfW have good people skills.
8) COMPANY delivers a good customer service.		8) TfW delivers good customer service.
9) I have built a personal relationship with the people at COMPANY.		9) I have built a personal relationship with the personnel at TfW.
10) COMPANY's facilities are better designed to fulfil my needs than their competitors.	Omitted as no competing rail providers in Wales	N/A
11) COMPANY's (online and/or offline) facilities are designed to be as efficient as possible (for me).		10) TfW's online (e.g. TfW's travel app, capacity checker, etc.) and/or offline (e.g. timetables at stations, real-time announcements, disabled access, etc.) services are as efficient as possible for me.

Modifications made to EXQ scale in the study		
Post-Purchase (post purchase experience)		
1) I choose COMPANY because they know me.		1) I feel that at TfW they know me.
2) COMPANY knows exactly what I want.		2) TfW knows exactly what I want.
3) COMPANY keeps me up-to-date about their products and latest developments.		3) TfW keeps me up-to-date about their latest services.
4) COMPANY will look after me for a long time.		4) TfW will look after me in the long run.
5) COMPANY deal(t) well with me when things go(went) wrong.		5) TfW deal(t) with me well when things go / went wrong.
6) I am happy with COMPANY as my provider.		6) I am happy with TfW's rail services
7) Being a client at/customer of COMPANY gives me social approval.		7) Using TfW's rail services gives me social approval.

Source: this study

5.7.8 Passenger satisfaction

The shortened Satisfaction with Travel scale (STS) was used, with modifications, to operationalise Passenger Satisfaction (Ettema et al. 2017). The original STS consisted of the sub-dimensions of Positive Activation, Positive Deactivation and Cognitive Evaluation, measured along a 7-point semantic differential scale using three sets of polarised adjectives that highly correlated within sub-dimensions (Friman et al. 2013) (Table 28). Singleton (2019) psychometrically analysed the STS and found it to have satisfactory construct reliability and discriminant validity, congruent with Ollsen et al.'s (2012) findings.

Sukhov et al. (2022) has applied the STS with SEM to offer transport providers strategic options to increase passenger satisfaction. This points to the applicability of the STS scale for the thesis, which holds similar aims to Sukhov et al. (2022). Following on from feedback during the pilot study, the thesis opted to use the shortened STS scale (Ettema et al. 2017) (Table 29) to mitigate response burden by shortening the survey length.

Table 28. Full STS scale

Sub-dimension	Semantic differential adjectives and scale	
	1	7
Positive Activation	Bored	Enthusiastic
	Fed up	Engaged
	Tired	Alert
Positive Deactivation	Stressed	Calm
	Worried	Confident
	Hurried	Relaxed
Cognitive Evaluation	Poorly	Worked Well
	Low standard	High standard
	Worst imaginable	Best imaginable

Source: Friman et al. (2013, p136)

Table 29. Shortened STS scale

Sub-dimension	Semantic differential adjectives and scale	
	1	7
Positive Activation	Very bored, tired, fed-up	Very enthusiastic, alert, engaged
Positive Deactivation	Very stressed, worried, hurried	Very relaxed, calm, confident
Cognitive Evaluation	My trip worked very poorly, held low standard, was the worst imaginable	My trip worked very well, held high standard, was the best imaginable

Source: Ettema et al. (2017, p5)

The shortened STS consisted of the same sub-dimensions of Positive Activation, Positive Deactivation and Cognitive Evaluation. Each sub-dimension was measured using a

single item that incorporated the same semantic differential adjectives used by the full-length STS. Ettema et al. (2017) shows the shortened STS significantly relates to passenger outcomes and travel conditions during regression analysis. As the thesis focused on passenger's value creation, rather than passenger satisfaction, using the shortened STS scale was deemed justifiable to mitigate response burden, per feedback from the pilot study. The shortened STS was used by the thesis with no modifications (Table 29).

5.7.9 Feedback intentions

Yi and Gong's (2013) feedback intensions scale was used with modifications to operationalise passengers' feedback intentions. The construct was measured using 3 items (Table 30) along a 5-point Likert-scale ranging from 1 (strongly agree) to 5 (strongly disagree).

Table 30. Original and final survey items of feedback intentions

Modifications made to feedback intentions in the study		
Original Scale	Modifications	Scales used in the study
1) If I have a useful idea on how to improve service, I let the employee know.	"employee" modified to "TfW or its personnel"	If I have a useful idea on how to improve rail services, I let TfW or its personnel know.
2) When I receive good service from the employee, I comment about it.		When I receive good rail services from TfW or its personnel, I comment about it.
3) When I experience a problem, I let the employee know about it.		When I experience a problem, I let TfW or its personnel know about it.

Source: this study

5.7.10 Advocacy

Yi and Gong's (2013) advocacy scale was used with modifications to operationalise passengers' customer engagement behaviour of influencing (Jaakkola and Alexander, 2014). The construct was measured using three items (Table 31) along a 5-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree).

Table 31. Original and final survey items of advocacy

Modifications made to advocacy in the study		
Original Scale	Modifications	Scales used in the study
1) I said positive things about XYZ and the employee to others.	"XYZ" adapted to "TfW and their employees" or "TfW" depending on item context.	1) I said positive things about TfW and their employees to others.
2) I recommended XYZ and the employee to others.		2) I recommended TfW and their employees to others.
3) I encouraged friends and relatives to use XYZ.		3) I encouraged friends and relatives to use TfW.

Source: this study

5.7.11 Future patronage

Vivek et al.'s (2014) Future Patronage scale was used with modifications to operationalise passengers' attitudes to future rail use (Table 32). Originally the scale was a single-item measure. Single item measures can be appropriate when constructs are "judged to be concrete" (Rossiter, 2002, p 313) as they are "easily and uniformly imagined" by respondents (Bergkvist and Rossiter 2007, p 176). However, as the construct may have been interpreted differently by different passenger demographics (e.g. commuter, leisure and business passengers), a multi-item scale was used. Multi-item scales help to "average out errors and specificities" that can be inherent to single item measures and they "increase reliability and construct validity" (Diamantopoulos et al. 2012, p 436). Thus, passengers' future patronage was measured using two additional items, namely attitudes to using rail services again (item 2) and in the long-term (item 3).

Table 32. Original and final survey items of future patronage

Modifications made to future patronage in the study		
Original Scale	Modifications	Scales used in the study
1) I intend to do business with___ in the future.	"do business" adapted to "travel with" & "____" modified to "TfW"	I intend to travel with TfW in the future.
		I would like to use TfW's rail services again.
		I aim to use TfW in the long-term.

Source: this study

5.8 Screening question

Screening questions were used to assess the eligibility of respondents and mitigate sampling frame errors. Only those over 18 years old were eligible, and respondents were also asked whether they had used TfW's rail services before (Table 33).

Table 33. Screening questions used in the survey

Screening questions		
1. Have you used TfW's rail services before?	Yes	No
2. Are you over the age of 18?	Yes	No
Self-service questions		
1. Did you use digital self-service features? (e.g. Wi-Fi, TfW's Travel app, Capacity Checker, etc)	Yes	No
4. Did you use physical self-service features (Ticket machines, automated gates, car parking, signage, announcements, etc)	Yes	No

5.8.1 Questions about passengers' journey

Items measuring passengers' general days of travel (weekdays / weekends), period of travel (peak and off-peak), journey purpose (commuter, leisure and business) and frequency of travel were used to examine passengers' travel conditions. Additionally, to incorporate the geography of passengers' rail use, respondents were asked what region they generally travelled in via rail (Table 34) (Appendix 20). To record whether passengers travelled along Core Valley Lines (CVL), respondents travelling in South-East and South-West Wales, as well as Wales Border Regions, were asked if they travelled on CVL routes. Respondents that stated they generally travelled outside of these regions, where CVL routes were not present, were not asked this question.

Table 34. Survey questions measuring passengers rail journeys, geographical background and where they found the survey

journey questions		
1. Did you use weekday (Monday – Friday) rail services? If no, go to question 5.		
Yes	No	
2. On weekdays, generally what was the purpose of your journey? (If more than one answer applies, please choose your most common purpose of journey on weekdays).		
Weekday Leisure	Weekday Commuter	
Weekday Business (e.g. weekday work travel outside daily commute)		
3. On weekdays, how frequently did you use rail services?		
1 day per month	1-3 days per month	
1-2 days per week	3-5 days per week	
4. On weekdays, do you commonly travel at peak (before 9:30am) or off-peak (9:30am – 4:00pm / 6:30pm+) times? (If more than one answer applies, please choose your most commonly travelled time period).		
Peak times	Off-Peak Times	
5. Did you use weekend (Saturday & Sunday) rail services? If no, go to question 8.		
Yes	No	
6. On weekend services, what was the most common purpose of your journey? (If more than one answer applies, please choose your most common purpose of journey on weekends).		
Weekend Leisure	Weekend Commuter	
Weekend Business (weekend work travel outside daily commute)		
7. On weekend services, how often did you travel?		
1 day per month	1-2 times per weekend	
3-4 times per weekend	5+ times per weekend	
8. What setting do you live in?		
Rural	Village	City / Town
9. Generally region do you commonly travel in? (if more than one, state the most common one)		
Southeast Wales	Southwest Wales	Mid Wales
Northeast Wales	Northwest Wales	Wales & England Border areas
10. Do you commonly travel on South Wales Valley's route's (e.g., Cardiff to Rhymney or vice versa)		
Yes		No
12. How did you find this survey?		
TfW's Rail (social media, professional network, Customer (Sgwrs) / Accessibility Panel)	Transport Focus / Rail Future	Traveline Cyrmu
Community Rail Passengers Association (e.g. South West Wales Connected, Heart of Wales, Groundworks North Wales, etc.)		Higher Education Institute / Organisation (E.g. Cardiff University, Swansea University, etc.)

5.8.2 Demographic questions

Items on passengers' demographic backgrounds were used to measure respondents demographic information (Table 35) (Appendix 20).

Table 35. Survey questions measuring passengers' demographic backgrounds

1. You are?				
	Male	Female	Other	
2. What is your age group?				
	18-24	25-34	35-44	45-54
	55-64	65-74	75+	
3. What is your ethnicity?				
	White	Black	Asian	
	Mixed Ethnicity	Other (Please specify)		
4. What is your highest educational attainment?				
	Primary Education	Secondary Education	A-levels / College	
	Higher Education (Degree)	Postgraduate Degree (Masters, PhD)		
5. What is your approximate combined household income in pounds?				
	Less than £10K	£10-20K	£20K - £30K	
	£30K - £40K	£40K - £50K	£60K - £70K	
	£70 - £80K	£80K - £90K	£100K +	
6. Working status?				
	Student	Unemployed	Part-time Employed	
	Full-time Employed	Self-Employed	Retired	
	Other (please specify)			
7. Marital status?				
	Single	In a relationship	Married	
	Civil Partnership	Divorced	Widowed	

5.9 Pre-testing survey measures

Survey measures were pre-tested conceptually (i.e. as being reflective or formative measures). This section discusses pre-testing survey measures through conceptual frameworks proposed by research.

5.9.1 Formative & reflective measurements

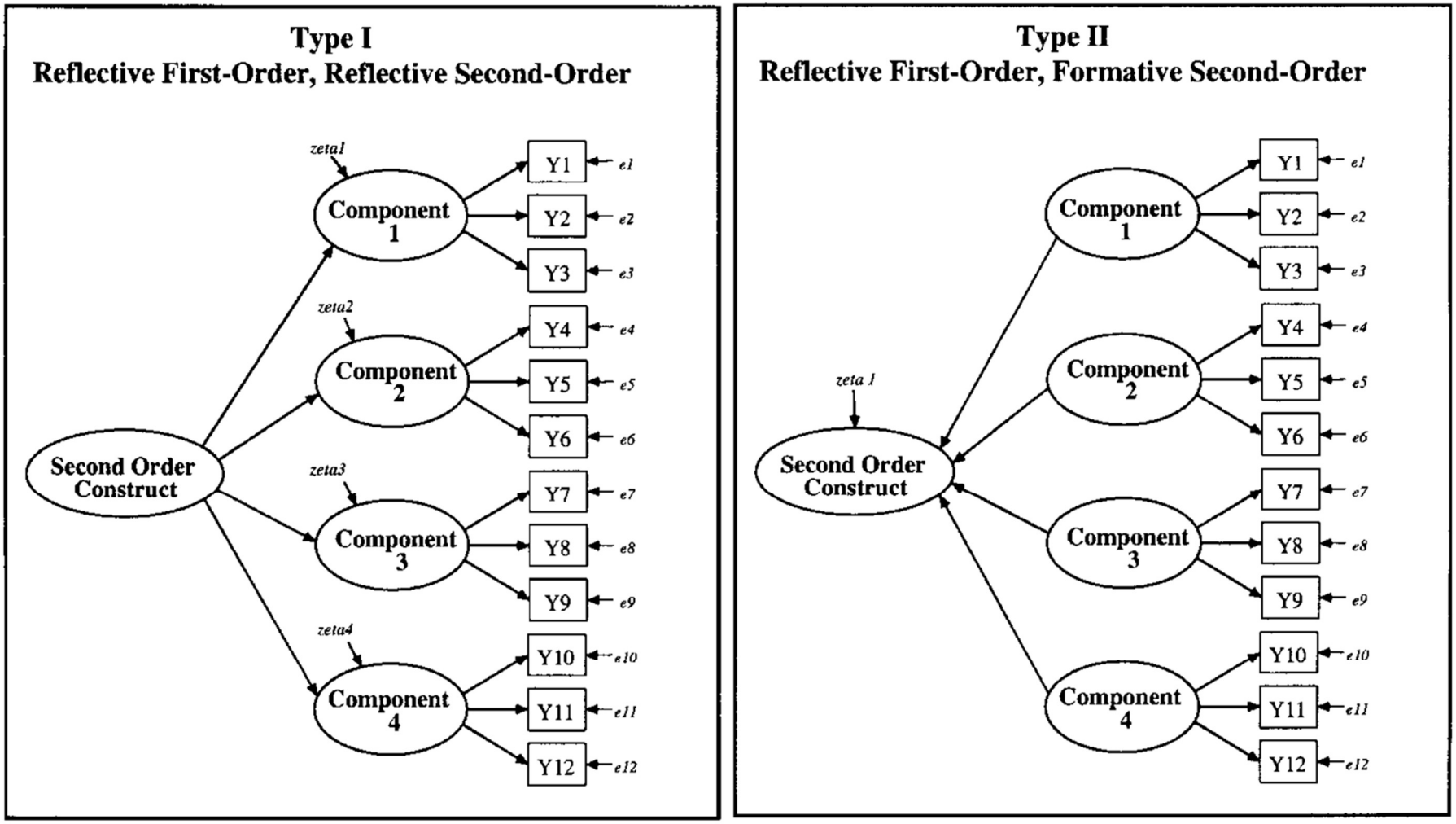
Survey measures were pre-tested conceptually by applying Jarvis et al.'s (2003) framework for distinguishing formative and reflective constructs (Table 36). Jarvis et al. (2003) reviewed SEM research across four prominent marketing journals and found the most common mistake was construct misspecification. Jarvis et al. (2003) identified four types of models with respect to first and second-order constructs, which represented different combinations of formative and reflective constructs (Figure 39 & Figure 40). To mitigate the potential for construct misspecification in the thesis, Jarvis et al.'s (2003) framework was applied to distinguish formative and reflective constructs and, where applicable, identify the type of model developed by prior research (i.e., Type I – IV) (Table 37).

Table 36. Framework for distinguishing formative and reflective constructs

Decision rules for determining whether a construct is formative or reflective		
	Formative model	Reflective model
1. Direction of causality from construct to measure implied by the conceptual definition Are the indicators (items) (a) defining characteristics or (b) manifestations of the construct? Would changes in the indicators/items cause changes in the construct or not? Would changes in the construct cause changes in the indicators?	Direction of causality is from items to construct Indicators are defining characteristics of the construct Changes in the indicators should cause changes in the construct Changes in the construct do not cause changes in the indicators	Direction of causality is from construct to items Indicators are manifestations of the construct Changes in the indicator should not cause changes in the construct Changes in the construct do cause changes in the indicators
2. Interchangeability of the indicators/items Should the indicators have the same or similar content? Do the indicators share a common theme? Would dropping one of the indicators alter the conceptual domain of the construct?	Indicators need not be interchangeable Indicators need not have the same or similar content Indicators need not share a common theme Dropping an indicator may alter the conceptual domain of the construct	Indicators should be interchangeable Indicators should have the same or similar content Indicators should share a common theme Dropping an indicator should not alter the conceptual domain of the construct
3. Covariation among the indicators Should a change in one of the indicators be associated with changes in the other indicators?	Not necessary for indicators to covary with each other Not necessarily	Indicators are expected to covary with each other Yes
4. Nomological net of the construct indicators Are the indicators/items expected to have the same antecedents and consequences?	Nomological net for the indicators may differ Indicators are not required to have the same antecedents and consequences	Nomological net for the indicators should not differ Indicators are required to have the same antecedents and consequences

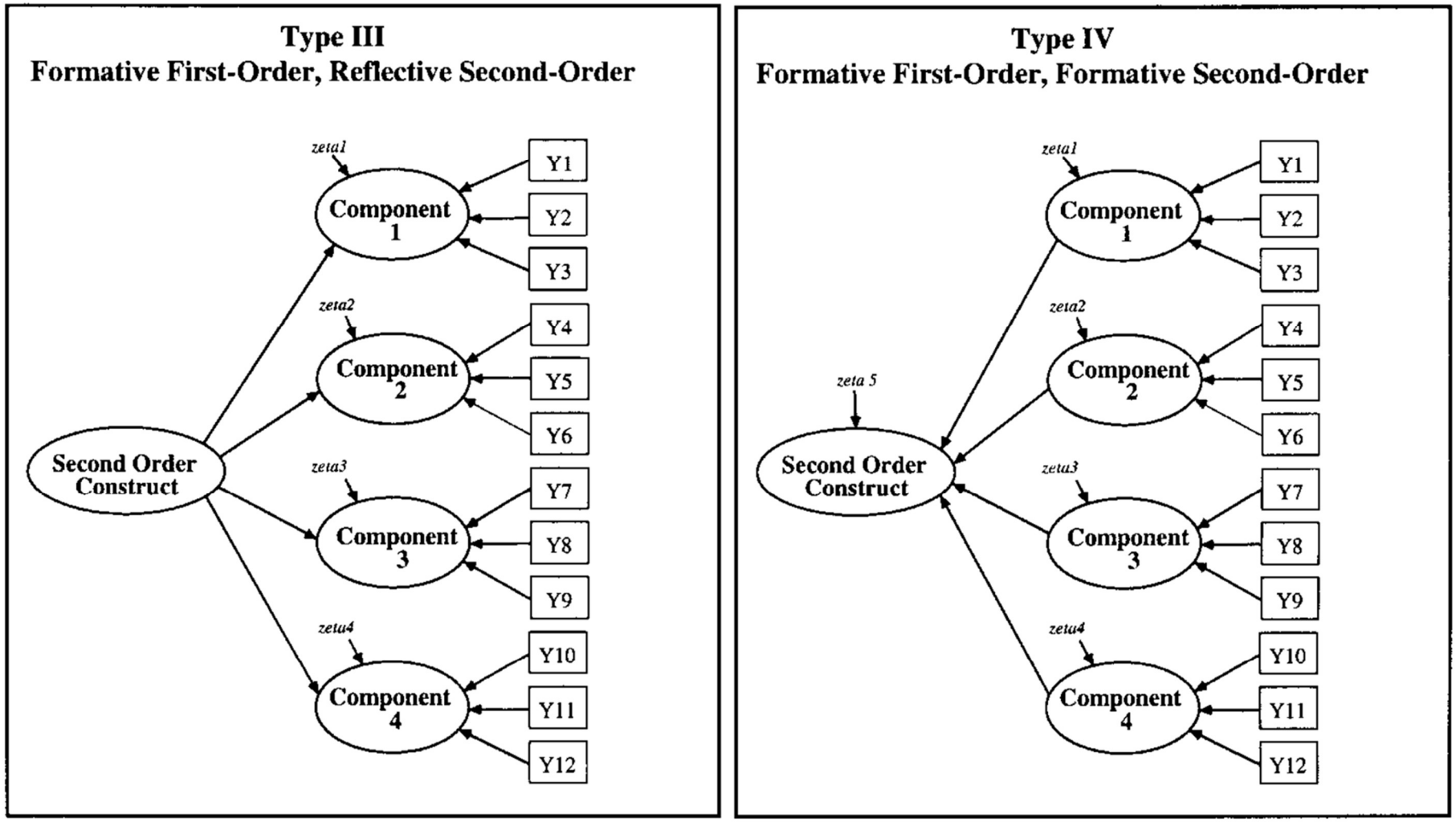
Source: Jarvis et al. (2003, p203)

Figure 39. Type I and II models of formative and reflective constructs



Source: Jarvis et al. (2003, p205)

Figure 40. Type III and Type IV models of formative and reflective constructs



Source: Jarvis et al. (2003, p205)

Table 37. Formative and Reflective measures and models in research used in conceptual model

Construct	Formative / Reflective Models & Measure	Measure	CR	Item changes construct	Items hold similar content
• Brand experience • Service provider experience • Post-purchase experience	Type I – Reflective 1st & 2nd order constructs (Kuppelwieser & Klaus, 2021, p625)	Reflective	.92 - .94	✓	✓
Co-production • Knowledge • Relating • Interaction	Type IV - Formative 1st & 2nd order constructs (Ranjan and Read, 2016, p304)	Formative	N/A	No	No
Positive value-in-use • Relationship • Personalisation • Experience			N/A	No	No
Negative value-in-use • Monetary Costs • Emotional Costs (Behavioural Cost) • Time & Effort Costs (Behavioural Cost)	Reflective measure (Plewa et al. 2015; Sweeney et al. 2018)	Reflective	.79 - .93	✓	✓
Social value co-creation • C2C interaction	C2C Interaction – Formative (Ranjan and Read, 2016, p304)	Formative	N/A	No	No
• Helping • Information seeking	Helping & Information Seeking – Reflective (Yi and Gong, 2013, p1282)	Reflective	.91 / .97	✓	✓
Independent value creation • Value from digital / physical self-service technology	Reflective (Turner & Shockley, 2014)	Reflective	.88	✓	✓
Perceived value • Perceived value	Reflective (Vivek et al. 2014)	Reflective	.91	✓	✓
Passenger Satisfaction • PDNA (Stress) • PAND (Enthusiasm) • Cognitive evaluation	Type I – Reflective 1st and 2nd order (Sukhov et a. 2022; Singleton, 2019; Friman et al. 2013)	Reflective	α (.76 - .83)	✓	✓
Future patronage	Reflective (Vivek et al. 2014 – single item measure)	Reflective	-	✓	✓
Feedback intentions	Feedback intentions & Advocacy - Reflective (Yi and Gong, 2013)	Reflective	.93	✓	✓
Advocacy			.97	✓	✓

5.10 Data analysis

The thesis applied SEM to examine the conceptual model previously discussed (Chapter 4). In marketing research, SEM is "frequently applied by marketing and business researchers to assess empirically new theoretical proposals articulated by means of complex models" (Martinez-Lopez, Gazquez-Abad and Sousa, 2013, p115). Martinez-Lopez et al.'s (2013) review of SEM research totalled almost 650 studies across four popular journals in the last 30 years, emphasising SEM's ubiquity. The review highlighted how SEM research often developed models based on data rather than theory-driven decisions. Additionally, Martinez-Lopez et al. (2013) noted how researchers often declined to differentiate measurement and structural models whilst reporting and did not establish measurement invariance when comparing groups. To avoid these issues, this thesis reported measurement and structural models separately, and established measurement invariance when comparing passenger groups.

Two approaches to SEM used by research are covariance-based SEM (CB-SEM) and Partial Least Squared Equation Modelling (PLS-SEM), and these are typically used to confirm established theories and exploratory research, respectively (Hair, Matthews, Matthews and Sarstedt, 2017). CB-SEM estimates model parameters that reduce discrepancies between observed and estimated covariance matrices in a theoretical model, and thus, it uses distance measures to gauge model quality in terms of discrepancies between covariance matrices (Hair, Sarstedt, Ringle and Mena, 2012). In contrast, PLS-SEM aims to maximise the extent variance in variables can be explained by predictors, and as such "aligns well with most types of business research, which typically aims at testing a theory (i.e., explanation) while offering recommendations for management practice (i.e., prediction)" (Hair et al. 2017, p109). When comparing CB-SEM and PLS-SEM, Hair et al. (2017) highlights the former to be most appropriate for explanatory research adopting reflective measures, whilst the latter is more appropriate for exploratory research adopting formative measures like in the thesis (Table 38).

Table 38. Guidelines for selecting PLS-SEM and CB-SEM

Types of analysis	PLS-SEM	CB-SEM	Both
Objective = prediction	X		
Objective = exploratory research or theory development	X		
Objective = explanation only		X	
Objective = explanation and prediction	X		
Measurement philosophy = total variance (composite-based)	X		
Measurement philosophy = common variance only (factor-based)		X	
Reflective measurement model specification			X
Formative measurement model specification	X		
Metric data			X
Non-metric data = ordinal and nominal	X		
Smaller sample sizes – N = < 100	X		
Larger sample sizes – N = > 100			X
Binary moderators			X
Continuous moderators	X		
Normally distributed data			X
Non-normally distributed data	X		
Secondary (archival) data	X		
Higher order constructs = two 1st order constructs	X		
Higher order constructs = three of more 1st order constructs			X
Latent variable scores needed for subsequent analysis	X		

Source: Hair et al. (2017, p118)

The thesis used PLS-SEM for data analysis. This approach to SEM is recommended for models with both formative and reflective constructs (Hair et al. 2014). During PLS-SEM, Hair et al. (2019) recommends reviewing SEM in two separate stages, namely the measurement and structural models. Reflective measurement models are assessed in terms of internal consistency, reliability, indicator loadings, convergent validity and discriminant validity. Formative measurement models were assessed in terms of convergent validity, collinearity and the significance and relevance of indicators (Hair et al. 2019; Hair et al. 2014). Structural models were assessed in terms of collinearity, in-sample predictive power

(R^2 values), out-of-sample predictive power (PLSPredict Q^2 values) and comparisons with alternative models (Hair et al. 2019).

Prior research has used the survey scales previously discussed during SEM. Research using the EXQ scale has applied SEM to examine the roles of patient satisfaction during loyalty in healthcare (Kashif et al. 2016) and relationship quality in banking (Wugayan, 2019). Value creation research has used SEM to examine the relationships between value-in-use, customer satisfaction and WoM (Ranjan and Read, 2014; Sweeney et al. 2018). In customer engagement research, Vivek et al. (2014) and Yi and Gong (2013) have applied SEM to examine different aspects of the constructs in relation to future patronage and co-creation behaviours. In public transport research, Sukhov et al. (2022) have used SEM to examine the relationships between service quality and passenger satisfaction. This was done to offer transport operators strategies for increasing passenger satisfaction, in line with the aims of this thesis.

5.11 Ethical considerations

Ethical considerations form an important part of research as they allow researchers to follow ethical frameworks. From a detailed literature review, Nill and Schibrowsky (2007) have developed a framework for examining the ethicality of common marketing practices. Although geared towards providers, Nill and Schibrowsky's (2007) framework highlights the relationship between ethics and profits. In the thesis, this raises the question of who benefits from the findings, given their commercial utility for TOCs. To mitigate this issue, the thesis was performed independent of TfW and only summary findings were shared upon its conclusion. Other more practical ethical issues arose during data collection in terms of respondents. To maintain anonymity, no recognisable information (e.g. names) were recorded. To further maintain anonymity, any personal information (e.g. age, income, ethnicity) were recorded through approximate categories (e.g. 18–25 years old), except for the purpose of distributing retail vouchers when respondents offered email addresses. Email addresses were deleted upon main data collection finishing and vouchers being sent to respondents. Respondents were assigned randomised codes during data analysis to maintain their anonymity.

As respondents can be wary of sharing personal information in public settings, respondents were repeatedly informed that all responses were anonymised. Following feedback from the ethical application, the option of "prefer not to disclose" was included for approximate household income. Respondents were informed of their right to withdraw at any point without giving a reason, and that this did not affect their entitlement to shopping vouchers. Vouchers were distributed via email and addresses were deleted upon data collection finishing (March 2023). To gain informed consent, respondents were informed of the thesis's purpose and data storage procedures and were given contact details for an independent party if they felt their queries were not handled satisfactorily by the main researcher. Confidentiality of responses was maintained by following GDPR compliant guidelines and Cardiff University's guidelines for ethical data storage (Appendices 16 & 17). Respondents were presented with instructions on how to complete the survey (Appendix 18), as well as a prompt to complete it (Appendix 19). After finishing, respondents were presented with a debriefing that explained the nature and aims of the study (Appendix 21).

5.12 Summary of methodology

In summary, the thesis takes positivism as its research philosophy and deductive reasoning as its logical reasoning. Quantitative measures in the form of Likert and semantic differential scales were used to measure constructs and the thesis adopted a descriptive cross-sectional survey design. Surveys were self-administered by respondents and distributed via the internet. Pre-testing of the survey was performed through conceptual checks for reflectively and formatively measured constructs and empirically during a pilot study.

The pilot study used snowball and convenience sampling and achieved an adequate sample size, with feedback aiding survey refinement. During the pilot study all reflective scales, except Time and Effort costs, held acceptable internal consistency. For the main data collection quota sampling was used, with quotas being based on TfW's passenger experience data in terms of passengers' journey purpose. During main data collection, surveys were distributed through various commercial (i.e. TfW, Traveline Cyrmru) and non-commercial (i.e. RailFuture, Transport Focus, passenger community groups, Cardiff University) channels. Survey development involved modifying scales from prior research. Finally, literature that highlights errors in existing SEM research in marketing was reviewed to mitigate the potential for these to arise in the thesis.

Chapter Six – Descriptive Analysis

Chapter Six – Descriptive Analysis

6.1 Introduction

Chapter 6, divided into six sections, offers a descriptive analysis of survey responses. It discusses data collection and non-response bias, demographic profiles in the dataset and passengers' travel behaviours. Next, the chapter reviews response patterns for survey indicators and closes with a summary.

6.2 Data collection period and non-response bias

Data collection was performed over a 6-month period from 10th of November 2022 to 17th of March 2023. Surveys were distributed through commercial and non-commercial channels and 2,232 responses were collected (Table 18). Responses were cleaned by omitting respondents that did not finish the survey, which represented 489 responses in total. This left a dataset of 1,733 responses that had a mean response time of 13.5 minutes, notably shorter than the mean response time of 18.6 minutes in the pilot study. A preliminary review of the internal consistency for reflective scales showed no scales, other than brand, service provider and post-purchase experience, had acceptable internal consistency in the 1,733 responses (Table 39). In contrast, all reflective scales had acceptable internal consistency in the pilot study, except for time and effort costs (Table 20).

To further clean the dataset, respondents with response times less than the mean response time in the pilot study (i.e., 18.6 minutes) were omitted. This was done in an attempt to omit respondents that had not engaged with the survey material sufficiently, and so, had response times faster than respondents in the pilot study. From this action, a further 1,179 responses were omitted. A review of responses shorter than 18.6 minutes showed over half came from TfW's passenger panel (34.5%) and TfW's social media / professional networks (19.3%) (Table 40). After omission, 554 responses remained, with a mean response time of 18.1 minutes and all reflective scales had acceptable internal consistency, except time and effort costs ($\alpha = .68$) that was just below the research threshold ($\alpha > .70$) (Table 39).

Overall, this left a cleaned dataset of 554 responses, with a valid response rate of 24.6% after omitting respondents that did not finish and respondents that finished the survey faster than the mean response time in the pilot study.

Table 39. Preliminary analysis of internal consistency for reflective constructs after omitting respondents that did not finish the survey

Construct	α after omitting respondents that did not finish the survey	α after omitting responses shorter than mean duration in the pilot study (18.6 mins)
Helping	.51	.79
Information seeking	.51	.77
Digital self-service	.67	.83
Physical self-service	.59	.89
Monetary Costs	.62	.94
Emotional Costs	.61	.87
Time and effort costs	.27	.68
Brand experience	.75	.87
Service provider experience	.86	.93
Post-purchase experience	.82	.92
Percieved value	.50	.85
Passenger satisfaction	.65	.91
Feedback Intentions	.46	.72
Advocacy	.65	.91
Future Patronage	.55	.84

Table 40. Breakdown of responses longer than mean response time in the pilot study by source

Response source	Frequency	Percentage
TfW's Rail (Social media, professional network)	227	19.3
Transport Focus / Rail Future	152	12.9
Higher Education Institute / Organisation (E.g. Cardiff University, Swansea University, etc.)	144	12.2
Community Rail Passengers Association (e.g. South West Wales Connected, Heart of Wales, Groundworks North Wales, etc.)	206	17.5
Traveline Cyrmu	39	3.3
TfW's Rail Passenger Pannel	406	34.5
TfW's Rail Accessibility Panel	4	.3

To examine non-response bias in the cleaned dataset, the first and last quartiles of respondents were compared. A non-parametric Mann-Whitney U test showed only indicators of customer engagement constructs, and some individual indicators, significantly differed between these quartiles (Table 41). In all significant comparisons, first quartile respondents had significantly higher median scores than last quartile respondents. Although the thesis made a concerted effort to avoid rail strikes, this non-response bias may be attributed to the small number of strikes at the end of main data collection, and this point is noted whilst discussing the results in Chapter 8. No significant differences were found between the first and last quartiles for all other indicators (Appendix 21).

Table 41. Analysis of non-response bias for all items showing significant differences

Construct	Item	First 25% (Group A)	Last 25% (Group B)	Z-score	p. value
Knowledge	K3	155.98	123.02	-3.587	<0.001*
Helping	H1	153.52	125.48	-3.101	.002*
	H3	153.29	125.71	-3.024	.002*
Personalisation	P3	152.33	126.67	-2.830	.005*
	P4	150.57	128.43	-2.364	.018*
Experience	EX2	152.55	126.45	-2.890	.004*
Time & Effort Cost	TEC1	128.88	150.12	-2.268	.023*
	TEC2	131.05	147.95	-1.856	.063
Perceived Value	PV1	149.74	129.26	-2.214	.027*
	PV2	149.16	129.84	-2.085	.037*
Brand Experience	BX3	150.06	128.94	-2.236	.025*
	BX4	151.07	127.93	-2.437	.015*
	BX5	148.85	130.15	-1.990	.047*
Service Provider Experience	SPE5	129.18	149.82	-2.207	.027*
	SPE8	152.92	126.08	-2.831	.005*
	SPE10	149.94	129.06	-2.194	.028*
Post-Purchase Experience	PPE3	151.50	127.50	-2.527	.011*
	PPE6	151.28	127.72	-2.477	.013*
Feedback Intention	FI2	150.17	128.83	-2.283	.022*
	FI3	151.37	127.63	-2.567	.010*
Advocacy	AD1	152.70	126.30	-2.825	.005*
	AD2	149.64	129.36	-2.172	.030*
	AD3	153.76	125.24	-3.061	.002*
Future Patronage	FP1	155.08	123.92	-3.438	.001*
	FP2	155.90	123.10	-3.594	<.001*
	FP3	148.59	130.41	-2.120	.034*
Feedback Intention	FI1	148.40	130.60	-1.900	.057
	FI2	150.17	128.83	-2.283	.022*

6.3 Overall sample demographic profile

Reviewing the dataset in terms of demographic information against TfW's passenger experience data and census information highlights some similarities and differences (Table 42). With respect to gender, the dataset appears to overrepresent male and underrepresent female respondents compared to these sources. Additionally, with respect to marital status, the dataset appears to overrepresent respondents that are married (45.3%) or in a relationship (19.3%) compared to census information that combines these categories (46.9%).

This may be due quotas being based on proportions of commuter, leisure and business passengers as their commercially important for TfW, rather than demographic information. However, overall, the dataset deviated by less than 20% at most compared to TfW's passenger experience data and census information, mitigating concerns of representation for demographic information (Table 42). For how respondents found the survey, respondents that found the survey via TfW's social media or professional platforms and passenger panel made up just over half of the sample. The rest of respondents found the survey via higher education institutes, rail passenger communities and public transport research groups (Table 42).

Table 42. Overall demographic profile of respondents in the study

Variable	Category	Research Sample (n = 554)		TfW Passenger Experience Data 2019	Census
		Freq.	%	%	%
Gender	Male	336	60.1	45.2	48.9
	Female	213	38.4	54.8	51.1
	Other	5	.9	~	0.1*
Age	18-24	47	8.5	22.6	11.7
	25-34	132	23.8	17.4	12.3
	35-44	118	21.3	11.5	11.6
	45-54	80	14.4	12.4	12.9
	55-64	85	15.3	13.8	13.6
	65-74	72	13	13.2	11.6

Variable	Category	Research Sample (n = 554)		TfW Passenger Experience Data 2019	Census
		Freq.	%	%	%
	75+	20	3.6	2.8	9.7
Highest educational attainment	Primary Education	11	2.0	~	~
	Secondary Education	73	13.2	~	14.2
	A-levels / College	142	25.6	~	17.2
	Higher Education (Degree)	211	38.1	~	31.5 (Undergraduate and
	Postgraduate Degree (Masters, PhD)	117	21.1	~	Postgraduate)
Employment status	Student	29	5.2	16.5	5.7**
	Unemployed	16	2.9	2.6	3.4*
	Part-time Employed	70	12.6	12.6	
	Full-time Employed	276	49.8	46.3	47.6*
	Self-Employed	36	6.5	~	9.6*
	Retired	108	19.5	17.4	
	Other (please specify)	19	3.4	~	
Marital status	Single	110	19.9	~	37.9*
	In a relationship	107	19.3	~	
	Married	251	45.3	~	46.9*
	Civil Partnership	40	7.2	~	
	Divorced	32	5.8	~	9.1*
	Widowed	14	2.5	~	6.1*
Approximate household income	Less than £10K	26	4.7		
	£10-20K	50	9.0		
	£20K - £30K	109	19.7		
	£30K - £40K	66	11.9		
	£40K - £50K	86	15.5		

Variable	Category	Research Sample (n = 554)		TfW Passenger Experience Data 2019	Census
		Freq.	%	%	%
	£60K - £70K	45	8.1		
	£70 - £80K	35	6.3		
	£80K - £90K	37	6.7		
	£100K +	33	6.0		
	Prefer not to disclose	67	12.1		
Response source	TfW's Rail (Social media, professional network)	237	42.8	~	~
	Transport Focus / Rail Future	36	6.5		
	Higher Education Institute / Organisation (E.g. Cardiff University, Swansea University, etc.)	77	13.9		
	Community Rail Passengers Association (e.g. South West Wales Connected, Heart of Wales, Groundworks North Wales, etc.)	67	12.1		
	Traveline Cyrmu	30	5.4		
	TfW Passenger Pannel	98	17.7		
	TfW's Rail Accessibility Panel	9	1.6		

*Source: This study, *Wales (2021) and England & Wales 2021 Census*

6.4 Sample travel usage behaviour

For respondents' travel use, the thesis disaggregated travel use to greater increments than the TOC's passenger data by distinguishing between weekday and weekend travel. Thus, comparisons were made between the thesis's sample and the closest demographic information from the TOC's data (Table 43).

Table 43. Overall profiles of passengers' travel usage behaviours

Travel Usage	Category	Research Sample (n = 554)		TfW's data & census
		Freq.	%	%
Weekday purpose of journey	Weekday Leisure	234	42.2 ***(59)***	58.1 (overall)
	Weekday Commuter	195	35.2 ***(20.5)***	25.2 (overall)
	Weekday Business	102	18.4 ***(12.9)***	16.7 (overall)
	Do not use weekday	23	4.2	
Peak / Off-peak	Peak-times	271	51.0	~
	Off-peak times	260	49.0	
Weekday travel frequency	Less than 1 day per month	65	11.7	2.2 (Only time using) 3.8 (Less often) 18.1 (Few times / year)
	1 day per month	88	15.9	23.7 (Every month)
	1-3 days per month	164	29.6	
	1-2 days per week	112	20.2	16.1 (Once / week) 15.9 (Few times / week)
	3-5 days per week	102	18.4	20.1 (5 days / week)
Weekend journey purpose	Weekend Leisure	420	75.8	58.1 (overall)
	Weekend Commuter	93	16.8	25.2 (overall)
	Weekend Business	41	7.4	16.7 (overall)
Weekend travel frequency	Less than 1 day per month	286	51.6	~
	1-2 times per weekend	191	34.5	~
	3-4 times per weekend	63	11.4	~
	5+ times per weekend	14	2.5	~
Residential setting	Rural	77	13.9	32.8 (Rural)**
	Village	160	28.9	
	City / Town	313	56.5	67.2 (Urban)**
Commonly travelled region	Southeast Wales	185	33.4	49.0* (Pop. Density)
	Southwest Wales	104	18.8	22.3*
	Mid-Wales	88	15.9	6.6*
	Northeast Wales	53	9.6	12.4*
	Northwest Wales	46	8.3	9.7*
	Wales or England Border areas	78	14.1	~
Core Valley Lines	Yes	211	38.1	37.3 (CVL)
	No	156	28.2	67.2 (WBC)
			33.8 (other regions)	
			62.0 - WBC	

Source: This study, TfW Passenger Experience Data, Wales 2021 Census, Wales and England 2011 Census**, and bold and italics denote comparison with combined groups in thesis sample*

In contrast with the TfW's data, initial comparisons with weekday leisure and commuter passengers suggested they were under and overrepresented in the sample, respectively, whilst weekday business passengers were similarly represented. For weekend travel, weekend leisure was overrepresented in the sample, whilst weekend commuter and business were both underrepresented, compared to the TOCs data. However, when the analysis combined these groups, and compared them to the TOCs overall metric of leisure, business and commuter passengers, these groups were represented accurately in the sample. For example, combining weekday leisure (N = 420) and weekend leisure (N = 234) gave a total of 654. Divided by the total responses for these two questions of 1108 (i.e., 554 x 2) gave a similar percentage to the TOCs overall representation of leisure passengers (58.1%) (Table 43). This was consistent for commuter and business passengers, as well, suggesting overall the thesis's sample was representative of passengers' different purpose of journey with respect to the TOCs data.

For frequency of weekday travel, TfW used different categories to measure travel frequency, although some comparisons could be made. Passengers traveling between once per week and 5 days per week formed over half of responses in the TOCs data. In contrast, respondents travelling between these levels of frequency formed just under half of responses (38.1%) in the sample, suggesting these group were underrepresented (Table 43). In the TOC's data, passengers travelling every month formed just under a quarter of passengers (23.7%). In contrast, respondents travelling between less than 1 day per month and 1–3 days per month comprised just over half of respondents (56.6%), suggesting these groups were overrepresented in the thesis's sample.

For respondents' residential setting, comparisons with the England and Wales (2011) census offers some insights in terms of representation. Compared to the England and Wales (2011) census, respondents living in urban settings (e.g. cities) represented a similar proportion to the sample. Rural and Village groups, which were combined into the Rural classification by the census, were also similarly represented in the sample. For all three groups, the sample deviated by approximately 10% (Table 43).

For commonly travelled regions, comparing the sample with regional population density offers insights for representativeness in the sample. Comparing the sample with the Wales census (2021) suggested although South-East Wales was the largest group, this region was still unrepresented considering its population density. Considering population density, all other regions were well represented, with only a mean deviation of 6.5% (Table 43). Lastly,

considering proportions of Core Valley Lines (CVL) and Wales Border Crossing (WBC) passengers in the sample, versus TfW's data, suggests these groups were accurately represented with only 0.8% and 5.2% deviations, respectively. Comparisons for WBC passengers were made by combining respondents that did not use CVL lines with all other regions travelled (Table 43).

6.5 Statistical descriptive analysis of responses

This section examines responses to all survey items. As described in Chapter 4, the conceptual model consisted of: co-production (i.e. knowledge, equity and joint interaction); positive value-in-use (i.e. relationship, personalisation and experience); independent value creation (i.e. value from digital self-service and value from physical self-service); social value co-creation (i.e. social interaction, helping and information seeking); negative value-in-use (i.e. monetary cost, emotional cost and time and effort cost); perceived value; customer experience (i.e. brand experience, service provider experience and post-purchase experience); satisfaction (i.e. positive deactivation, positive activation and cognitive evaluation); feedback intentions; advocacy and future patronage.

Customer experience constructs were measured along a 7-point Likert scale. Passenger satisfaction items were measured along a 7-point semantic differential scale. All other constructs were measured along a 5-point Likert scale. No items were reversed, and scale interpretations are presented below (Table 44 & Table 45).

Table 44. Interpretation of 5- and 7-point Likert scale values

Likert Scale Point	Customer experience scales	Other Scales*
From 1 to 1.50	Strongly disagree	Strongly disagree
From 1.51 to 2.50	Moderately disagree	Moderately disagree
From 2.51 to 3.50	Disagree a little	Neither agree nor disagree
From 3.51 to 4.50	Neither agree nor disagree	Moderately agree
From 4.51 to 5.50 maximum of 5 for other scales*	Agree a little	Strongly agree
From 5.51 to 6.50	Moderately agree	~
From 6.51 to 7.00	Strongly agree	~

Table 45. Interpretation of semantic differential scale used for satisfaction with travel scale

Semantic Differential Scale Points	Positive Deactivation	Positive Activation	Cognitive Evaluation
From 1 to 1.50	(-3) very stressed, worried, hurried	(-3) very bored, tired, fed-up	(-3) very poorly, held low standard, was the worst imaginable
From 1.51 to 2.50	-2	-2	-2
From 2.51 to 3.50	-1	-1	-1
From 3.51 to 4.50	Neutral	Neutral	Neutral
From 4.51 to 5.50	+1	+1	+1
From 5.51 to 6.50	+2	+2	+2
From 6.51 to 7.00	(+3) very relaxed, calm, confident	(+3) very enthusiastic, alert, engaged	(+3) very well, held high standard, was the best imaginable

6.5.1 Co-Production responses

The sub-dimensions of co-production of knowledge, equity and joint interaction were measured using four, three and four items, respectively, along a 5-point Likert scale (Table 44). Overall respondents tended to neither agree nor disagree for most indicators. However, respondents moderately agreed that: TfW offered enough illustrations and information for service usage (K2) (M = 3.51, SD = 1.07); that they were willing to spare time and effort to share ideas with TfW (K3) (M = 3.84, SD = 1.02); TfW gave passengers relevant information during dialogue (JI2) (M = 3.51, SD = 1.09) and that they had to actively engage in dialogue with TfW to get the most from rail services (JI4) (M = 3.56, SD = 1.01) (Table 46).

Table 46. Responses for co-production sub-constructs: knowledge, equity and joint interaction

Construct	Item	Response Scale (%)							
		1	2	3	4	5	Mean	SD	Interpretation
Knowledge	K1	11.7	14.4	47.1	19.0	7.8	2.97	1.06	neither agree nor disagree
	K2	5.2	12.1	25.6	40.6	16.4	3.51	1.07	moderately agree
	K3	3.1	7.4	20.6	40.1	28.9	3.84	1.02	moderately agree
	K4	10.3	12.3	40.6	26.5	10.3	3.14	1.09	neither agree nor disagree
Equity	E1	11.6	13.5	44.0	21.5	9.4	3.04	1.74	neither agree nor disagree
	E2	30.9	19.7	15.3	23.1	11.0	2.64	1.74	neither agree nor disagree
	E3	16.6	14.1	37.7	22.0	9.6	2.94	1.79	neither agree nor disagree
Joint Interaction	JI1	5.6	11.6	34.5	34.1	14.3	3.40	1.05	neither agree nor disagree
	JI2	6.0	11.2	26.9	38.1	17.9	3.51	1.09	moderately agree
	JI3	9.9	13.2	40.1	24.5	12.3	3.16	1.11	neither agree nor disagree
	JI4	4.2	7.6	34.3	35.9	18.1	3.56	1.01	moderately agree

6.5.2 Positive value-in-use responses

The sub-dimensions of positive value-in-use of relationship and personalisation were both measured by four items. The sub-dimension of experience was measured by three items and all sub-dimensions were measured along a 5-point Likert scale (Table 44). Overall, respondents tended to neither agree nor disagree to most indicators (Table 47). However, respondents moderately disagreed they felt an attachment or relationship to TfW or its personnel (R2) (M = 2.64, SD = 1.41) and moderately agreed that passengers get involved differently in rail services depending upon their preferences and experiences (P3) (M = 3.80, SD .92) and their experiences of rail services may differ from other passengers (EX2) (M = 3.71, SD = 1.13) (Table 47).

Table 47. Responses for positive value-in-use sub-constructs: relationship, personalisation and experience

Construct	Item	Response Scale (%)							
		1	2	3	4	5	Mean	SD	Interpretation
Relationship	R1	11.6	13.5	44.0	21.5	9.4	3.04	1.09	neither agreed not disagreed
	R2	30.9	19.7	15.3	23.1	11.0	2.64	1.41	moderately disagreed
	R3	16.6	14.1	37.7	22.0	9.6	2.94	1.19	neither agreed not disagreed
	R4	24.5	19.0	26.9	20.4	9.2	2.71	1.29	neither agreed not disagreed
Personalisation	P1	9.4	7.8	32.3	35.4	15.2	3.39	1.12	neither agreed not disagreed
	P2	9.7	13.2	26.9	35.4	14.8	3.32	1.17	neither agreed not disagreed
	P3	2.5	3.4	28.5	42.6	22.9	3.80	0.92	moderately agreed
	P4	13.5	16.1	22.7	33.0	14.6	3.19	1.26	neither agreed not disagreed
Experience	EX1	15.9	16.4	33.8	20.8	13.2	2.99	1.24	neither agreed not disagreed
	EX2	4.2	7.8	22.9	43.7	21.5	3.71	1.02	moderately agreed
	EX3	10.6	12.3	37.4	28.0	11.7	3.18	1.13	neither agreed not disagreed

6.5.3 Independent value creation responses

The sub-dimensions of independent value creation of value from digital self-service and value from physical self-service were both measured, by four items each, along a 5-point Likert scale (Table 44). Overall, respondents neither agreed nor disagreed for all indicators (Table 48).

Table 48. Responses for independent value creation sub-constructs: value from digital self-service and value from physical self-service usage

Construct	Item	Response Scale (%)							
		1	2	3	4	5	Mean	SD	Interpretation
Value from Digital Self-Service	DSS1	4.7	15.4	15.4	47.7	16.8	3.57	1.08	neither agree nor disagree
	DSS2	3.3	8.6	17.6	48.2	22.3	3.78	0.96	neither agree nor disagree
	DSS3	3.9	7.6	17.2	49.6	21.7	3.78	0.98	neither agree nor disagree
	DSS4	5.9	11.1	18.6	40.4	24.0	3.65	1.13	neither agree nor disagree
Value from Physical Self-Service	PSS1	4.3	12.3	18.6	45.2	19.5	3.63	1.06	neither agree nor disagree
	PSS2	3.0	11.3	20.1	46.5	19.0	3.67	1.01	neither agree nor disagree
	PSS3	3.0	12.1	23.4	39.4	22.1	3.65	1.05	neither agree nor disagree
	PSS4	4.3	16.5	22.5	33.8	22.9	3.55	1.14	neither agree nor disagree

6.5.4 Social value co-creation responses

The sub-dimensions of social value co-creation of social interaction, helping and information seeking were measured along a 5-point Likert scale using two, three and three items, respectively (Table 44). Overall, respondents tended to neither agree nor disagree for most indicators (Table 49). However, respondents moderately agreed: they helped other passengers if they seemed to have problems using rail services (H1) (M = 3.99, SD = .91); gave advice on rail services to other passengers (H3) (M = 3.68, SD = 1.07) and paid attention to the behaviours of other passengers to use rail services well (IS3) (M = 3.53, SD = 1.14) (Table 49).

Table 49. Responses for social value co-creation sub-constructs: social interaction, helping and information seeking

Construct	Item	Response Scale (%)							
		1	2	3	4	5	Mean	SD	Interpretation
Social Interaction	SI1	6.9	8.1	50.2	25.5	9.4	3.22	0.97	neither agree nor disagree
	SI2	7.9	10.5	39.7	30.7	11.2	3.27	1.05	neither agree nor disagree
Helping	H1	1.6	4.5	18.6	44.0	31.2	3.99	.91	moderately agree
	H2	7.0	8.7	31.0	36.5	16.8	3.47	1.09	neither agree nor disagree
	H3	6.5	5.4	22.6	44.4	21.1	3.68	1.07	moderately agree
Information Seeking	IS1	12.8	14.4	25.1	33.9	13.7	3.21	1.23	neither agree nor disagree
	IS2	15.7	14.1	26.9	28.9	14.4	3.12	1.27	neither agree nor disagree
	IS3	7.8	9.0	25.8	37.2	20.2	3.53	1.14	moderately agree

6.5.5 Negative value-in-use responses

The sub-dimensions of negative value-in-use of monetary cost and emotional cost were both measured by three items, while time and effort cost was measured by two items. All sub-dimensions were measured along a 5-point Likert-scale (Table 44). Overall, respondents tended to neither agree nor disagree for most indicators (Table 50). However, respondents moderately disagreed that: TfW's rail services are expensive (MC1) (M = 3.64, SD = 1.09); TfW's rail services charge too much (MC2) (M = 3.58, SD = 1.09); and that TfW's rail services are highly priced (MC3) (M = 3.56, SD = 1.15) but moderately disagreed that they spend a lot of time filling out forms to use TfW's rail services (TC2) (M = 2.48, SD = 1.29) (Table 50).

Table 50. Responses for negative value-in-use sub-constructs of monetary cost, emotional cost and time and effort costs

Construct		Item	Response Scale (%)							
			1	2	3	4	5	Mean	SD	Interpretation
Monetary Cost		MC1	3.1	13.2	25.5	33.2	25.1	3.64	1.09	moderately agree
		MC2	3.1	14.6	27.4	31.2	23.6	3.58	1.09	moderately agree
		MC3	4.9	15.0	24.2	31.6	24.4	3.56	1.15	moderately agree
Behavioural Cost	Emotional Cost	EC1	11.4	25.3	28.9	20.9	13.5	3.00	1.21	neither agree nor disagree
		EC2	15.9	25.6	17.7	24.4	16.4	3.00	1.34	neither agree nor disagree
		EC3	19.0	25.8	26.0	17.7	11.6	2.77	1.27	neither agree nor disagree
	Time and Effort Cost	TC1	20.8	26.0	21.8	20.2	11.2	2.75	1.30	neither agree nor disagree
		TC2	30.7	23.3	21.1	17.1	7.8	2.48	1.29	moderately disagree

6.5.6 Perceived value responses

Perceived value was measured using three items along a 5-point Likert scale (Table 44). Overall, respondents moderately agreed for all indicators of perceived value (Table 51). It is worth noting the construct of percieved value was not included in the thesis's conceptual model, but instead was used to assess convergent validity in formative value creation constructs.

Table 51. Responses for perceived value

Construct	Item	Response Scale (%)							
		1	2	3	4	5	Mean	SD	Interpretation
Perceived Value	PV1	4.9	12.6	20.4	39.2	22.9	3.63	1.11	moderately agree
	PV2	7.2	9.6	21.5	41.3	20.4	3.58	1.13	moderately agree
	PV3	5.4	8.7	17.3	43.7	23.9	3.74	1.10	moderately agree

6.5.7 Customer experience responses

The sub-dimensions of customer experience — brand experience, service provider experience and post-purchase experience — were measured by six, ten and seven items respectively, along a 7-point Likert scale (Table 44). Overall, respondents tended to agree a little for most indicators of brand experience and service provider experience, but neither agreed nor disagreed to almost all indicators of post-purchase experience (Table 52).

Table 52. Responses for customer experience sub-constructs: brand experience, service provider experience and post-purchase experience

Construct	Item	Response Scale (%)									
		1	2	3	4	5	6	7	Mean	SD	Interpretation
Brand Experience	BX1	11	13.5	15.3	15	13.9	21.8	9.4	4.10	1.88	neither agree nor disagree
	BX2	7.2	8.8	11.6	12.6	18.8	26.0	15.0	4.65	1.81	agree a little
	BX3	5.8	4.7	8.5	19.9	20.8	25.6	14.8	4.81	1.64	agree a little
	BX4	8.8	5.6	6.1	19.9	16.2	22.0	21.3	4.80	1.85	agree a little
	BX5	2.3	3.2	5.6	17.1	20.4	28.5	22.7	5.27	1.48	agree a little
	BX6	16.4	10.6	11.6	9.0	19.5	20.6	12.3	4.15	2.03	neither agree nor disagree
Service Provider Experience	SPE1	6.3	7.6	10.6	15.5	22.2	22.2	15.5	4.68	1.74	agree a little
	SPE2	6.7	5.1	9.4	14.4	21.7	24.2	18.6	4.86	1.74	agree a little
	SPE3	7.4	7.9	9.6	15.7	15.7	20.6	22.7	4.67	1.79	agree a little
	SPE4	4.0	5.2	7.4	29.2	19.9	20.6	13.7	4.72	1.54	agree a little
	SPE5	20.9	12.3	7.9	27.6	11.6	11.0	8.7	3.64	1.92	neither agree nor disagree
	SPE6	7.6	5.4	7.6	28.3	19.3	19.9	11.9	4.54	1.66	agree a little
	SPE7	1.1	4.2	8.1	14.3	24.5	30.0	17.9	5.18	1.41	agree a little
	SPE8	7.0	7.2	8.5	13.4	20.8	25.1	18.1	4.81	1.79	agree a little
	SPE9	22.6	8.7	8.5	24.0	14.1	13.5	8.7	3.74	1.97	neither agree nor disagree
	SPE10	8.8	8.3	9.2	18.6	22.0	21.8	11.2	5.00	1.76	agree a little
Post-Purchase Experience	PPE1	27.6	10.1	9.6	20.8	13.2	10.1	8.7	3.47	2.01	disagree a little
	PPE2	25.5	11.2	8.5	22.2	12.8	11.2	8.7	3.54	1.99	neither agree nor disagree
	PPE3	20.5	10.1	8.5	17.0	24.2	17.9	11.9	4.36	1.83	neither agree nor disagree
	PPE4	11.6	8.1	9.0	23.3	19.5	17.0	11.6	4.28	1.82	neither agree nor disagree
	PPE5	12.8	8.8	8.1	22.6	16.6	18.1	13.0	4.27	1.89	neither agree nor disagree
	PPE6	18.8	11.4	9.9	11.7	15.7	19.3	13.2	4.05	2.09	neither agree nor disagree
	PPE7	14.4	5.6	4.3	36.5	15.7	13.0	10.5	4.14	1.78	neither agree nor disagree

6.5.8 Passenger satisfaction responses

The sub-dimensions of passenger satisfaction — positive deactivation, positive activation and cognitive evaluation — were measured using one item each along a 7-point semantic differential scale (Table 45). Overall, respondents tended to be neutral for all indicators of passenger satisfaction (Table 53).

Table 53. Responses for passenger satisfaction sub-constructs: positive deactivation, positive activation and cognitive evaluations

Construct	Item	Response Scale (%)									
		1	2	3	4	5	6	7	Mean	SD	Interpretation
Positive Deactivation	PD	7.9	10.1	13.2	20.4	20.4	15.3	12.6	4.32	1.76	neutral
Positive Activation	PA	6.7	7.6	11.6	27.8	21.3	16.4	8.7	4.33	1.60	neutral
Cognitive Evaluation	CE	6.3	10.3	10.6	19.3	21.8	20.8	10.8	4.46	1.71	neutral

6.5.9 Feedback intention responses

Feedback intentions were measured using three items along a 5-point Likert scale (Table 44). Overall, respondents neither agreed nor disagreed for most indicators of feedback intentions, but moderately agreed they would let TfW or its personnel know if they experienced a problem (FI3) (M = 3.73, SD = 1.05) (Table 54).

Table 54. Responses for feedback intentions

Construct	Item	Response Scale (%)							
		1	2	3	4	5	Mean	SD	Interpretation
Feedback Intentions	FI1	11.2	13.4	29.1	32.3	14.1	3.25	1.19	neither agree nor disagree
	FI2	7.9	13.0	25.3	36.1	17.7	3.43	1.16	neither agree nor disagree
	FI3	3.8	10.6	17.3	44.8	23.5	3.73	1.05	moderately agree

6.5.10 Advocacy responses

Advocacy was measured using three items along a 5-point Likert scale (Table 44). Overall, respondents neither agreed nor disagreed for all indicators of advocacy (Table 55).

Table 55. Responses for advocacy

Construct	Item	Response Scale (%)							
		1	2	3	4	5	Mean	SD	Interpretation
Advocacy	AD1	11.0	10.5	26.5	34.8	17.1	3.37	1.20	neither agree nor disagree
	AD2	13.5	13.0	26.0	32.7	14.8	3.22	1.24	neither agree nor disagree
	AD3	12.5	13.0	22.2	35.4	17.0	3.31	1.25	neither agree nor disagree

6.5.11 Future patronage responses

Future Patronage was measured using three items along a 5-point Likert scale (Table 44). Overall, respondents moderately agreed for all indicators of future patronage (Table 56).

Table 56. Responses for future patronage

Construct	Item	Response Scale (%)							
		1	2	3	4	5	Mean	SD	Interpretation
Future Patronage	FP1	2.9	4.5	17.5	38.4	36.6	4.01	0.99	moderately agree
	FP2	4.3	4.2	18.2	34.1	39.2	4.00	1.06	moderately agree
	FP3	1.6	1.6	11.9	35.0	49.8	4.30	0.86	moderately agree

6.6 Summary of descriptive analysis

Overall, non-response bias was not present for all indicators, except for customer engagement constructs and select indicators. This may be attributable to rail strikes toward the end of main data collection, with the first quartile of respondents having significantly higher median ranks than last quartile respondents. The sample held a varied representation of different passenger demographics and rail use behaviours. This was largely representative of TfW's data and census information. On average, respondents tended to neither agree nor disagree to most indicators measured via Likert scales and were neutral for the STS measured via a semantic differential scale.

Chapter Seven - Partial least squares structural equation modelling (PLS-SEM)

Chapter Seven - Partial least squares structural equation modelling (PLS-SEM)

7.1 Introduction

This chapter, divided into four parts, discusses the thesis's PLS-SEM analysis using Smart PLS V4.09.5. The chapter begins with an introduction (S7.1) and then outlines preparations for performing PLS-SEM such as checking for sufficient sample size (S7.2.1), distributional assumptions (S7.2.2), statistical power (S7.2.3) and construct specifications (i.e., via CTA) (S7.3).

Part two focuses on measurement models for constructs (S7.4) and began with an introduction to reflective measurement models. Measurement models for first-order reflective constructs (S7.4.1) were examined in terms of: internal consistency reliability and convergent validity (S7.4.2); indicator reliability (S7.4.3) and discriminant validity (S7.4.4). Particular attention was paid to customer experience indicators due to multicollinearity issues (S7.4.5). Next, the topic of formative measurement models were discussed (S7.5). Measurement models for first-order formative constructs were examined in terms of: convergent validity (S7.5.1); collinearity assessments (S7.5.2); the significance and relevance of indicators (S7.5.3) and a summary of first-order measurement models is given (S7.5.4).

The discussion then examined measurement models for second-order reflective (S7.6) and formative (S7.7) constructs using the same criteria and offered a summary of these measurement models (S7.7.4). Closing the second part of the chapter, measurement models for third-order formative constructs were examined (S7.8), and a summary is given of the final measurement model (S7.8.5).

Part three focused on the structural model analysis (S7.9). This began with an introduction to structural model analyses (S7.9.1) and reviewed structural collinearity in the model (S7.9.2) and the significance and relevance of its structural relationships (S7.9.3). Next followed a mediator analysis (S7.10) and an examination of the model's predictive relevance in terms of in-sample predictive power (S7.11.1); out-of-sample predictive power (S7.11.2) and a summary of the model's predictive power is given (S7.11.3). This part of the analysis

finished with an examination of the model's quality according the PLS-SEM research standards (S7.12) and a comparison of alternative models (S7.13).

Part four focused on robustness checks proposed by PLS-SEM research and a multi-group analysis comparing different passenger groups (S7.14). Robustness checks (S7.14.1) were performed by an assessment of any potential non-linear relationships in the model (S7.14.2) and unobserved heterogeneity in the sample (S7.14.3). Next, the analysis examined the extent measurement model invariance was established between passenger groups (S7.15) and then performed a multi-group analysis comparing groups where invariance was present (S7.16). Part four closed with a summary of the analysis and conclusion to Chapter 7 (S7.17).

7.2 Part two: preparations for PLS-SEM

Hair et al. (2019) recommends reviewing required sample sizes, distributional assumptions and statistical power requirements before applying PLS-SEM and, although they also recommend reviewing construct specifications post-analysis, these were examined beforehand to save lengthy revisions to the analysis.

7.2.1 Sample size

PLS-SEM needs complete entries for its analysis, and so, only respondents that used both weekday and weekend rail services, and both digital and physical self-service, were in included in the analysis. Thus, respondents that did not use rail services on both weekdays and weekends, and used only one medium of self-service, were omitted from the analysis (Table 57).

Table 57. Further cleaning criteria to include only complete entries

	Self-service	
Period of rail use	Digital self-service	Physical self-service
Weekday	Yes	Yes
Weekend	Yes	Yes

This produced an end-sample of 406. A guideline for estimating sample sizes in PLS-SEM is the ten-times rule, according to which proposed samples should be "ten times the largest number of formative indicators" per construct or "ten times the largest number of structural paths directed at a particular latent construct" (Hair et al. 2011, p144). Along this

guideline, the model's minimum sample size was 460, as 46 repeated indicators formatively estimated holistic value creation.

An alternative guideline was the minimum R^2 method, which based estimates on the maximum number of independent variables directed at a single construct, the significance level used (i.e., p = .05) and the model's minimum R^2 value (Kock and Hadya, 2016). In the model, holistic value creation had the maximum number of four path coefficients, significance was set at p = 0.05 and feedback intentions (.109) had the lowest R^2 value. Using the minimum R^2 method, the minimum sample size for the model was 137. Overall, the analysis satisfied the latter guideline by a large margin but fell slightly below the ten-times rule (406 Vs 460). The next preliminary consideration examined was distributional assumptions.

7.2.2 Distributional assumptions

A major advantage of PLS-SEM is its lack of distributional assumptions, although Hair et al. (2019) highlights that this should not be the main motive for using this type of SEM. In the study, all constructs held distributions that violated normality assumptions (Appendix 23). As the favourable conditions for using PLS-SEM were discussed in Chapter 6, Hair et al.'s (2019) arguments around distributional assumptions were satisfied. To account for normality violations, the analysis used bias-corrected (BCa) bootstrapping with a sample of 5,000 to estimate significance levels.

The dataset was also examined for common method bias, which reflects "variance that is attributable to the measurement method rather than to the constructs the measures represent" (Podsakoff, MacKenzie, Lee and Podsakoff, 2003, p897). Podsakoff et al. (2003) recommends identifying common method bias via post-hoc statistical analysis and procedural remedies during data collection. Of the procedural remedies highlighted by Podsakoff et al. (2003) the thesis used: counterbalancing survey items; anonymising responses and collecting responses from different sources. These will now be discussed.

The thesis counterbalanced the order of survey items, and this was done within their respective constructs. For example, all indicators of brand experience were presented together but in randomised orders to mitigate sequencing effects. This was done to mitigate the downside of counterbalancing, which can "disrupt the logical flow and make it impossible to use the funnelling procedure (progressing logically from general to specific questions)" potentially increasing response burden (Podsakoff et al. 2003, p888).

Next, the thesis anonymised responses by purposely collecting no identifiable information, and where necessary used approximate categories to collect potentially sensitive information, per feedback from ethical approval (Chapter 5 – 5.11). Podsakoff et al. (2003, p888) has highlighted anonymising responses helps reduce evaluation apprehension, making respondents "less likely to edit their responses to be more socially desirable, lenient, acquiescent, and consistent with how they think the researcher wants them to respond".

Lastly, Podsakoff et al. (2003) proposes obtaining measures of predictor and criterion variables from different sources to mitigate the impact of using the same rater for both. However, this remedy holds a significant downside, which is that as "the data comes from different sources, it must be linked together" and so requires an identifying variable, potentially undermining respondents' anonymity (Podsakoff et al. 2003, p887). As no identifiable information was collected to ensure respondents anonymity, this procedure was not possible. However, responses were collected from several sources ranging from commercial to educational organisations, and passenger communities (Table 18).

For post-hoc statistical measures, Podsakoff et al. (2003) proposes using Harman's single factor test, and when more than 50% of variance in a dataset can be attributed to a single factor common method bias is deemed present. In the thesis's sample, Harman's single factor test showed 38% of variance was attributed to a single factor, showing common method bias was not present in the dataset. More recently, PLS-SEM research has proposed reviewing variance inflation factors (VIF) for collinearity to determine the extent a model is influenced by common method bias, and VIF values less than 3.3 indicate common method bias has not impacted a model (Kock, 2015).

At this point in the discussion, it is worth noting the analysis initially used the repeated indicators approach to estimate constructs. This can increase collinearity, as residuals become artificially correlated due to the same indicators being used multiple times (Becker et al. 2012). Reviewing VIF values for satisfactory measurement models of first-order constructs showed several indicators held values greater than 3.3, suggesting common method bias was present (Table 58). Following steps to mitigate collinearity issues (sections 7.4.4 & 7.4.5) and estimating some higher-order constructs using their own latent variables, VIF values were reduced below 3.3 for all indicators, except co-production and positive viu (Table 58). This suggests although common method bias may have been present for some first-order constructs in the model, it was largely mitigated when estimating higher-order

constructs. Additionally, inner model VIF values for structural relationships showed no possible collinearity (VIF < 3.3) suggesting common method bias did not impact the model in terms of structural relationships (Table 74).

Table 58. Review of VIF values for first, second and third-order constructs for identifying common method bias

3rd-order	Inner model VIF ≤ 5	2nd-order	Outer model VIF ≤ 5	1st-order	Outer model VIF ≤ 5
Value co-creation	1*	Co-production	3.55	Knowledge	*3.51*
				Equity	*3.47*
				Joint Interaction	*3.35*
		Positive viu	3.55	Experience	2.58
				Personalisation	3.16
				Relationship	*3.48*
Holistic value creation	1*	Independent Value Creation	1.67	Digital Self-Service	1.55
				Physical Self-Service	1.55
		Social Value Co-Creation	2.47	Helping	1.45
				Information Seeking	1.85
				Social Interaction	1.79
		Negative Viu	1.18	Monetary Cost	*3.51*
				Behavioural Cost	1.19
		Customer experience	1*	Brand experience	3.22
				Service provider experience	*6.67*
				Post-purchase experience	*3.97*
		Passenger satisfaction	1*	CE	2.81
				PA	2.88
				PDA	3.12
				Advocacy	1*
				Feedback intentions	1*
				Future patronage	1*

Note: constructs estimated using their own latent variable score*

7.2.3 Statistical power

Research can estimate statistical power via several methods, most notably Cohen's (1998) power table or a Monte Carlo simulation study (Beniteza et al. 2020). In the analysis, Cohen's (1998) power table was used to estimate statistical power. Prior research has found strong relationships between different value dimensions, customer experience and WoM ($\beta > .69$) (Kuppelwieser et al. 2021). As the study examined relationships between similar constructs (i.e. value creation, customer experience, passenger satisfaction and customer engagement behaviours), a medium effect size was assumed ($d = 0.5$). Using a significance level of 0.05

and a power level of .80 proposes a minimum sample size of 95 and 190, respectively, to detect within and between subject effects. As the sample size of 406 exceeded this estimation, sufficient statistical power was assumed for the analysis. Although Hair et al. (2019) recommends reviewing construct specification post-analysis as a robustness check, the study opted to review construct specifications before its analysis to save lengthy revisions between lower and higher-order constructs. The discussion turns now to construct specifications.

7.3 Confirmatory tetrad analysis

Constructs were initially designated as reflective or formative on conceptual grounds (Chapter 6). However, model misspecifications can undermine the validity of SEM (Jarvis et al. 2003). To mitigate this concern, Hair et al. (2018) have recommended applying CTA-PLS as a robustness check, as it is typically used after establishing measurement models. However, due to the size of the model with first, second and third-order constructs, CTA-PLS was used at the beginning to mitigate lengthy revisions. For constructs' final designations, when conceptual assumptions and CTA-PLS differ, Hair et al. (2018) have recommended designations be made on conceptual grounds.

CTA was introduced to PLS-SEM by Gudergan et al. (2008) and examines tetrads, or the "relationship between pairs of covariances" between indicators and whether covariance pairs significantly differ between indicator pairings (Hair et al. 2018, p91). In reflective constructs, indicators represent constructs equally well, and so all tetrads should vanish as they do not significantly differ. If a single tetrad remains, constructs are suggested to be formative as indicators do not represent constructs equally. CTA-PLS is typically only applied to constructs with four or more indicators. Although a borrowed indicator has been developed, Hair et al. (2018) have recommended only using CTA-PLS for constructs with four or more indicators. The analysis followed this guideline.

CTA-PLS found non-vanishing tetrads ($p < .05$) for all constructs, suggesting a formative specification, except for positive viu, personalisation and digital self-service where all tetrads vanished ($p > .05$), suggesting a reflective specification for these constructs (Appendix 24). Compared to prior conceptual assumptions, congruent findings were found for all constructs except knowledge, positive viu, personalisation, behavioural cost, physical self-service, customer experience, brand experience, service provider experience and post-

purchase experience (Table 60). Per Hair et al.'s (2018) recommendation, final designations were based on conceptual assumptions (Table 59), though incongruent CTA-PLS results prompted these to be reassessed (Table 60).

Table 59. Final construct designations in the current model

Construct	Final designation
Co-production	Formative HOC
Knowledge	Formative LOC
Equity	
Joint interaction	
Positive viu	Formative HOC
Relationship	Formative LOC
Personalisation	
Experience	
Social value co-creation	Formative HOC
Social interaction	Formative LOC
Helping	Reflective LOC
Information seeking	Reflective LOC
Independent value creation	Formative HOC
Digital S-S	Reflective LOC
Physical S-S	
Negative viu	Formative HOC
Monetary costs	Reflective LOC
Behavioural cost	
Customer experience	Reflective HOC
Brand experience	Reflective LOC
Service provider experience	
Post-purchase experience	
Passenger satisfaction	Reflective HOC
Feedback intentions	Reflective LOC
Advocacy	
Future patronage	

Table 60. Summary of conceptual and CTA-PLS assumptions, as well as final designation of constructs as reflective or formative in current model

Construct	Prior research	Conceptual designation	CTA Result	Final designation	Application of Jarvis et al.'s (2003) framework
Co-Production	1st & 2nd Formative (Ranjan and Read, 2016, p304)	Formative HOC	Formative	Formative HOC	Indicators of Co-Production are defining characteristics of the construct (No. 1), do not share similar content / are interchangeable (No. 2) and do not share nomological nets (No. 4)
Knowledge		Formative LOC	Reflective	Formative LOC	Indicators are defining characteristics of knowledge / joint interaction during creation during value co-creation (No. 1), do not share similar content / are interchangeable (No. 2) and only moderately correlated (r < .5)
Equity			~		
Joint Interaction					
Positive Viu		Formative HOC	Reflective	Formative HOC	Indicators are defining characteristics of the construct (No. 1) & do not share similar content / are not interchangeable (No. 2)
Relationship		Formative LOC	Formative	Formative LOC	Indicators do not share similar content / are not interchangeable (No. 2) and do not highly correlate (r < .5) (No. 3)
Personalisation			Reflective		
Experience			~		
Social Value Co-Creation	Formative	Formative	Formative	Formative HOC	Indicators are defining characteristics of SVCC (No 1.), do not share similar content / are interchangeable (No. 2) and do not share same nomological nets (e.g. H & IS nested in participation and citizenship behaviours respectively [Yi and Gong, 2013]) (No. 4)
Social interaction	Formative	Formative LOC	~	Formative LOC	Indicators do not share similar content / are not interchangeable (No. 1)
Helping	Reflective	Reflective LOC	~	Reflective LOC	Indicators hold similar content / are interchangeable (No. 1) & omitting indicator leaves H and IS unaltered (No. 2). Higher inter-item correlation (r > ~.5) (No. 3)
Information seeking	Reflective		~		
Independent Value Creation	Formative	Formative HOC	Formative	Formative HOC	Indicators different characteristics of IVC (No. 1), do not share similar content (i.e. distinct mediums of self-service) (No. 2) and only medium correlations between indicators (r < .5) (No. 3)
Digital SS	Reflective	Reflective	Reflective	Reflective LOC	Indicators hold similar content / are interchangeable & omitting indicator leaves DSS and PSS unaltered (No. 2). Higher inter-item correlation (r > ~.5) (No. 3)
Physical SS	Reflective	Reflective	Formative		
Negative Viu	Reflective	Formative HOC	Formative	Formative HOC	Indicators are defining characteristics of –Viu (No. 1), do not share similar contents / are not interchangeable (No. 2) and do not share nomological nets (No. 4)
Behavioural Cost	Reflective	Reflective LOC	Formative	Reflective LOC	Indicators share similar content, measuring behavioural costs (No. 2) and high inter-item correlation (r > .5) (No. 3)

Construct	Prior research	Conceptual designation	CTA Result	Final designation	Application of Jarvis et al.'s (2003) framework
Customer experience	1st & 2nd Reflective	Reflective	Formative	Reflective HOC	Indicators hold similar content / are interchangeable, as CX resembles a wholistic construct (No. 2) and strong correlations between indicators (r > .65) (No. 3)
Brand experience		Reflective	Formative	Reflective LOC	Indicators hold similar content respective of each construct (No. 2) with high inter-item correlation per construct (r > ~.5) (No. 3) and share nomological nets related to brand perceptions / purchase experiences / post-purchase experiences (No. 4)
Service provider Experience		Reflective	Formative		
Post-purchase experience		Reflective	Formative		
Passenger satisfaction	Reflective 1st & 2nd	Reflective HOC	~	Reflective HOC	Indicators share similar content (No. 2), have high inter-item correlations (r > ~.5) (No. 3) and share nomological nets (No. 4) (Ollsen et al. (2012; Ettema et al. 2017; Sukhov et al. 2022)
Feedback intentions	Reflective LOC	Reflective LOC	~	Reflective LOC	Indicators share similar content, with respect to their own constructs (No. 2) and have high inter-item correlations within their own constructs (r > ~.5) (No. 3)
Advocacy					
Future patronage					

7.4 Part two: measurement model analysis

7.4.1 First-order reflective measurement models

Smart PLS 4.0.9.5 was used to assess measurement and structural models in the analysis. Reflective measurement models were assessed in terms of internal consistency reliability, indicator reliability, convergent validity and discriminant validity (Hair et al. 2014; 2019). This section assessed first-order reflective measurement models and began with an assessment of the internal consistency reliability and convergent validity of first-order reflective constructs.

7.4.2 Internal consistency reliability & convergent validity

Internal consistency reliability is established when a construct's composite reliability is greater than 0.7, with Hair et al. (2014) recommending rho_a as a suitable measure of composite reliability. All first-order reflective constructs had satisfactory composite reliability, ranging from 0.773 to 0.939. Convergent validity was assessed in terms of average variance extracted (AVE), with values greater than 0.5 showing satisfactory convergent validity (Hair et al. 2019). All construcs had acceptable convergent validity (Table 61, Table 62 & Table 63). Next, the analysis examined the indicator reliability of first order reflective constructs.

7.4.3 Indicator reliability

Indicator reliabilities are established when indicator loadings are significant and higher than .707 (Hair et al. 2014). All indicators had significant loadings above this threshold, except DSS4 (Table 61), BX4, SPE5, SPE9 (Table 62) and FI3 (Table 63). Hair et al. (2014) recommends reviewing indicators with loadings between 0.4 and 0.7 for their contributions to a construct's internal consistency reliability and convergent validity. When indicator omission is found to increase constructs above thresholds for these criteria, Hair et al. (2014) suggests omitting the indicator. However, when constructs remain above thresholds regardless of indicator omission, indicators should be retained. As the respective constructs remained above thresholds regardless of indicator omission, these indicators were retained (Table 64). Next, the analysis examined discriminant validity for indicators of first-order reflective constructs.

Table 61. Scale reliability, convergent validity, indicator loading and collinearity assessment for first-order reflective value creation constructs

	Scale Reliability & Convergent Validity			Indicator Reliability			Collinearity
Constructs	rho_a	AVE	α	Indicators	Construct loading	95% CI	VIF
Acceptable Level	≥.70	≥.50	≥ .70		≥.70		≤ 5
Digital Self-Service	0.84	0.67	0.83	DSS1	0.83	0.789; 0.866	1.92
				DSS2	0.88	0.844; 0.901	2.46
				DSS3	0.86	0.821; 0.883	2.23
				DSS4	0.69	0.625; 0.754	1.36
Physical Self-Service	0.90	0.76	0.90	PSS1	0.88	0.850; 0.911	2.88
				PSS2	0.91	0.884; 0.926	***3.34***
				PSS3	0.90	0.880; 0.921	2.96
				PSS4	0.78	0.732; 0.829	1.75
Helping	0.78	0.68	0.94	H1	0.76	0.676; 0.815	1.49
				H2	0.83	0.789; 0.865	1.52
				H3	0.88	0.847; 0.897	1.81
Information Seeking	0.77	0.69	0.77	IS1	0.87	0.832; 0.889	1.99
				IS2	0.87	0.837; 0.898	2.02
				IS3	0.74	0.667; 0.794	1.30
Monetary Cost	0.94	0.89	0.94	MC1	0.92	0.899; 0.944	***3.33***
				MC2	0.95	0.933; 0.960	***4.64***
				MC3	0.95	0.935; 0.961	***4.81***
Behavioural Cost	0.90	0.70	0.89	EC1	0.86	0.831; 0.886	2.76
				EC2	0.82	0.779; 0.860	2.22
				EC3	0.90	0.877; 0.915	***3.52***
				TC1	0.85	0.823; 0.882	2.35
				TC2	0.72	0.640; 0.779	1.62

N.B. Indicators showing possible or greater collinearity are in bold and italics.

Table 62. Scale reliability, convergent validity, indicator loading and collinearity assessment for first-order customer experience constructs

	Scale Reliability & Convergent Validity			Indicator Reliability			Collinearity
Constructs	rho_a	AVE	α	Indicators	Construct loading	95% CI	VIF
Acceptable Level	≥.70	≥.50	≥ .70		≥.70		≤ 5
				BX1	0.84	0.818; 0.888	***3.60***
				BX2	0.89	0.856; 0.905	***3.76***
				BX3	0.87	0.816; 0.875	2.92
				BX4	0.64	0.537; 0.696	1.52
				BX5	0.76	0.668; 0.785	2.29
Brand Experience	0.88	0.65	0.89	BX6	0.87	0.837; 0.889	2.90
				SPE1	0.83	0.786; 0.856	2.97
				SPE2	0.85	0.813; 0.872	***3.95***
				SPE3	0.87	0.845; 0.895	***3.89***
				SPE4	0.86	0.830; 0.889	3.25
				SPE5	0.68	0.614; 0.739	2.34
				SPE6	0.86	0.834; 0.887	3.29
				SPE7	0.77	0.725; 0.813	2.34
				SPE8	0.86	0.833; 0.885	***3.41***
				SPE9	0.65	0.573; 0.714	2.19
Service Provider Experience	0.94	0.64	0.94	SPE10	0.71	0.642; 0.760	1.78
				PPE1	0.86	0.810; 0.878	***3.91***
				PPE2	0.88	0.841; 0.894	***4.24***
				PPE3	0.82	0.781; 0.851	2.33
				PPE4	0.88	0.851; 0.897	3.27
				PPE5	0.85	0.812; 0.878	2.86
				PPE6	0.86	0.829; 0.887	2.94
Post-Purchase Experience	0.93	0.73	0.94	PPE7	0.83	0.789; 0.860	***3.91***

N.B. Indicators showing possible or greater collinearity are in bold and italics.

Table 63. Scale reliability, convergent validity, indicator loading and collinearity assessment for first-order reflective customer experience constructs

	Scale Reliability & Convergent Validity			Indicator Reliability			Collinearity
1st order reflective customer engagement behaviour constructs	rho_a	AVE	α	Indicators	Construct loading	95% CI	VIF
Acceptable Level	≥.70	≥.50	≥ .70		≥.70		≤ 5
Passenger Satisfaction	0.91	0.84	0.91	CE	0.91	0.895; 0.934	2.81
				PA	0.92	0.905; 0.937	2.88
				PDA	0.92	0.887; 0.930	3.12
Feedback Intentions	0.80	0.63	0.72	FI1	0.88	0.820; 0.923	1.44
				FI2	0.83	0.749; 0.876	1.51
				FI3	0.66	0.492; 0.762	1.34
Advocacy	0.91	0.85	0.91	AD1	0.93	0.919; 0.947	***3.46***
				AD2	0.94	0.925; 0.952	***3.87***
				AD3	0.90	0.908; 0.943	2.63
Future Patronage	0.92	0.72	0.82	FP1	0.87	0.812; 0.904	2.17
				FP2	0.90	0.842; 0.938	1.70
				FP3	0.77	0.678; 0.838	1.83

Table 64. Impact of indicator omission on respective constructs

	rho_a		AVE	
Constructs	With	Without	With	Without
Digital Self-Service	0.84	0.85	0.67	0.77
Brand Experience	0.91	0.90	0.65	0.72
Service Provider Experience	0.94	0.94	0.64	0.71
Feedback Intentions	0.80	0.71	0.63	0.75

7.4.4 Discriminant validity

Discriminant validity was assessed via HTMT and VIF values. Hair et al. (2014) give a threshold of 0.9 for HTMT values, while VIF values below 3.3 and 5 indicate no serious collinearity or severe multicollinearity, respectively. All reflective first-order constructs had HTMT values below threshold, except between BX, SPE and PPE (Table 65). Per Hair et al. (2014), cross-loadings for these indicators were reviewed, which showed widespread cross-loading (Table 66). VIF values for all indicators suggested no issues with collinearity (VIF < 3.3) except for PPS2, EC3, MC1, MC3, MC3, BX1, BX2, SPE2, SPE 3, SPE8, PPE1, PPE2, AD1 and AD2 (Table 61, Table 62 & Table 63).

Initially the analysis estimated higher-order constructs using the repeated indicators approach, although this method can produce collinearity as residuals become artificially correlated (Becker et al. 2012). Since value creation, customer experience and customer engagement are closely related (De Keyser et al. 2015), it was important to mitigate collinearity issues. Therefore, the analysis opted to use the two-stage approach that involved using latent variable scores as indicators of higher-order constructs (Ringle et al. 2012). Using this approach can mitigate issues with collinearity, although Hair et al. (2014) notes that collinearity issues can be carried into latent variable scores when not dealt with at the indicator level.

To mitigate collinearity, first-order indicators showing possible collinearity (VIF > 3.3) were omitted. For constructs with multiple indicators holding possible collinearity (i.e. Monetary Cost and Advocacy) those with the highest VIF values were omitted (MC3, AD2). After omission, all affected constructs had satisfactory internal consistency reliability and convergent validity, and the remaining indicators had no collinearity issues (VIF < 3.3) (Table 67). However, as almost 30% of first-order indicators of customer experience constructs showed possible collinearity issues (Table 62), a more detailed approach was needed to not undermine the constructs' content validity. To further mitigate possible issues of collinearity, passenger satisfaction, feedback intentions, advocacy and future patronage were estimated using their latent variable scores. Next, the analysis examined how multi-collinearity issues were mitigated for first-order indicators of customer experience.

Table 65. Discriminant validity (HTMT) analysis

	AD	BC	BX	DSS	FI	FP	H	IS	MC	PS	PSS	PPE	SPE
AD													
BC	0.14												
BX	0.82	0.14											
DSS	0.50	0.12	0.64										
FI	0.61	0.34	0.41	0.35									
FP	0.57	0.13	0.58	0.58	0.30								
H	0.45	0.21	0.39	0.44	0.61	0.47							
IS	0.46	0.45	0.45	0.40	0.58	0.24	0.66						
MC	0.17	0.44	0.12	0.05	0.14	0.08	0.14	0.16					
PS	0.75	0.24	0.74	0.51	0.38	0.40	0.24	0.28	0.20				
PSS	0.44	0.08	0.57	0.71	0.32	0.50	0.40	0.37	0.06	0.44			
PPE	0.82	0.21	0.85	0.58	0.60	0.39	0.43	0.58	0.10	0.73	0.55		
SPE	0.77	0.23	**0.93**	0.63	0.52	0.49	0.40	0.50	0.09	0.70	0.58	**0.93**	

Advocacy (AD); Behavioural Cost (BC); Brand Experience (BX); Digital Self-Service (DSS); Feedback Intentions (FI); Future Patronage (FP); Helping (H); Information Seeking (IS); Monetary Cost (MC); Passenger Satisfaction (PS); Physical Self-Service (PSS); Post-Purchase Experience (PPE); Service Provider Experience (SPE). HTMT values greater than threshold denoted in bold.

Table 66. Cross-loadings of brand experience, service provider experience and post-purchase experience indicators, with loadings in bold denoting their measured construct

	Brand experience	Service provider experience	Post-purchase experience
BX1	**0.86**	0.68	0.71
BX2	**0.89**	0.74	0.65
BX3	**0.85**	0.74	0.65
BX4	**0.62**	0.49	0.45
BX5	**0.73**	0.67	0.51
BX6	**0.87**	0.76	0.80
SPE1	0.71	**0.83**	0.66
SPE2	0.74	**0.85**	0.64
SPE3	0.76	**0.87**	0.74
SPE4	0.74	**0.86**	0.71
SPE5	0.51	**0.68**	0.74
SPE6	0.72	**0.86**	0.78
SPE7	0.70	**0.77**	0.61
SPE8	0.76	**0.86**	0.70
SPE9	0.50	**0.65**	0.70
SPE10	0.59	**0.70**	0.67
PPE1	0.56	0.68	**0.85**
PPE2	0.60	0.71	**0.87**
PPE3	0.67	0.73	**0.82**
PPE4	0.72	0.80	**0.88**
PPE5	0.69	0.80	**0.85**
PPE6	0.80	0.76	**0.86**
PPE7	0.65	0.69	**0.83**

Table 67. Impact of omitting PSS2, EC3, MC3 and AD2 on internal consistency reliability and convergent validity of associated constructs, with VIF values for retained indicators

	rho_a		AVE		Retained	VIF
Constructs	With	Without	With	Without	Indicator	
					PSS1	2.60
					PSS2	2.84
Physical Self-Service	0.90	0.85	0.76	0.76	PSS4	1.63
					EC1	2.01
					EC2	2.01
					TC1	2.29
Behavioural Cost	0.90	0.85	0.70	0.68	TC2	1.52
					MC1	2.84
Monetary Cost	0.94	0.89	0.89	0.90	MC2	2.84
					AD1	2.17
Advocacy	0.91	0.85	0.85	0.87	AD3	2.17

7.4.5 Brand experience, service provider experience and post-purchase experience: mitigating collinearity

To mitigate collinearity in customer experience constructs, inner model VIFs were assessed to identify the potential source of collinearity. This found serious multicollinearity between customer experience and passenger satisfaction (VIF = 5.047). Significant bivariate correlations ranged between .369 and .711 between all first-order indicators of customer experience constructs and the latent variable score of passenger satisfaction (Table 68). To mitigate collinearity, the highest correlating indicators were sequentially omitted and VIF values reassessed.

After omission of PPE 6 (r = .771), BX6 (r = .690) and BX1 (r = .612) collinearity between first-order customer experience constructs and passenger satisfaction (VIF < 4.67) was mitigated bellow the severe multicollinearity threshold (VIF < 5). However, collinearity could not be mitigated below possible collinearity (VIF < 3.3) without potentially undermining the content validity of first-order customer experience constructs. After indicator omissions, satisfactory measurement models were found for brand experience (CR = 0.840, AVE = 0.651) and post-purchase experience (CR = 0.926, AVE = 0.728) and at most only possible collinearity issues remained (3.3 < VIF < 5) (Table 68).

Table 68. Ranked descending bivariate correlations for first-order customer experience indicators and passenger satisfaction latent score, alongside VIF values for retained indicators (p < .001)**

Item	Correlations	VIF after indicator omission	Item	Correlations	VIF after indicator omission
PPE6	.711*	-	SPE2	.539**	3.95
BX6	.690**	-	PPE3	.535**	2.23
BX1	.612**	-	PPE2	.515**	4.18
PPE4	.597**	3.16	PPE1	.504**	3.91
BX2	.593**	2.27	SPE1	.494**	2.97
PPE5	.584**	2.71	SPE10	.487**	1.78
SPE8	.580**	3.41	SPE5	.464**	2.34
SPE3	.576**	3.89	PPE7	.441**	2.36
SPE4	.571**	3.25	SPE9	.402**	2.19
SPE7	.562**	2.34	BX5	.399**	1.74
SPE6	.560**	3.29	BX4	.369**	1.33
BX3	.545**	2.34	-	-	-

7.5 First-order formative measurement models

Next, the analysis examined the measurement models for first-order formative constructs. Per Hair et al.'s (2014) guidelines, formative measurement models were assessed in terms convergent validity, collinearity and the significance and relevance of formative indicators. The analysis began by assessing the convergent validity of first-order formative constructs.

7.5.1 Convergent validity

To examine convergent validity, Hair et al. (2014) have recommended examining formative constructs in relation to the same construct that has been reflectively measured or a global reflective indicator. This became problematic for the analysis because, to the best of the author's knowledge, no reflective measures or a global reflective indicator exists for co-production and positive viu. Hair et al. (2014) noted that this approach extends survey lengths and this was particularly problematic for a current survey that was already 125 items long.

Ranjan and Read (2014) assessed convergent validity for co-production and positive viu in relation to a conceptually related reflective construct. The reflective construct of perceived value was chosen for this purpose, as it represented a summation of customers' value in terms of what is offered and received to obtain a service (Zeithaml et al. 1988). Significant and positive path coefficients were found between all first-order formative constructs and perceived value, suggesting convergent validity had been established (Table 69).

7.5.2 Collinearity assessment

Next, the analysis examined collinearity for first-order formative indicators. No possible collinearity issues were found for first-order formative indicators (VIF < 3.3) (Table 69).

7.5.3 Significance and relevance of formative indicators

Next, the analysis examined the significance and relevance of indicators for formative first-order constructs. For formative indicators, Hair et al. (2014) have recommended reviewing each indicator's weight (i.e. relative contribution), loadings (i.e. absolute contribution) and significance levels. When indicators have non-significant weights, Hair et al. (2014) suggest assessing indicator loadings and for indicators with non-significant loadings less than 0.5 to be omitted. When loadings are significant, Hair et al. (2014) suggest considering retaining indicators. All indicators had significant weights, except K3 (weight = 0.06, CI: -0.006; 0.127), P3 (weight = 0.076, CI: -0.033; 0.129) and R1 (weight = 0.003, CI: -0.096; 0.068).

However, as these indicators had significant loadings, they were retained so as not to alter the conceptual domain of their respective formative constructs (Jarvis et al. 2003) (Table 69).

Table 69. Convergent validity, indicator reliability and collinearity assessment for first-order value creation constructs

Convergent Validity				Indicator Reliability					Collinearity
Constructs	Path Coefficient (β)	95% CI		Indicators	Construct weight	95% CI	Construct Loading	95% CI	VIF
Acceptable Level			Sig.				≥.50		≤ 5
			Yes	K1	0.37	0.267; 0.481	0.88	0.828; 0.917	2.16
				K2	0.20	0.113; 0.290	0.70	0.622; 0.773	1.54
				K3	0.06	-0.006; 0.127	0.28	0.166; 0.394	1.07
Knowledge	0.61	0.537; 0.663		K4	0.56	0.444; 0.658	0.93	0.885; 0.958	2.02
			Yes	EQ1	0.39	0.270; 0.496	0.89	0.837; 0.931	2.30
				EQ2	0.36	0.254; 0.464	0.89	0.849; 0.919	2.40
Equity	0.53	0.445; 0.593		EQ3	0.37	0.241; 0.487	0.92	0.884; 0.946	2.94
			Yes	JI1	0.15	0.041; 0.258	0.77	0.696; 0.837	2.09
				JI2	0.30	0.208; 0.381	0.77	0.706; 0.822	1.76
				JI3	0.65	0.554; 0.746	0.94	0.909; 0.967	1.82
Joint Interaction	0.59	0.515; 0.650		JI4	0.09	0.013; 0.170	0.48	0.358; 0.580	1.24
			Yes	R1	0.00	-0.096; 0.068	0.40	0.291; 0.507	1.30
				R2	0.20	0.097; 0.301	0.78	0.710; 0.839	2.08
				R3	0.31	0.238; 0.451	0.86	0.796; 0.904	2.07
Relationship	0.62	0.548; 0.669		R4	0.61	0.487; 0.688	0.94	0.907; 0.963	2.09
			Yes	P1	0.28	0.209; 0.398	0.77	0.687; 0.833	1.55
				P2	0.25	0.107; 0.322	0.79	0.724; 0.845	1.88
				P3	0.08	-0.033; 0.129	0.53	0.430; 0.615	1.32
Personalisation	0.67	0.593; 0.727		P4	0.59	0.487; 0.723	0.94	0.903; 0.966	2.13
			Yes	EX1	0.50	0.403; 0.621	0.82	0.736; 0.887	1.30
				EX2	0.19	0.074; 0.246	0.48	0.366; 0.579	1.14
Experience	0.58	0.498; 0.635		EX3	0.58	0.460; 0.689	0.87	0.802; 0.915	1.33
			Yes	SI1	0.58	0.270; 0.532	0.85	0.785; 0.896	1.26
Social Interaction	0.44	0.359; 0.511		SI2	0.59	0.640; 0.848	0.86	0.793; 0.905	1.26

7.5.4 Summary of first-order measurement models

Next, the analysis summarised first-order measurement models for reflective and formative constructs. Satisfactory measurement models were established for first-order reflective and formative constructs. Potential collinearity was mitigated as much as possible, and the analysis used the two-stage approach to estimate higher-order constructs.

7.6 Second-order reflective measurement models

Next, the analysis examined the measurement models for second-order constructs, beginning with reflective second-order constructs. During the two-stage approach, indicator weights or loadings represent path coefficients between lower and higher-order formative or reflective constructs, respectively (Becker et al. 2012; Ringle et al. 2012).

7.6.1 Internal consistency reliability & convergent validity

The analysis examined measurement models for second-order reflective constructs and began by examining their internal consistency reliability and convergent validity. Customer experience had a satisfactory internal consistency reliability (CR = 0.927) and convergent validity (AVE = 0.862) (Table 70).

7.6.2 Indicator reliability

Next, the analysis examined the indicator reliability of second-order reflective constructs. Brand experience (0.893, CI: 0.868; 0.913), service provider experience (0.968, CI: 0.961; 0.973) and post-purchase experience (0.923, CI: 0.910; 0.936) had significant loadings above 0.7 and were retained (Table 70).

7.6.3 Discriminant validity

The discriminant validity for customer experience indicators was then examined. No issues of discriminant validity were present for customer experience indicators (HTMT < 0.90) and in relation to other constructs (Table 71). However, possible and severe multi-collinearity were present for post-purchase experience (VIF = 3.97) and service provider experience (VIF = 6.67). For reflective constructs, indicators can be omitted without altering a construct's conceptual domain (Jarvis et al. 2003). However, omitting either post-purchase experience or service provider experience may have undermined the content validity of customer experience as a higher-order construct. Therefore, the indicators were retained, and customer

experience was estimated using its own latent variable score. Doing so reduced collinearity between customer experience and passenger satisfaction below possible collinearity (VIF = 2.14) without undermining the former construct's content validity.

Table 70. Loadings of second-order customer experience, along with Cronbach's alpha, composite reliability and average variance explained of the construct

	Scale Reliability & Convergent Validity			Indicator Reliability			Collinearity
1st order reflective value creation constructs	rho_a	AVE	α	Indicators	Construct loading	95% CI	VIF
Acceptable Level	≥.70	≥.50	≥ .70		≥.70		≤ 5
Customer experience	0.96	0.59	0.96	Brand Experience	0.87	0.835; 0.889	3.22
				Service Provider Experience	0.93	0.916; 0.943	6.67
				Post-Purchase Experience	0.98	0.973; 0.981	3.97

Table 71. Discriminant validity (HTMT) analysis

	AD	BC	CX	DSS	FI	FP	H	IS	MC	PS	PSS
AD	-										
BC	0.165	-									
CX	0.85	0.16	-								
DSS	0.509	0.107	0.657	-							
FI	0.639	0.352	0.533	0.345	-						
FP	0.58	0.105	0.536	0.575	0.298	-					
H	0.474	0.233	0.436	0.443	0.607	0.47	-				
IS	0.469	0.477	0.525	0.397	0.579	0.238	0.664	-			
MC	0.168	0.448	0.075	0.05	0.153	0.067	0.15	0.16	-		
PS	0.76	0.26	0.743	0.51	0.375	0.402	0.243	0.278	0.186	-	
PSS	0.439	0.089	0.573	0.714	0.306	0.509	0.384	0.345	0.055	0.440	-

Advocacy (AD); Behavioural Cost (BC); Brand Experience (BX); Digital Self-Service (DSS); Feedback Intentions (FI); Future Patronage (FP); Helping (H); Information Seeking (IS); Monetary Cost (MC); Passenger Satisfaction (PS); Physical Self-Service (PSS); Post-Purchase Experience (PPE); Service Provider Experience (SPE).

7.7 Second-order formative measurement models

Next, the analysis examined the measurement models of second-order formative constructs of co-production, positive viu, independent value creation, social value co-creation and negative viu.

7.7.1 Convergent validity

The analysis began by assessing convergent validity for these constructs. Significant and positive path coefficients were present between co-production (β = 0.586; CI: 0.510; 0.646), Positive Viu (β = 0.679; CI: 0.614; 0.734), independent value creation (β = 0.537; CI: 0.444; 0.608) and social value co-creation (β = 0.453; CI: 0.366; 0.520) and perceived value. However, no significant path coefficient was present between negative viu (β = -0.095; CI: -0.176; 0.174) and perceived value (Table 72). Therefore, convergent validity was established for all constructs except negative viu.

7.7.2 Collinearity assessment

Next, the analysis examined collinearity for indicators of second-order formative constructs. No serious multicollinearity was found for second-order formative indicators, although possible collinearity (VIF > 3.3) was found for knowledge (VIF = 3.51), equity (VIF = 3.47), joint interaction (VIF = 3.35) and relationship (VIF 3.48) (Table 72).

7.7.3 Significance and relevance of indicators

Next, the analysis examined the significance and relevance of indicators for seconds-order formative constructs. All second-order formative indicators had significant weights except for helping (weight = 0.117, CI: -0.032; 0.256), information seeking (weight = 0.118, CI: -0.044; 0.290) and monetary cost (weight = -0.681; CI: -1.087; 0.257) (Table 72). Of these indicators, all had significant loadings more than 0.5 and were retained, except for monetary cost (loading = -0.266, CI: -0.977; 0.582).

Hair et al. (2019, p10) notes that when weights “take values lower or higher than this [+1 or -1]” this may be attributable to “collinearity issues and/or small sample sizes”. As no possible collinearity issues were present for monetary cost (VIF = 2.87), this abnormal finding may potentially be due to sampling issues, although the construct held a satisfactory measurement model itself. monetary cost was considered for omission but retained to not alter the conceptual domain of negative viu as representing both tangible and intangible costs for customers (Plewa et al. 2015; Sweeney et al. 2018).

Table 72. Convergent validity, indicator reliability and collinearity assessment for second-order formative value creation constructs

Convergent Validity				Indicator Reliability					Collinearity
Constructs	Path Coefficient (β)	95% CI		Indicators	Construct weight	95% CI	Construct Loading	95% CI	VIF
Acceptable Level			Sig.				≥.50		≤ 5
Co-Production	0.586	0.510; 0.646	Yes	Knowledge	0.35	0.262; 0.438	0.93	0.902; 0.952	3.51
				Equity	0.31	0.215; 0.391	0.92	0.892; 0.940	3.47
				Joint Interaction	0.41	0.331; 0.504	0.94	0.920; 0.957	3.35
Positive Viu	0.679	0.614; 0.734	Yes	Experience	0.16	0.074; 0.250	0.84	0.788; 0.877	2.58
				Personalisation	0.55	0.443; 0.654	0.96	0.942; 0.975	3.16
				Relationship	0.36	0.259; 0.467	0.93	0.898; 0.953	3.48
Independent Value Creation	0.453	0.366; 0.520	Yes	Digital Self-Service	0.70	0.561; 0.815	0.94	0.892; 0.977	1.55
				Physical Self-Service	0.42	0.269; 0.557	0.83	0.752; 0.897	1.55
Social Value Co-Creation	0.537	0.444; 0.608	Yes	Helping	0.12	-0.032; 0.256	0.60	0.476; 0.695	1.45
				Information Seeking	0.12	-0.044; 0.290	0.72	0.622; 0.812	1.85
				Social Interaction	0.86	0.733; 0.968	0.99	0.968; 0.999	1.79
Negative Viu	-0.095	-0.176; 0.174	No	Behavioural Cost	-0.68	-1.087; 0.257	-0.27	-0.977; 0.582	1.19
				Monetary Cost	1.05	0.544; 1.142	0.78	-0.144; 0.999	3.51

7.7.4 Summary of second-order measurement models

Next, the analysis summarised measurement models for second-order reflective and formative constructs. In summary, satisfactory measurement models were established for all second-order constructs, except negative viu and an anomalous weighting for monetary cost was found. No serious multicollinearity were found (VIF < 5), although possible collinearity issues were present for SPE, PPE, knowledge, equity, joint interaction and relationship (VIF > 3.3). Next, the analysis examined the measurement models for third-order formative constructs.

7.8 Third-order formative measurement model

This portion of the analysis examined measurement models for the third-order formative constructs of holistic value creation and value co-creation.

7.8.1 Convergent validity

The analysis began with convergent validity. Significant and positive path coefficients were found between holistic value creation (β = 0.709, CI: 0.644; 0.758) and value co-creation (β = 0.673, CI: 0.611; 0.726) and perceived value, indicating convergent validity was established for these constructs.

7.8.2 Collinearity assessment

Next was collinearity for indicators of third-order formative constructs. No collinearity issues were found for all indicators of holistic value creation, although possible collinearity issues were found for co-production (VIF = 3.552) and positive viu (VIF = 3.552) as indicators of value co-creation (Table 73). A potential solution was to estimate value co-creation using its own latent variable score. However, as collinearity was below the serious multicollinearity threshold (VIF < 5) these indicators were retained to assess the hypotheses of H1a and H1b.

7.8.3 Significance and relevance of indicators

Next, the analysis examined the significance and relevance of indicators for third-order formative constructs. All formative indicators of holistic value creation and value co-creation had significant weights and loadings, except for negative viu that had a non-significant weight (-0.028, CI: -0.199; 0.056) but a significant loading (0.131, CI: 0.012; 0.238) (Table 73). Per Hair et al.'s (2014) recommendation, negative viu was considered for omission. However, it was retained to not alter the conceptual domain of value creation as a holistic representation of customers' value creation sphere (Grönroos and Voima, 2013).

Table 73. Convergent validity, indicator reliability and collinearity assessment for third-order formative value creation constructs

Convergent Validity				Indicator Reliability					Collinearity
Constructs	Path Coefficient (β) with percieved value	95% CI		Indicators	Construct weight	95% CI	Construct Loading	95% CI	VIF
Acceptable Level			Sig.				≥.50		≤ 5
Value Co-Creation	0.673	0.611; 0.726	Yes	Co-Production	0.65	0.503; 0.793	0.98	0.959; 0.993	3.55
				Positive Viu	0.39	0.233; 0.536	0.94	0.906; 0.964	3.55
Holistic Value Creation	0.709	0.644; 0.758	Yes	Independent Value Creation	0.50	0.420; 0.637	0.83	0.755; 0.881	1.67
				Social Value Co-Creation	0.64	0.538; 0.747	0.88	0.818; 0.925	2.47
				Negative Viu	-0.03	-0.119; 0.056	0.13	0.012; 0.238	1.18

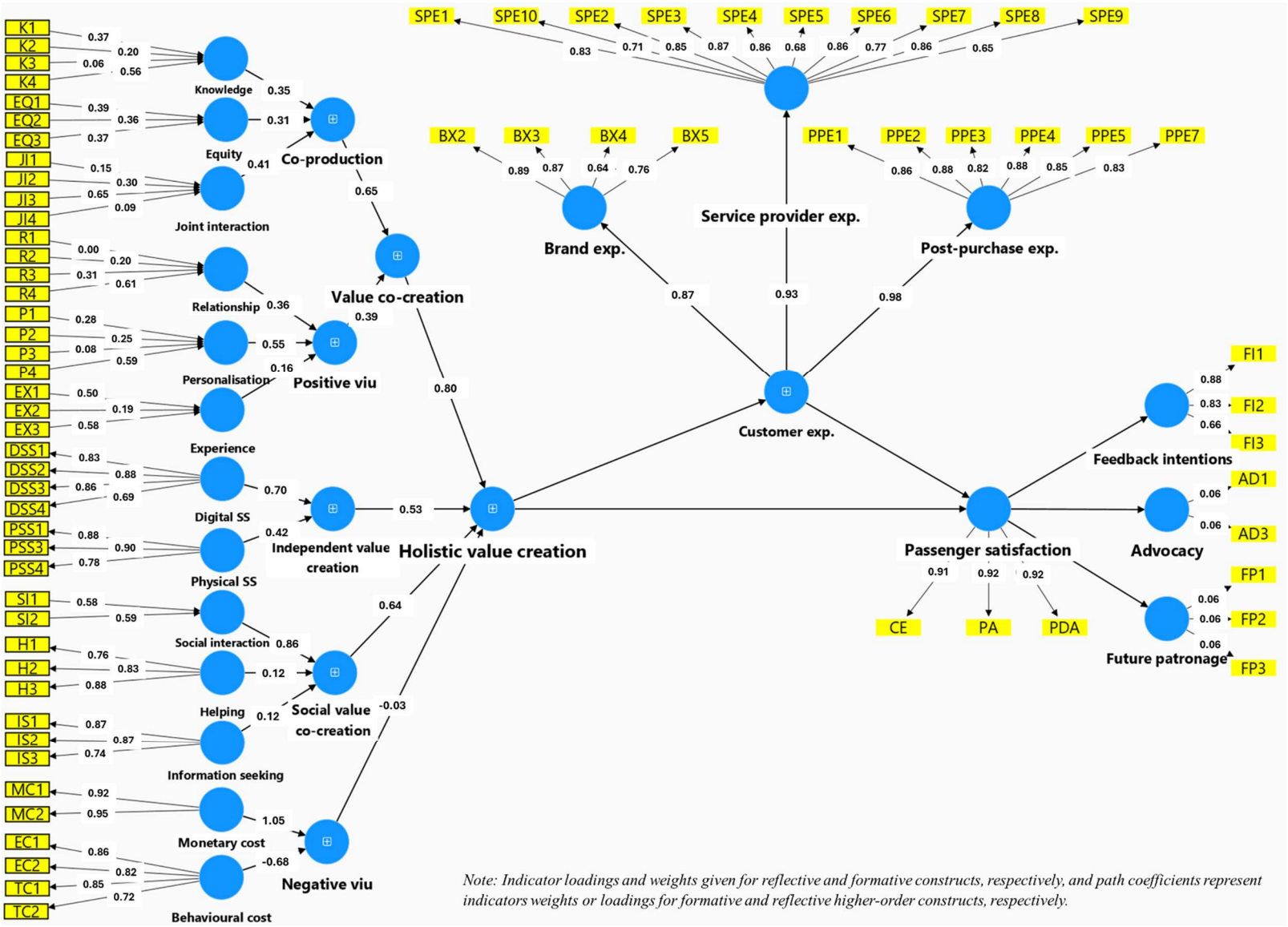
7.8.4 Summary of third-order formative measurement model

Next, the analysis summarised measurement models for third-order formative constructs, and then measurement models overall. Satisfactory measurement models were established for both holistic value creation and value co-creation, although possible collinearity was found for co-production and positive viu indicators (VIF < 5).

7.8.5 Final measurement model summary

In summary, satisfactory measurement models were established for first, second and third-order reflective and formative constructs, except for negative viu. Only co-production and positive viu showed possible but not serious collinearity issues (VIF < 5). A summary of measurement models, focusing on first, second and third-order constructs, is given bellow (Figure 41).

Figure 41. Summary of first, second and third-order measurement models



Note: Indicator loadings and weights given for reflective and formative constructs, respectively, and path coefficients represent indicators weights or loadings for formative and reflective higher-order constructs, respectively.

7.9 Part three: structural model analysis

7.9.1 Structural model analysis

Hair et al. (2019) recommends reviewing structural models in three phases, namely in terms of collinearity, the significance and relevance of structural relationships and the model's predictive power. Predictive power was assessed in terms of in-sample predictive power by reviewing coefficients of determination (R^2) and effect sizes (f^2) and out-of-sample predictive power using PLSpredict. Lastly, two robustness checks were performed by assessing for non-linearity and unobserved heterogeneity. Once measurement model invariance was established, a multi-group analysis was performed to compare different passenger groups.

7.9.2 Structural collinearity assessment

Inner model VIF values for all constructs showed no issues with collinearity (VIF < 3.3) (Table 74).

7.9.3 Significance and relevance of structural relationships

All path coefficients had non-normal distributions (Appendices 25–30) and were significant except for the path coefficient between holistic value creation and passenger satisfaction (Table 74). Hair et al. (2014) recommends interpreting direct effect sizes less than 0.15 to be weak effects, those between 0.15 and 0.35 to be moderate effects and those greater than 0.35 to be strong effects. The strongest direct effect was of value co-creation on holistic value creation ($f^2 = 1.739$), then the direct effect of holistic value creation on customer experience ($f^2 = 1.127$). The weakest direct effect was of passenger satisfaction on feedback intentions ($f^2 = 0.122$) (Table 74).

It is worth noting that during the two-stage approach indicator weights or loadings represent path coefficients from lower to higher-order constructs (Becker et al. 2012; Ringle et al. 2012). As such, indicator weights for co-production, positive viu, independent value creation, social value co-creation and negative viu were brought forward from the measurement model analysis to show their path coefficients and effect sizes. Effect sizes for holistic value creation indicators were calculated by omitting each indicator and calculating its contribution to the construct's R^2 value (Hair et al. 2014). Of these indicators, value co-creation ($f^2 = 1.739$) had a strong direct effect on holistic value creation, then social value co-creation ($f^2 = 0.395$) and independent value creation ($f^2 = 0.167$). Effect sizes could not be calculated for

co-production and positive viu as only two indicators were used to estimate value co-creation (Table 74).

Table 74. Structural analysis of path coefficients in terms of significance, collinearity and direct effect sizes

Construct Paths	Path coefficient	95% CI	Sig	VIF	f^2	Interpretation
Value co-creation → Holistic value creation (H1)	0.80	0.750; 0.831	Yes	1	1.74	Strong
Co-production → Value co-creation (H1a)	0.65*	0.503; 0.793	Yes	3.55	~	~
Positive viu → Value co-creation (H1b)	0.39*	0.233; 0.536	Yes	3.55	~	~
Independent value creation → Holistic value creation (H2)	0.53*	0.420; 0.637	Yes	1.67	0.17	Moderate
Social Value Co-Creation → Holistic value creation (H3)	0.64*	0.538; 0.747	Yes	2.47	0.40	Strong
Negative value-in-use → Holistic value creation (H4)	-0.03*	-0.119; 0.056	No	1.18	0	None
Holistic value creation → Customer experience (H5)	0.73	0.668; 0.775	Yes	1	1.13	Strong
Customer experience → Passenger satisfaction (H6)	0.67	0.562; 0.764	Yes	2.14	0.39	Strong
Passenger Satisfaction → Feedback Intentions (H8)	0.33	0.220; 0.430	Yes	1	0.12	Weak
Passenger satisfaction → Advocacy (H9)	0.67	0.594; 0.726	Yes	1	0.80	Strong
Passenger Satisfaction → Future patronage (H10)	0.38	0.289; 0.461	Yes	1	0.16	Moderate

Note: As indicator weights or loadings of lower-order constructs represent path coefficients to higher-order constructs during the two-stage approach. As only two indicators predicted value co-creation, effect sizes for co-production and positive viu were not calculated.*

For total effects overall, the total effect of value co-creation on holistic value creation was the strongest ($f^2 = 0.98$), then the total effect of holistic value creation on customer experience ($f^2 = 0.73$). The weakest total effect was of value co-creation on future patronage ($f^2 = 0.15$) and feedback intentions ($f^2 = 0.13$). There were other noteworthy total effects. Value co-creation held a strong total effect on customer experience ($f^2 = 0.58$) and passenger satisfaction ($f^2 = 0.40$), although customer experience held a stronger and larger total effect on passenger satisfaction ($f^2 = 0.67$). Regarding customer engagement behaviours, passenger

satisfaction held a moderate total effect on feedback intentions ($f^2 = 0.33$) and future patronage ($f^2 = 0.38$) and a strong total effect on advocacy ($f^2 = 0.67$) (Table 75).

For indirect effects, Ogbeibu et al. (2023) consider indirect effects between 0.01 and 0.04 to be small, those between 0.04 and 0.09 to be medium and those greater than 0.09 to be large. Value co-creation held the largest total indirect effect on customer experience ($v^2 = 0.34$), followed by the indirect effect of holistic value creation on passenger satisfaction ($v^2 = 0.23$). The smallest indirect effects were of value co-creation on future patronage ($v^2 = 0.02$) and feedback intentions ($v^2 = 0.02$) (Table 76).

Some other indirect effects are also important to note. Value co-creation ($v^2 = 0.02$) and holistic value creation ($v^2 = 0.03$) had small indirect effects on feedback intentions. In contrast, customer experience had a comparatively stronger medium indirect effect on feedback intentions ($v^2 = 0.05$). Value co-creation ($v^2 = 0.07$) and holistic value creation ($v^2 = 0.11$) had medium and large indirect effects on advocacy, respectively. In contrast, customer experience had a comparatively stronger and large indirect effect on advocacy ($v^2 = 0.19$). Value co-creation ($v^2 = 0.02$) and holistic value co-creation ($v^2 = 0.04$) had small indirect effects on future patronage. In contrast, customer experience had a comparatively stronger and medium indirect effect on future patronage ($v^2 = 0.06$) (Table 76).

Reviewing the specific indirect effects found no significant relationships between value co-creation, holistic value creation, passenger satisfaction and customer engagement constructs in the absence of customer experience (Table 77).

Considering the significant and positive weights of holistic value creation indicators and significant structural relationships is congruent with all hypotheses except H4 (Table 78 & Figure 42). Hypothesis H6 was subsequently examined via a mediator analysis. However, since Hair et al. (2019) advise comparing alternative conceptual models, definitive support for each hypothesis was given at the end of the analysis.

Table 75. Total effects found during structural analysis

Total Effects	f^2	Interpretation	t-statistic	95% CI
Value co-creation → Holistic value creation	0.797	Strong	40.683	0.750; 0.831
Holistic value creation → Customer experience	0.728	Strong	26.999	0.668; 0.775
Passenger satisfaction → Advocacy	0.666	Strong	20.004	0.594; 0.726
Customer experience → Passenger satisfaction	0.665	Strong	12.871	0.562; 0.764
Value co-creation → Customer experience	0.580	Strong	17.121	0.505; 0.641
Holistic value creation → Passenger satisfaction	0.503	Strong	12.643	0.413; 0.574
Customer experience → Advocacy	0.443	Strong	9.482	0.357; 0.538
Value co-creation → Passenger satisfaction	0.401	Strong	10.509	0.317; 0.468
Passenger satisfaction → Future patronage	0.378	Strong	8.76	0.289; 0.461
Holistic value creation → Advocacy	0.335	Moderate	9.309	0.260; 0.406
Passenger satisfaction → Feedback intentions	0.330	Moderate	6.209	0.220; 0.430
Value co-creation → Advocacy	0.267	Moderate	8.215	0.200; 0.330
Customer experience → Future patronage	0.251	Moderate	6.636	0.181; 0.332
Customer experience → Feedback intentions	0.220	Moderate	5.469	0.142; 0.301
Holistic value creation → Future patronage	0.190	Moderate	6.227	0.131; 0.250
Holistic value creation → Feedback intentions	0.166	Moderate	4.98	0.104; 0.234
Value co-creation → Future patronage	0.151	Moderate	5.728	0.102; 0.205
Value co-creation → Feedback intentions	0.132	Weak	4.652	0.080; 0.191

Table 76. Indirect effects found during structural analysis

Indirect Effect	v^2	Interpretation	t-statistic	95% CI
Value co-creation → Customer experience	0.34	Large	17.121	0.505; 0.641
Holistic value creation → Passenger satisfaction	0.23	Large	11.554	0.405; 0.572
Customer experience → Advocacy	0.19	Large	9.482	0.357; 0.538
Value co-creation → Passenger satisfaction	0.16	Large	10.509	0.317; 0.468
Holistic value creation → Advocacy	0.11	Large	9.309	0.260; 0.406
Value co-creation → Advocacy	0.07	Medium	8.215	0.200; 0.330
Customer experience → Future patronage	0.06	Medium	6.636	0.181; 0.332
Customer experience → Feedback intentions	0.05	Medium	5.469	0.142; 0.301
Holistic value creation → Future patronage	0.04	Small	6.227	0.131; 0.250
Holistic value creation → Feedback intentions	0.03	Small	4.98	0.104; 0.234
Value co-creation → Future patronage	0.02	Small	5.728	0.102; 0.205
Value co-creation → Feedback intentions	0.02	Small	4.652	0.080; 0.191

Table 77. Specific indirect effects found during structural analysis

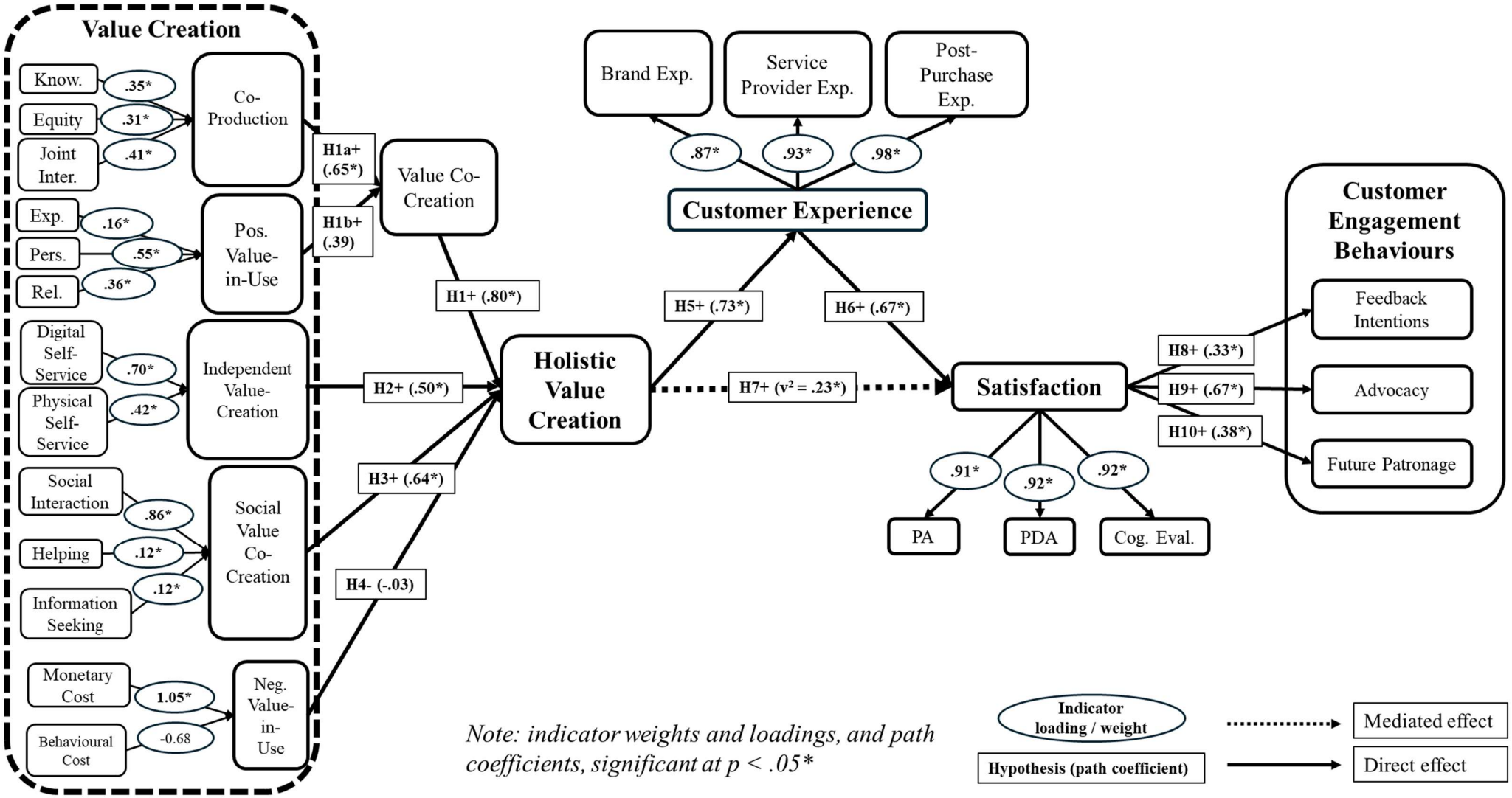
Specific indirect effects	v^2	Interpretation	t-statistic	95% CI
Value co-creation → Holistic value creation → Customer experience	0.339	Large	17.121	0.505; 0.641
Holistic value creation → Customer experience → Passenger satisfaction	0.232	Large	11.554	0.405; 0.572
Customer experience → Passenger satisfaction → Advocacy	0.194	Large	9.482	0.357; 0.538
Value co-creation → Holistic value creation → Customer experience → Passenger satisfaction	0.148	Large	10.409	0.317; 0.464
Holistic value creation → Customer experience → Passenger satisfaction → Advocacy	0.103	Large	8.723	0.256; 0.402
Value co-creation → Holistic value creation → Customer experience → Passenger satisfaction → Advocacy	0.066	Medium	8.072	0.200; 0.325
Customer experience → Passenger satisfaction → Future patronage	0.063	Medium	6.636	0.181; 0.332
Customer experience → Passenger satisfaction → Feedback intentions	0.048	Medium	5.469	0.142; 0.301
Holistic value creation → Customer experience → Passenger satisfaction → Future patronage	0.033	Small	6.165	0.129; 0.246
Holistic value creation → Customer experience → Passenger satisfaction → Feedback intentions	0.025	Small	5.077	0.101; 0.225
Value co-creation → Holistic value creation → Customer experience → Passenger satisfaction → Future patronage	0.021	Small	5.786	0.100; 0.201
Value co-creation → Holistic value creation → Customer experience → Passenger satisfaction → Feedback intentions	0.016	Small	4.798	0.078; 0.183
Holistic value creation → Passenger satisfaction → Advocacy	*< .001*	*None*	*0.341*	*-0.061; 0.084*
Holistic value creation → Passenger satisfaction → Future patronage	*< .001*	*None*	*0.343*	*-0.035; 0.048*
Value co-creation → Holistic value creation → Passenger satisfaction → Feedback intentions	*< .001*	*None*	*0.341*	*-0.024; 0.035*
Holistic value creation → Passenger satisfaction → Feedback intentions	*< .001*	*None*	*0.34*	*-0.030; 0.043*
Value co-creation → Holistic value creation → Passenger satisfaction → Future patronage	*< .001*	*None*	*0.335*	*-0.028; 0.039*
Value co-creation → Holistic value creation → Passenger satisfaction → Advocacy	*< .001*	*None*	*0.337*	*-0.048; 0.068*
Value co-creation → Holistic value creation → Passenger satisfaction	*< .001*	*None*	*0.332*	*-0.073; 0.102*

N.B. Non-significant relationships where customer experience is absent are denoted in italics. Significance interpreted using sign change rule.

Table 78. Summary of analysis at this stage with reference to hypotheses

Hypothesis	Results
H1: Value co-creation positively relates to holistic value creation	Value co-creation → holistic value creation (β = 0.80) with a large direct effect (f^2 = 1.808).
H1a: Co-production positively relates to value co-creation	Co-production has a significant weight (0.65) as an indicator of value co-creation.
H1b: Positive value-in-use positively relates to value co-creation	Positive viu has a significant weight (0.39) as an indicator of value co-creation
H2: Independent value creation during self-service positively relates to holistic value creation	Independent value creation has a significant weight (0.50) with a moderate effect size (f^2 = 0.108) as an indicator of holistic value creation
H3: Social value co-creation positively relates to holistic value creation	Social value co-creation has a significant weight (0.67) with a moderate effect size (f^2 = 0.412) as an indicator of holistic value creation
H4: Negative value-in-use negatively relates to holistic value creation	Negative viu has n.s weight (0.020, $p > .05$) with a no effect size ($f^2 < .002$) as an indicator of holistic value creation
H5: Holistic value creation positively relates to customer experience	Holistic value creation → customer experience (β = 0.73) with a large direct effect (f^2 = 0.855).
H6: Customer experience positively relates to passenger satisfaction	Customer experience → passenger satisfaction (β = 0.68) with a large direct effect (f^2 = 0.386).
H7: Holistic value creation positively relates to passenger satisfaction, mediated by customer experience	~
H8: Passenger satisfaction positively relates to feedback intentions	Passenger satisfaction → feedback intentions (β = 0.33) with a weak effect (f^2 = 0.122).
H9: Passenger satisfaction positively relates to advocacy	Passenger satisfaction → advocacy (β = 0.67) with a strong effect (f^2 = 0.797).
H10: Passenger satisfaction will positively relate to future patronage	Passenger satisfaction → future patronage (β = 0.38) with a moderate effect (f^2 = 0.167).

Figure 42. Conceptual model at current stage of analysis with structural relationships and measurement models



7.10 Mediator analysis

Mediators are a "variable that accounts for all or part of the relationship between a predictor and an outcome" (Baron & Kenny, 1986, p1176) and can be competitive or complementary (Hair et al. 2014). Zhao, Lynch and Chen's (2010) framework for mediator analysis was used to determine the extent to which H6 was supported. A significant and direct relationship was found between holistic value creation and customer experience (β = 0.73, CI: 0.672; 0.777) and between customer experience and passenger satisfaction (β = 0.67, CI: 0.622; 0.517) in line with H5 and H6 (Table 74). However, no significant direct relationship was found between holistic value creation and passenger satisfaction (β = 0.02, CI: -0.043; 0.188). Following Zhoa et al.'s (2010) framework, customer experience was identified as an indirect only mediator, suggesting that the presence of an omitted mediator was unlikely. At this stage of the analysis, the findings supported H6, with customer experience fully mediating the relationship between holistic value creation and passenger satisfaction. Definitive findings for the hypothesis are offered after model comparisons.

7.11 Predictive relevance

Predictive relevance was assessed in terms of in-sample predictive power (i.e. a model's explanatory power) and out-of-sample predictive power (i.e., a model's explanatory and predictive power) (Hair et al. 2019). Assessing in-sample predictive power involved using the entire dataset to estimate the model and predicting observations. In-sample predictive power is assessed in terms of coefficients of determination (R^2) and effect sizes of predictors (f^2). Hair et al. (2011) suggests marketing research interpret the coefficients of 0.25, 0.50 and 0.75 as weak, moderate, and substantial levels of predictive accuracy. Hair et al. (2014) have also recommended interpreting adjusted R^2 values to account for model complexity and sample size. Assessing out-of-sample predictive power involved using a training set to estimate the model during PLSPredict, which then estimated novel observations withheld from the training set (Hair et al. 2014).

7.11.1 In-sample predictive power

Holistic value creation had the highest and moderate coefficients of determination (R^2 = 0.617), then customer experience (R^2 = .533). Value co-creation (f^2 = 1.739) and holistic value creation (f^2 = 1.127) had the strongest effect sizes for these constructs. Future patronage (R^2 =

.143, $f^2 = 0.141$) and feedback intentions ($R^2 = .104$, $f^2 = 0.107$) held the lowest and weakest coefficients of determination and effect sizes, respectively. Only small differences were found between R^2 and adjusted R^2 values, suggesting model complexity and sample size did not overly inflate coefficients of determination (Table 79).

Table 79. Coefficient of determination (R^2) values for predicted constructs and effect sizes (f^2) of relationships, interpreted using Hair et al. (2019) thresholds

Constructs & path coefficients	R^2	Adj. R^2	R^2 Interpretation	f^2	f^2 Interpretation
Holistic value creation	0.617	0.616	Moderate		
Value co-creation → Holistic value creation				1.739	Strong
Holistic value creation → Passenger satisfaction				0	No effect
Holistic value creation → Customer experience				1.127	Strong
Customer experience	0.533	0.532	Moderate		
Customer experience → Passenger satisfaction				0.386	Strong
Passenger satisfaction	0.460	0.457	Weak		
Passenger satisfaction → Advocacy				0.797	Strong
Passenger satisfaction → Feedback intentions				0.122	Weak
Passenger satisfaction → Future patronage				0.167	Moderate
Feedback intentions	0.109	0.107	Weak		
Advocacy	0.444	0.442	Weak		
Future Patronage	0.143	0.141	Weak		

7.11.2 Out-of-sample predictive power

PLSPredict was used to assess out-of-sample predictive power. The approach has been recommended over blind-folding as it involves omitting entire cases, making it a true out-of-sample approach (Shmueli et al. 2019). PLSPredict relies on a k-fold validation process where datasets are typically divided into ten equally sized folds. Nine folds act as a training sample to estimate the model which then predicts values in the tenth fold (Shmueli et al. 2016). This is typically repeated five times and prediction errors are calculated by comparing predicted and actual values (Shmueli et al. 2019). These differences are used to calculate errors in terms of root-mean squared error of predictions (RMSE), mean absolute error (MAE), mean absolute percentage error (MAPE) and the Q^2 predict value. Q^2 predict values offer a naive benchmark, as mean indicator scores are used to predict holdout sample scores.

Q^2 predict values less than or equal to 0 suggest the model has less predictive power than using median indicator scores as predictors (i.e. the naive benchmark) (Hair et al. 2014).

In PLSPredict, the linear model (LM) calculates prediction errors by regressing all exogenous indicators onto endogenous indicators and offers a more rigorous benchmark to researchers. When prediction errors are less or more than LM prediction errors, the model has greater or lesser predictive power than this more rigorous benchmark (Hair et al. 2014). PLSPredict also reports CVPAT, which calculates the average loss difference for the model compared to both benchmarks. Average loss difference is interpreted in terms of "a higher loss impl[ying] a higher average prediction error, which indicates an inferior out-of-sample model performance" (Liengaard et al. 2021, p367).

Positive or negative average loss differences indicate the model outperforms or underperforms compared to a benchmark. Hair et al. (2014) have highlighted that researchers using PLSPredict must ensure training samples still hold adequate samples sizes for model estimation. Hair et al.'s (2011) ten-times rule and the minimum R^2 value (Kock and Hadya, 2016) recommend a minimum sample size of 240 and 137, respectively, for the structural model. As the training sample (N = 365) used in the training sample exceeds this minimum, Hair et al.'s (2014) recommendation was satisfied.

Histograms of path coefficients, errors of indicators and errors of latent variables were non-symmetrically distributed (Appendices 25 - 44). Thus, following Hair et al. (2014), MAE values were interpreted to compare the model against the naive and LM benchmark. Prediction summaries for indicators and latent variables showed the model had greater predictive relevance than the naive benchmark (Q^2) for all indicators and constructs, except negative viu. However, the model had a greater prediction error compared to the LM benchmark for all constructs except independent value creation and negative viu (Table 80). CVPAT showed the model had a significantly lower average loss difference compared to the naive benchmark (average loss difference = -0.321, $p < .001$) but a significantly higher average loss compared to the LM benchmark (average loss difference = 0.093, $p < .001$) (Table 81). Therefore, out-of-sample predictive power was established, as the model outperformed the naive benchmark. However, as only two indicators outperformed the LM benchmark, this predictive power was low.

Table 80. Indicator prediction & latent variable summary reported during PLSPredict

	Indicator PLSPredict			Latent Variable PLSPredict	
		PLS-SEM			
Construct	Q^2 predict	MAE	LM MAE	Q^2predict	MAE
Independent value creation	0.382	0.613	0.616		
Negative value-in-use	-0.012	0.825	0.826		
Social value co-creation	0.526	0.543	0.538		
Customer experience	0.683	0.463	0.365	0.681	0.465
Passenger satisfaction	0.396	0.629	0.566	0.397	0.630
Advocacy	0.320	0.655	0.477	0.320	0.656
Feedback intentions	0.119	0.738	0.634	0.119	0.739
Future patronage	0.093	0.776	0.755	0.093	0.777
Value creation				0.635	0.479

Table 81. CVPAT for average loss difference for constructs in contrast with indicator average and LM benchmarks

	PLS-SEM Vs Indicator Average			PLS-SEM Vs LM		
	Average loss difference	t value	p value	Average loss difference	t value	p value
Advocacy	-0.321	12.473	< .001	0.318	8.119	0.000
Customer experience	-0.684	14.206	< .001	0.089	6.355	0.000
Feedback intentions	-0.120	8.497	< .001	0.164	4.169	0.000
Future patronage	-0.093	6.264	< .001	0.070	2.634	0.009
Passenger satisfaction	-0.398	10.577	< .001	0.103	4.432	0.000
Holistic value creation	-0.316	9.384	< .001	-0.000	0.131	0.896
Overall	-0.321	13.126	< .001	0.093	8.449	0.000

7.11.3 Summary of predictive relevance

In summary, for in-sample predictive power the model had moderate to weak coefficients of determination values ($0.62 \geq R^2 \leq 0.11$) but generally a strong effect size ($1.74 \geq f^2 \leq 0.12$). Out-of-sample predictive power was established compared to the naive benchmark (Q^2) but was found to be low compared to the more rigorous LM benchmark.

7.12 Indicators of model quality

Research is contentious about using goodness of fit indices as indicators of model quality in PLS-SEM as distance-based measures (e.g. SRMR) assess discrepancies between expected and actual covariance matrices, which are inappropriate in PLS-SEM (Hair et al. 2019). As PLS-SEM focuses on the interaction between prediction and theory testing, research advocates for models to be assessed accordingly. Shmueli et al. (2016) propose assessing the quality of PLS-SEM models on three levels, namely the construct vs manifest level, in-sample vs out-sample cases and average case vs pairwise predictions.

At the manifest and construct level, predictive power was established compared to the naive benchmark, except for negative viu (Table 80). Moderate to weak coefficients of determination with generally strong effect sizes were found for in-sample predictive power (Table 79) and out-of-sample predictive power was established but only weakly. Lastly, CVPAT found all constructs to have significantly lower average loss differences compared to using average indicator scores (i.e. average cases) but not the LM model (i.e. pairwise predictions) (Table 81), partially satisfying this criterion. Overall, the model predominantly satisfied Shmueli et al.'s (2016) framework for assessing model quality in PLS-SEM.

7.13 Model comparisons

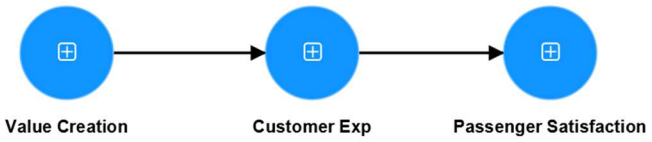
During SEM, researchers can compare alternative interpretations of their conceptual model in relation to prior research. As passenger satisfaction represents a regulatory metric in rail services (Transport Focus, 2020b) the analysis compared alternative conceptual models of value creation and customer experience, with respect to passenger satisfaction.

Prior research by De Keyser et al. (2015) conceptualises customer experience as antecedent to value creation, as value becomes actualised through value judgements, which themselves positively relate to passenger satisfaction in transport services (Gürler and Erturgut, 2018). Alternatively, Kuppelwieser et al. (2021) positions customer experience as consequential to value, and shows customer experience mediates the relationship between value and marketing outcomes for customers, which may include satisfaction as well.

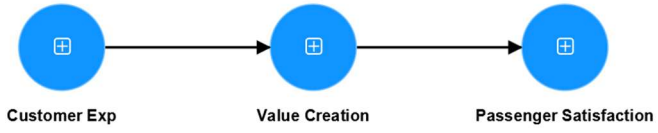
Conceptual research has also highlighted the cyclical and non-linear relationship between value creation and customer experience, with respect to marketing outcomes for customers (Akkeson et al. 2014; De Keyser et al. 2015; De Keyser et al. 2020). This leads the

analysis to also consider holistic value creation and customer experience, in tandem, as predictors of passenger satisfaction. The analysis compared the different relationships proposed by research, and customer experience as a direct-only mediator of the value-satisfaction relationship (1) represents the model proposed by current analysis (Figure 43).

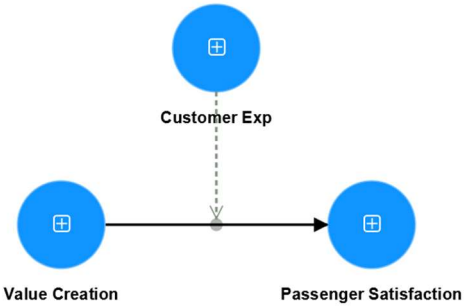
Figure 43. Comparisons of alternative conceptual orders for holistic value creation and customer experience in relation to passenger satisfaction



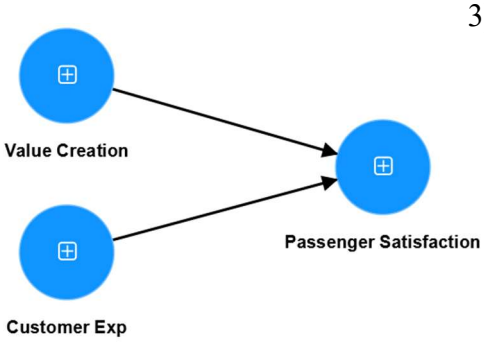
1) CX as direct-only relationship between VC and PS.



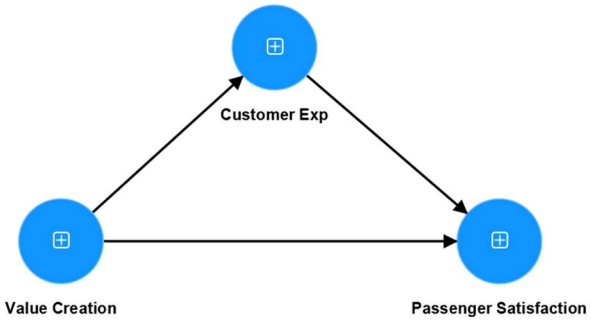
2) CX as predictor of VC.



3) CX as moderator of VC → PS.



4) CX and VC as predictors of PS.



5) CX as mediator of VC → PS.

These alternative approaches were assessed, and the thesis examined holistic value creation and customer experience in relation to passenger satisfaction. To compare models in PLS-SEM, Hair et al. (2019) recommends reviewing BIC values, whereby models with more negative BIC values are preferred over less negative ones. Additionally, R^2 values were considered to compare the in-sample predictive power of alternative models. Following Hair

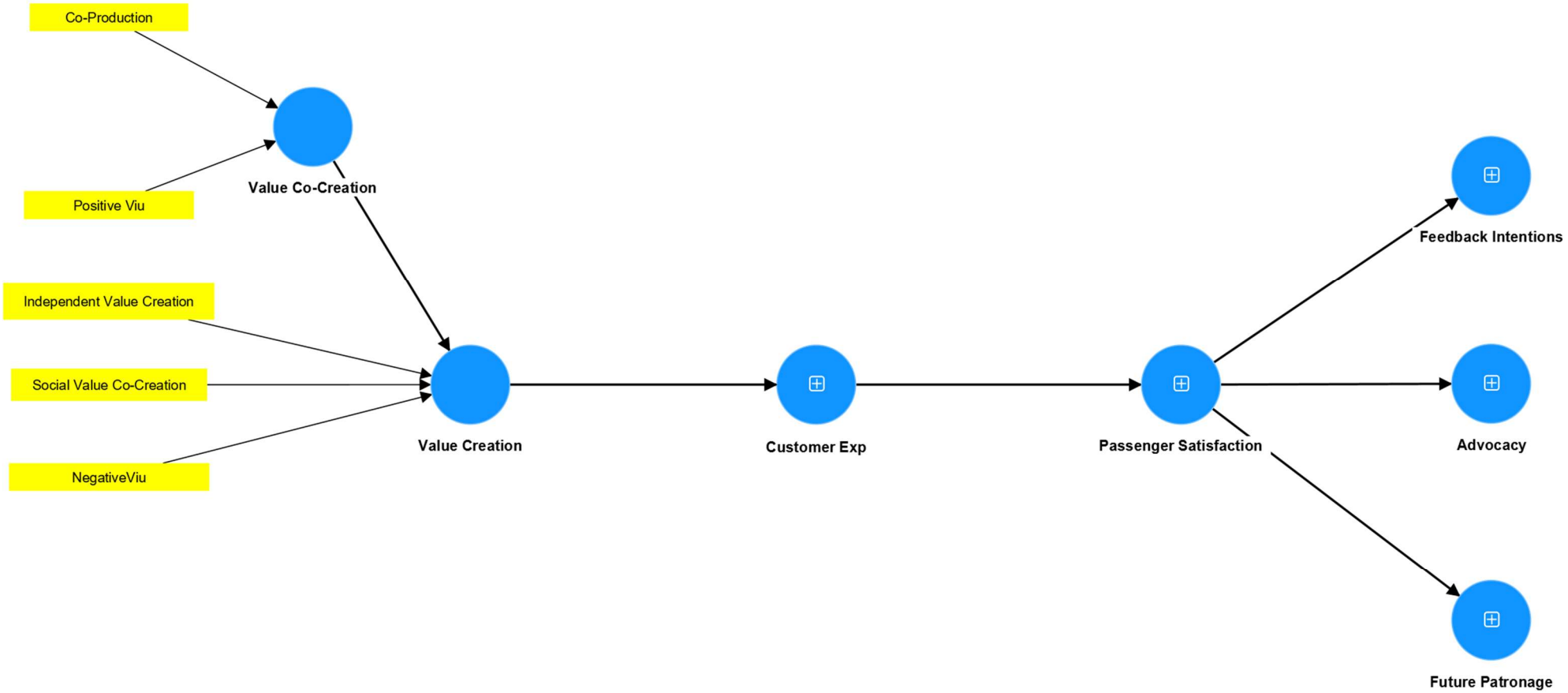
et al.'s (2019) recommendation to focus on core constructs when comparing models, BIC values for holistic value creation and passenger satisfaction were prioritised, as these represent the thesis's research focus and is a regulatory metric in the rail industry (Transport Focus, 2020b) respectively.

Across all models, holistic value creation and passenger satisfaction had the same R^2 values (0.46), except for Model 4 that had the lowest R^2 value (0.25) and worst BIC value for passenger satisfaction. As Model 1 had the best BIC value for both holistic value creation and passenger satisfaction, this was the preferred model (Table 82). This is congruent with the mediator analysis that found customer experience to be a direct-only full mediator of the relationship between holistic value creation and passenger satisfaction. Thus, this conceptualisation of the constructs was the preferred model (Figure 44).

Table 82. BIC and R^2 for all constructs and models

	1) CX with direct relationship		2) CX as predictor of VC		3) CX as moderator of VC → PS		4) CX & VC as predictors PS		5) CX as mediator of VC → PS	
	BIC	R^2	BIC	R^2	BIC	R^2	BIC	R^2	BIC	R^2
AD	-227.029	.44	-227.029	.44	-227.029	.44	-227.029	.44	-227.029	.44
FI	-35.835	.11	-35.835	.11	-35.835	.11	-35.835	.11	-295.393	.11
FP	-51.527	.14	-51.527	.14	-51.527	.14	-51.527	.14	-51.527	.14
PS	**-239.884**	**.46**	**-107.287**	**.25**	**-228.77**	**.46**	**-233.948**	**.46**	**-234.004**	**.46**
HVC	**-408.230**	**.64**	**-396.747**	**.64**	**-402.232**	**.64**	**-402.232**	**.64**	**-398.110**	**.64**
CX	-291.722	.53	-	-	-	-	-	-	-295.393	.53
VCC	-	-	-	-	-	-	-	-	-	-

Figure 44. Preferred model carried forward in the analysis, with customer experience as a direct-only mediator



7.14 Part four: robustness checks and multi-group analysis

This section focuses on robustness checks recommended by research when applying PLS-SEM (Hair et al. 2018) and a multi-group analysis to determine whether structural relationships in the model significantly differed between passenger groups. The purpose of the multi-group analysis was to support the commercial utility of the thesis. The multi-group analysis sought to identify significant differences between passenger groups, in terms of structural relationships in the model, to offer TfW insights on how to support these relationships with respect to the groups compared.

7.14.1 Structural model: robustness checks

The section began by performing the two robustness checks of assessing non-linearity between constructs and checking for unobserved heterogeneity in the dataset.

7.14.2 Non-linearity

To assess non-linearity, Hair et al. (2018) suggest reviewing scatterplots of latent variable scores in terms of structural relationships in the model. These scatterplots showed positive linear relationships between all constructs, indicated by positively sloped lines of best fit, except for the relationships between social value co-creation and negative viu as indicators of holistic value creation (Appendices 46–54). In these constructs, only weak linear relationships were found that did not suggest non-linearity.

7.14.3 Unobserved heterogeneity

Unobserved Heterogeneity represents heterogeneity in datasets that has not been captured by observed variables (Hair et al. 2018). FIMIX-PLS was used to identify unobserved heterogeneity in the analysis. FIMIX-PLS involves identifying homogeneous segments in datasets and Hair et al. (2018) note that these segments most likely represent a combination of observed variables. To begin FIMIX-PLS, the number of segments to initially retain must be determined by practical (e.g. relevance or plausibility) and statistical considerations (i.e. information and classification criteria). Sarstedt, Schwaiger and Ringle (2009) have highlighted that FIMIX-PLS is an exploratory technique and Hair et al. (2018) advises that segmentations should be based primarily on practical considerations. Considering demographic variables in the dataset suggested a solution of six potential segments (i.e. demographic categories), except for income that consisted of ten potential segments (income brackets).

For statistical considerations, Sarstedt et al. (2011) recommends examining AIC_3 and CAIC values, whilst also considering AIC and ICL-BIC values. Lower values reflected better measures for each criterion. Normed entropy (EN) values were also assessed, which measure segment partition quality and values greater than 0.5 indicate satisfactory segment partitions (Ringle, Sarstedt & Mooi, 2009). As ICL-BIC were not reported by PLS-SEM V4.03, only AIC_3 and AIC values were assessed. FIMIX-PLS found a 6-segment approach held the best AIC_3 and AIC values, although a 4-segment approach held the best CAIC value (Table 83). As both segment numbers had satisfactory EN values, a 6-segment approach was adopted on the basis of practical considerations. Reviewing each segment's percentage (

Table 84) compared to Regions Travelled (

Table 85) highlighted similarities, with both presenting two segments that contained the majority of observations. FIMIX-PLS also offers a discrete segment assignment function where observations are assigned to segments with their highest probability of group membership. Upon assignment, the analysis grouped observations assigned to segments 1 and 2 to Aggregated Segment 1, and observations assigned to segment 4 and 5 to Aggregated Segment 3.

These aggregated segments were compared to geographically aggregated Regions Travelled groups (e.g. South-East Wales and South-West Wales being grouped to South Wales) (

Table 86). Comparing percentages of these aggregated groups found only a 4.2% deviation on average (

Table 86). As previously stated, FIMIX-PLS offers an exploratory but not definitive approach to diagnosing unobserved heterogeneity. However, given the similarities between aggregated segments and aggregated regions travelled groups, the analysis included aggregated regions travelled in its multi-group analysis. Thus, the multi-group analysis included the aggregated regions of South Wales, Mid Wales, North Wales and Border Regions.

Table 83. Informational and Classification criteria values for one to six segment solutions

	Number of Segments					
Information Criteria	1	2	3	4	5	6
AIC (Akaike's information criterion)	5616.772	5362.97	4944.835	4876.481	4827.758	4801.99
AIC3 (modified AIC with Factor 3)	5628.772	5387.97	4982.835	4927.481	4891.758	4878.99
CAIC (consistent AIC)	5676.848	5488.129	5135.077	5131.805	5148.165	5187.479
EN (normed entropy statistic)	0	0.659	0.693	0.632	0.658	0.646

Table 84. Percentages of each segment for 6-segment solution reported by the FIMIX-PLS analysis

	Segment Number					
	1	2	3	4	5	6
%	28	26	16	14	13	4

Table 85. Percentages of Regions Travelled in Wales

	South-East Wales	South-West Wales	Mid-Wales	North-East Wales	North-West Wales	Border Region
%	35.2	19.0	15.0	10.6	8.4	11.8

Table 86. Comparisons of aggregated segments predicted by FIMIX-PLS and Aggregated Regions Travelled

	Segment Number					
	1	2	3	4	5	6
Aggregated Segment %	**54.0 (Segment 1 & 2)**		**16.0 (Segment 2)**	**27.0 (Segment 4 & 5)**		**4.0 (Segment 6)**
Regions Travelled	South-East Wales	South-West Wales	Mid-Wales	North-East Wales	North-West Wales	Wales or England border regions
Aggregated Segment %	**54.2 [South Wales]**		**15.0 [Mid-Wales]**	**19.0 [North Wales]**		**11.8 [Border Regions]**
% Difference	**0.2**		**1**	**8**		**7.8**
						$\bar{x}$ = 4.2%

7.15 Measurement model invariance

Before a multi-group analysis, researchers must establish measurement model invariance. This is done via the measurement of invariance in composite models (MICOM) procedure in terms of configural and compositional invariances, and equality of variances and means (Hensler, Ringle and Stardedt, 2016). Establishing configural invariance involved ensuring groups had the same indicators, data treatments (e.g. item coding) and data algorithms. Establishing compositional invariance involved ensuring composite construct scores do not significantly differ across groups, and that inter-group correlations do not significantly differ between their original and permutation correlations. Lastly, equality of variances and means was established when there are no significant differences between groups on these measures (Hensler et al. 2016).

Partial measurement invariance is established when both configural and compositional invariances are established and means standardised path coefficients can be compared. Full measurement invariance is established when all four criteria are satisfied and means that unstandardised path coefficients can be compared (Hair et al. 2018). The MICOM procedure was applied to the passenger groups of purpose of journey (i.e. leisure, commuter, business), Core Valley Lines (CVL) and Wales Border Crossing (WBC) passengers and aggregated regions travelled.

For purpose of journey groups, partial measurement invariance was established for customer experience, future patronage and value co-creation between leisure and commuter passengers. Between commuter and business passengers, partial measurement invariance was established for all constructs. Between leisure and business passengers, partial measurement invariance was established for all constructs except customer experience and feedback intentions. For CVL and WBC passengers, full measurement invariance was established for future patronage and passenger satisfaction. Partial measurement invariance was established for customer experience, advocacy and value co-creation. No measurement invariance was established for feedback intentions and holistic value creation between these groups.

For aggregated regions travelled groups, partial or full measurement model invariance was established between all groups except for feedback intentions. For feedback intentions, no measurement model invariance was established between South Wales and Mid Wales, between Mid Wales and Border Regions and between North Wales and Mid Wales (Table 87).

In review, the MICOM proceedure established atleast partial measurement invariance for the majority of constructs in the model for most of the groups compared (Table 87). This meant the analysis could compare groups on the relationship between two constructs, when atleast partial invariance was established for both constructs. For example, the analysis could compare the satisfaction-advocacy relationship between South and North Wales passengers, as partial invariance was established for both constructs between these groups. However, the analysis could not compare the satisfaction-feedback intentions relationship between leisure and business passengers, as no measurement invariance was established for feedback intentions between these groups (Table 87).

Table 87. Summary of extent to which measurement model invariance established between purpose of journey, CVL vs WBC and aggregated regions travelled groups

Construct	No / Partial / Full Measurement Invariance									
	L Vs C	C Vs B	L Vs B	CVL Vs WBC	S Vs M	S Vs N	S Vs B	N Vs B	M Vs B	N Vs M
Customer experience	P	P	No	P	F	P	P	F	F	F
Advocacy	No	P	P	P	P	P	P	F	F	F
Feedback intentions	No	P	No	No	No	P	P	F	No	No
Future patronage	P	P	P	F	F	F	P	F	F	F
Passenger satisfaction	No	P	P	F	P	P	P	F	F	F
Value co-creation	P	P	P	P	P	P	P	F	F	F
Holistic value creation	No	P	P	No	P	P	P	F	P	F

Notes: L = Leisure, C = Commuter, B = Business, CVL = Core Valley Lines, WBC = Wales Border Crossing, S = South Wales, M = Mid Wales, B = Border Regions and N = North Wales. P denotes partial measurement invariance established. F denotes full measurement invariance established. No denotes no measurement invariance established.

7.16 Multi-group analysis

Hair et al. (2018) suggests using MGA-PLS to compare groups over permutation bootstrapping when group sizes differ by more than double. As groups sizes for leisure (N = 292), commuter (N = 81), business (N = 33), CVL (N = 173), WBC (N = 233), South Wales (N = 220), Mid Wales (N = 61), North Wales (N = 77) and Border Regions (N = 48) often differed by more than double for their respective categories, MGA-PLS was used. The analysis only assessed MGA-PLS results for constructs where at least partial measurement invariance was established. Due to the length of the multi-group analysis, only findings showing significant differences were reported. Non-significant differences were reported in the appendices (Appendix 55).

7.16.1 Purpose of journey

For leisure and commuter passengers, no significant differences were found for indicator loadings or weights for constructs (customer experience, future patronage and value co-creation) that could be compared validly. For commuter and business passengers, only independent value creation showed a significantly higher loading in business (0.935) than commuter passengers (0.735). For leisure and business passengers, only value co-creation related significantly more to holistic value creation ($p < .001$) in business ($\beta = 0.938$) than leisure passengers ($\beta = 0.763$). Comparing total indirect effects, value co-creation related significantly more to customer experience in business ($v^2 = 0.815$) than leisure passengers ($v^2 = 0.519$). Value co-creation also related significantly more to passenger satisfaction in business ($v^2 = 0.608$) than leisure passengers ($v^2 = 0.344$) (Table 88). Independent value creation ($p = .042$), negative viu ($p = .045$) and social value co-creation ($p = .009$) also had significantly higher loadings in business than leisure passengers (Table 88).

7.16.2 CVL Vs WBC

For CVL and WBC passengers, no significant differences were found for any comparisons, except for positive viu ($p = .05$) which had a significantly higher weighting in WBC (weight = .507) than CVL passengers (weight = .218) for conceptualising holistic value creation (Table 88).

7.16.3 Aggregated regions travelled

No significant differences were found between South Wales and Mid Wales passengers or between South Wales and North Wales passengers. Between South Wales and Border Region

passengers, only social value co-creation had a significantly higher indicator loading ($p = 0.029$) for Border Region (0.958) than South Wales (0.851) (Table 88). Between North Wales and Border Region passengers, only indicator loadings of customer experience significantly differed ($p < .05$) albeit negligibly (Table 88). Between Mid Wales and Border Region passengers, no significant differences were found. Between North Wales and Mid Wales passengers, only indicator loadings of customer experience and passenger satisfaction differed significantly ($p < .05$), albeit negligibly (Table 88).

.

Table 88. MGA Analysis showing significant differences between purpose of journey, CVL Vs WBC and aggregated regions travelled groups

Group Comparisons		Difference	p. value (2-tailed)	Result
Purpose of Journey Comparisons				
Commuter Vs Business Indicator loadings				
Independent value creation → Holistic value creation	Commuter – Business	-0.2	0.015	Independent value creation showed a significantly higher loading in business (0.935) than commuter passengers (0.735)
Leisure - Business (Path Coefficient)				
Value co-creation → Holistic value creation	Leisure – Business	-0.175	0	Value co-creation related significantly more to holistic value creation ($p < .001$) in business ($\beta = 0.938$) than leisure passengers ($\beta = 0.763$)
Leisure vs Business (total indirect effects)				
Value co-creation → Passenger satisfaction	Leisure – Business	-0.263	0.02	Value co-creation also related significantly more to passenger satisfaction in business ($v^2 = 0.608$) than leisure passengers ($v^2 = 0.344$)
Leisure vs. Business (loadings)				
Independent value creation → Holistic value creation	Leisure – Business	-0.123	0.042	Independent value creation, negative viu and social value co-creation had significantly higher loadings in business than leisure passengers
Negative viu → Holistic value creation	Leisure – Business	-0.376	0.045	
Social value co-creation → Holistic value creation	Leisure – Business	-0.127	0.009	
CVL VS WBC (weights)				
Positive Viu → Value co-creation	CVL – WBC	-0.289	0.05	Positive viu ($p = .05$) had a significantly higher weighting in WBC (weight = .507) than CVL passengers (weight = .218)
Aggregate Regions Travelled Comparisons				
SW Vs BR (loadings)				

Group Comparisons		Difference	p. value (2-tailed)	Result
Social value co-creation → Holistic value creation	South Wales – Border Region	-0.108	0.029	Social value co-creation had a significantly higher indicator loading (p = 0.029) for Border Region (0.958) than South Wales (0.851)
NW Vs BR (loadings)				
Higher order construct (customer experience) ← customer experience	North Wales – Border Region	0	0.027	Indicator loadings of customer experience and passenger satisfaction (p < .05) significantly differed, although this difference was negligible
Higher order construct passenger satisfaction ← passenger satisfaction	North Wales – Border Region	0	0.044	
NW Vs MW (loadings)				
Higher order construct (customer experience) ← customer experience	North Wales – Mid Wales	0	0.037	Indicator loadings of customer experience and passenger satisfaction (p < .05) significantly differed, although this difference was negligible
Higher order construct passenger satisfaction ← passenger satisfaction	North Wales – Mid Wales	0	0.047	

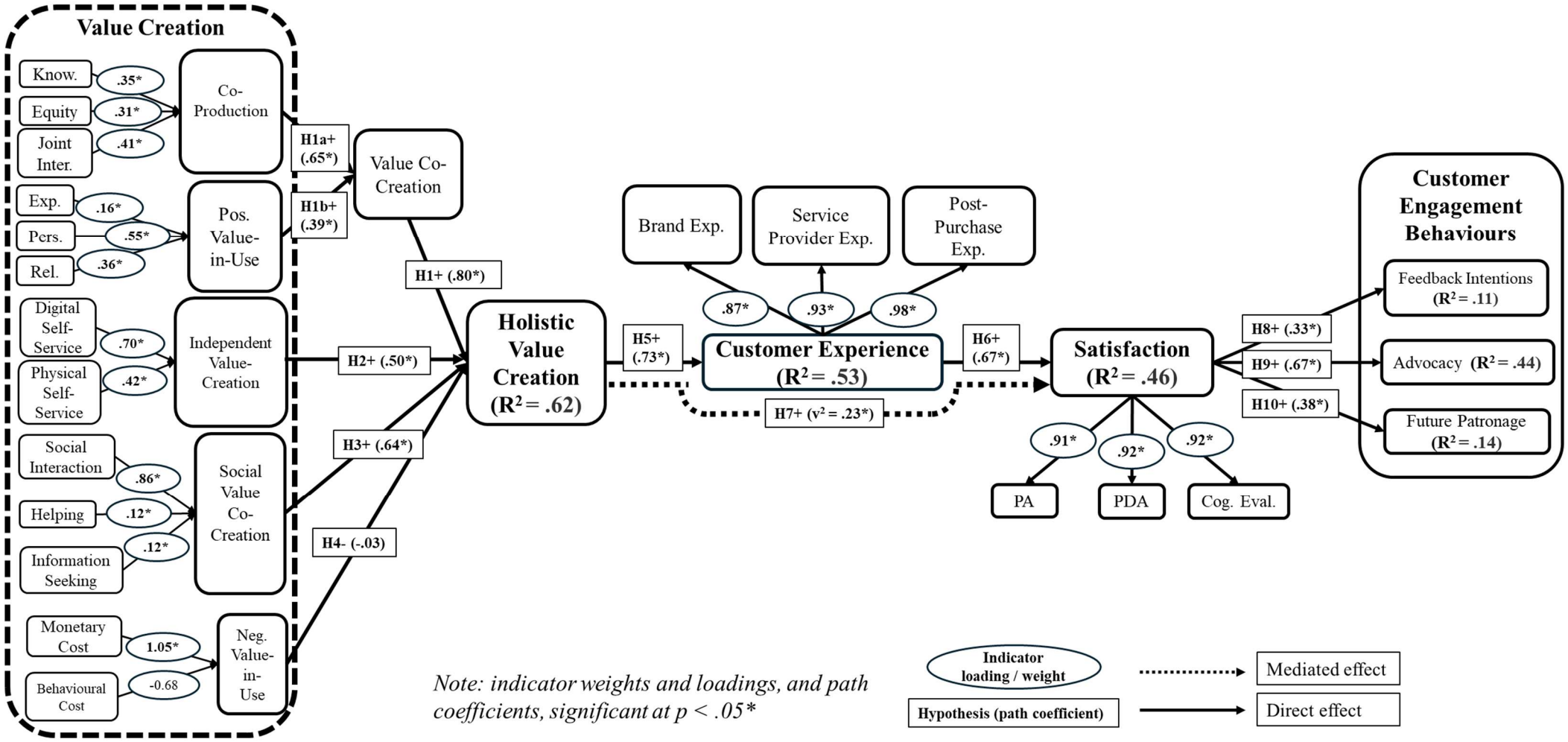
7.17 Summary of analysis & conclusion

CTA results generally agreed with conceptual assumptions for formative and reflective constructs. Satisfactory measurement models were established for first, second and third-order constructs, with indicators of value co-creation showing possible but not severe multicollinearity (5 >VIF < 3.3). The preferred model found structural relationships supported all hypotheses, except H4. A mediator analysis supported the hypothesis H6, showing customer experience fully mediated the relationship between holistic value creation and passenger satisfaction (Table 89 & Figure 45). No structural collinearity issues were found in the structural model. The model held weak to moderate explanatory power, with predominantly strong effect sizes, and out-of-sample predictive power was established but was low. Following guidelines for assessing model quality in PLS-SEM, the model showed good model quality.

Table 89. Summary of hypotheses conclusions using preferred model to estimate structural relationships

Hypothesis	Results
H1: Value co-creation positively relates to holistic value creation	Value co-creation → holistic value creation (β = 0.80) with a large direct effect (f^2 = 1.808). [supported]
H1a: Co-production positively relates to value co-creation	Co-production has a significant weight (0.65) as an indicator of value co-creation. [supported]
H1b: Positive value-in-use positively relates to value co-creation	Positive viu has a significant weight (0.39) as an indicator of value co-creation [supported]
H2: Independent value creation during self-service positively relates to holistic value creation	Independent value creation has a significant weight (0.50) with a moderate effect size (f^2 = 0.108) as an indicator of holistic value creation [supported]
H3: Social value co-creation positively relates to holistic value creation	Social value co-creation has a significant weight (0.64) with a moderate effect size (f^2 = 0.412) as an indicator of holistic value creation [supported]
H4: Negative value-in-use negatively relates to holistic value creation	Negative viu has n.s weight (0.03, p > .05) with a no effect size (f^2 < .002) as an indicator of holistic value creation [not supported]
H5: Holistic value creation positively relates to customer experience	Holistic value creation → customer experience (β = 0.73) with a large direct effect (f^2 = 0.855). [supported]
H6: Customer experience positively relates to passenger satisfaction	Customer experience → passenger satisfaction (β = 0.68) with a large direct effect (f^2 = 0.386). [supported]
H7: Holistic value creation positively relates to passenger satisfaction, mediated by customer experience	Holistic value creation → passenger satisfaction with a large specific indirect effect size (v^2 = 0.232) fully mediated by customer experience, suggesting the presence of an omitted indicator was unlikely [supported]
H8: Passenger satisfaction positively relates to feedback intentions	Passenger satisfaction → feedback intentions (β = 0.33) with a weak effect (f^2 = 0.122). [supported]
H9: Passenger satisfaction positively relates to advocacy	Passenger satisfaction → advocacy (β = 0.67) with a strong effect (f^2 = 0.797). [supported]
H10: Passenger satisfaction will positively relate to future patronage	Passenger satisfaction → future patronage (β = 0.38) with a moderate effect (f^2 = 0.167). [Supported]

Figure 45. Final model in analysis



*Note: indicator weights and loadings, and path coefficients, significant at p < .05**

Model comparisons found customer experience, positioned as a direct-only mediator, to be the preferred model by the analysis. Robustness checks found no non-linearity and assessing for unobserved heterogeneity highlighted Aggregated Regions Travelled as a novel demographic variable. This was subsequently included to the multi-group analysis. Measurement invariance was established for most groups compared and for most constructs in the model (Table 87). Between leisure, commuter and business passengers, significant differences were found between value co-creation and holistic value creation, and for some indicator loadings and weights. Between WBC and CVL passengers, positive viu held a significantly higher loading in WBC than CVL passengers. Between Aggregated Regions Travelled groups, only the loading of social value co-creation was significantly higher in Border Region than South Wales passengers (Table 88).

Next, Chapter 8 will discuss these results and contextualise them within existing research.

Chapter Eight - Discussion

Chapter Eight - Discussion

8.1 Introduction

This chapter will discuss the results in Chapter 7 in the context of the literature reviewed in Chapters 2, 3 and 4. The discussion comprises four sections. First, it reviews the thesis's hypotheses and summarises its findings. Second, the discussion focuses on findings for value creation processes and holistic value creation (i.e., H1 – H4). The third focuses on the relationship between holistic value creation, customer experience and passenger satisfaction (i.e. H5 – H7). The fourth discusses findings for the satisfaction-engagement (i.e. H8 – H10) and value-engagement relationships.

8.1.2 Discussion of results

All value creation processes significantly contribute to holistic value creation, supporting H1 to H3, except for negative value-in-use (H4). Value co-creation (weighting = 0.80, $f^2 = 1.74$) is the strongest contributor to holistic value creation, then social value co-creation (weighting = 0.64, $f^2 = 0.40$) and independent value creation (weighting = 0.50, $f^2 = 0.17$). Negative value-in-use does not significantly contribute to holistic value creation (weighting = 0.03, $p = 0.331$, $f^2 < 0.01$). Non-response bias is present for indicators of feedback intentions, advocacy and future patronage, and some select indicators (Table 41), which may be attributable to the small number of rail strikes at the end of main data collection. No potential multi-collinearity issues are present in the model, except for between co-production and positive value-in-use which shows possible multi-collinearity issues (VIF = 3.5). Indicators explain 64% of variation in holistic value creation.

For the value-satisfaction relationship, holistic value creation significantly relates to customer experience ($\beta = 0.73$), which significantly relates to passenger satisfaction ($\beta = 0.68$) supporting H5 and H6. Holistic value creation only significantly relates to passenger satisfaction via full mediation by customer experience ($v^2 = 0.23$), supporting H7. For satisfaction-engagement relationships, the findings support H8, H9 and H10, with passenger satisfaction most strongly relating to advocacy ($\beta = 0.67$), then future patronage ($\beta = 0.38$)

and feedback intentions (β = 0.33). Passenger satisfaction explains 44%, 14% and 11% of variance in advocacy, future patronage and feedback intentions, respectively.

Notable specific indirect effects are as follows. Value co-creation holds a strong indirect effect on customer experience ($v^2 = 0.34$) and customer experience more strongly relates to passenger satisfaction ($f^2 = 0.67$) than either value co-creation ($f^2 = 0.40$) and holistic value creation ($f^2 = 0.50$). Customer experience more strongly relates to all three engagement behaviours ($0.05 \geq v^2 \leq 0.19$) than value co-creation and holistic value creation ($0.02 \geq v^2 \leq 0.07$). Customer experience holds a medium indirect effect on feedback intentions ($v^2 = 0.05$), in contrast with value co-creation and holistic value creation, which only hold a small indirect effect on the construct ($v^2 = 0.02$). The specific indirect effects highlight a trend in the value-engagement relationship to be stronger for advocacy, in contrast with feedback intentions and future patronage. In these relationships, value co-creation, holistic value creation and customer experience more strongly relate to advocacy ($0.07 \geq v^2 \leq 0.19$) than feedback intentions ($0.02 \geq v^2 \leq 0.05$) and future patronage ($0.02 \geq v^2 \leq 0.06$).

Overall, the model shows moderate to low in-sample predictive power ($0.62 \geq R^2 \leq 0.11$) but generally a strong effect size ($1.74 \geq f^2 \leq 0.12$) and the analysis establishes its out-of-sample predictive power but only weakly. Model comparisons show that customer experience, as a direct only mediator, represents the dataset best with respect to holistic value creation, customer experience and passenger satisfaction. A multi-group analysis shows minor but significant differences for indicator weights, loadings and some structural relationships between passenger demographics. These comparisons are made where either partial or full measurement model invariance is present. Overall, the findings support all hypotheses, except H4 (Table 90), and the findings were largely congruent with marketing and public transport research (Table 91).

Table 90. Summary of results for relationships in the final models

Hypothesis number and path description		Supported
H1 (+)	Value co-creation → Holistic value creation	Yes
H1a (+)	Co-production → Value co-creation	Yes
H1b (+)	Positive value-in-use → Value co-creation	Yes
H2 (+)	Independent value creation → Holistic value creation	Yes
H3 (+)	Social value co-creation → Holistic value creation	Yes
H4 (-)	Negative value-in-use → Holistic value creation	No
H5 (+)	Holistic value creation → Customer experience	Yes
H6 (+)	Customer experience → Passenger satisfaction	Yes
H7 (+)	Holistic value creation → Customer experience → Passenger satisfaction	Yes
H8 (+)	Passenger satisfaction → Feedback intentions	Yes
H9 (+)	Passenger satisfaction → Advocacy	Yes
H10 (+)	Passenger satisfaction → Future patronage	Yes

Table 91. Summary of findings with respect to marketing and public transport research

Hypothesis	Assessment	Congruency with research	
		Marketing	Public transport
H1: Value co-creation positively relates to holistic value creation	➢ Strongest contributor to holistic value creation with large effect size ($\beta = 0.80$, $f^2 = 1.81$)	• Value co-creation overlaps with customers' value creation sphere (Grönroos and Voima, 2013) • Drives customers' value creation (Grönroos, 2017) - Service logic)	• Value co-creation contributes to passengers' value creation (Gebauer et al. 2010; Echeverri and Skålén, 2011)
H1a: Co-production positively relates to value co-creation	➢ Strongest contributor to value co-creation in public transport ➢ Joint interaction (0.41) strongest contributor, then knowledge (0.35) and equity (0.31)	• Congruent with SDL as co-production positively contributes to value co-creation • Incongruent with 1st-order indicator weights (Ranjan and Read, 2014) - SDL	• Interaction practice of delivery contributes to value co-creation in public transport (Echeverri and Skålén, 2011)
H1b: Positive value-in-use positively relates to value co-creation	➢ Weaker contributor to value co-creation in public transport ➢ Personalisation (0.55) strongest contributor, then relationship (0.36) and experience (0.16)	• Positive viu positively contributes to value co-creation - SDL • Incongruent with 1st-order indicator weights (Ranjan and Read, 2014) - SDL	• Customizable travel experiences highlighted to support passengers' value creation (Lu et al. 2015) • Low weighting of experience congruent with passengers' ideal journey experience that is automatic (Stradling et al. 2007)
H2: Independent value creation during self-service positively relates to holistic value creation	➢ 3rd strongest contributor to holistic value creation with moderate effect size (weight = 0.50, $f^2 = 0.11$) ➢ Value from digital self-service (0.70) stronger than physical self-service (0.42)	• Lone resource use contributes to customers' value creation sphere (Grönroos and Voima, 2013) – Service logic • Technological drivers consistently support value creation and experiences from self-service (Akkeson et al. 2014) - SDL	• Value from self-service contributes to passengers' value creation in public transport (Lu et al. 2015) • Digital self-service plays an important role in passengers' value creation (Gebauer et al. 2010; Lu et al. 2015)
H3: Social value co-creation positively relates to holistic value creation	➢ 2nd strongest contributor to holistic value creation, with moderate effect size (weight = 0.64, $f^2 = 0.41$)	• Focal customers' value creation includes social interactions (Grönroos and Gummerus, 2014) – Service logic • Public and instrumental interactions, supporting knowledge exchanges, drive social value co-creation (Heinonen et al. 2018; Rihova et al. 2018) - CDL	• TOCs should consider C2C interactions during service processes (Gebauer et al. 2010; Hildén et al. 2018) • Transport providers should also consider passengers' prosocial attitudes during value creation (Carreria et al. 2013; Reichenberger, 2017)

Hypothesis	Assessment	Congruency with research	
		Marketing	Public transport
H4: Negative value-in-use negatively relates to holistic value creation	➢ N.S contributor to holistic value creation	• Incongruent with sacrifices diminishing customers' value creation (Sweeney et al. 2018; Medberg and Grönroos, 2020) – Service logic	• Incongruent with passenger sacrifices negatively relating to percieved value (Tam, 2004; Sumaedi et al. 2012)
H5: Holistic value creation positively relates to customer experience	➢ Holistic value creation relates to customer experience, with large effect size ($\beta = 0.73$, $f^2 = 0.86$)	• Lower-order processes contribute to brand, service provider and post-purchase experiences (Lemon and Verhoef; 2016; Nysveen et al. 2012; Solakis et al. 2021)	• Lower-order processes contribute to passengers' service experiences at each journey stage (Gebauer et al. 2010; Lu et al. 2015)
H6: Customer experience positively relates to passenger satisfaction	➢ Customer experience relates to passenger satisfaction, with large effect size ($\beta = 0.68$, $f^2 = 0.39$)	• Experience stages, and customer experience overall, contribute to satisfaction (Ekinci and Dawes, 2008; Chen et al. 2013, Cheng et al. 2018; Solakis et al. 2021)	• Passengers' experience stages, and service experience overall, positively contributes to passenger satisfaction (Ibrahim et al. 2020; Ittamalla and Kumar, 2021)
H7: Holistic value creation positively relates to passenger satisfaction, mediated by customer experience	➢ Holistic value creation positively relates to passenger satisfaction, fully mediated by customer experience, with a large specific indirect effect size ($v^2 = 0.232$)	• Customer experience partially mediates the relationship between value constructs and marketing outcomes (Kuppelwieser et al. 2021; Solakis et al. 2021)	• Incongruent with research proposing a direct relationship between percieved value and passenger satisfaction (Gürler and Ertgurgut, 2018) • Congruent with research highlighting lower-order value creation processes relate to passenger satisfaction via passengers' experiences at each service stage (Gebauer et al. 2010; Lu et al. 2015; Ittamalla and Kumar, 2021
H8: Passenger satisfaction positively relates to feedback intentions	➢ Passenger satisfaction relates to feedback intentions, with a weak effect size ($\beta = 0.33$, $f^2 = 0.122$)	• In line with prior research (Söderlund, 1998; Verleye et al. 2013)	• Incongruent with public transport research that shows a weaker relationship (Saha and Theingi, 2009)
H9: Passenger satisfaction positively relates to advocacy	➢ Passenger satisfaction relates to advocacy, with a strong effect size ($\beta = 0.67$, $f^2 = 0.797$)	• Similar to research showing a positive relationship between satisfaction and advocacy behaviours (Stoke and Lomax, 2002; Babin et al. 2005)	• In line with research showing a similar satisfaction-WoM relationship in transport services (Gürler and Ertgurgut, 2018)

Hypothesis	Assessment	Congruency with research	
		Marketing	Public transport
H10: Passenger satisfaction will positively relate to future patronage	➢ Passenger satisfaction relates to future patronage, with a moderate effect size ($\beta = 0.38$, $f^2 = 0.167$)	• Similar relationship to research on satisfaction-behavioural loyalty relationship (Fen and Liam, 2004 Roy, 2013; Chen and Chen, 2010)	• Congruent with general trend in public transport research using service quality (Saha and Theingi 2009; Wu et al. 2011) • Incongruent with public transport research using theory of mind (Fu and Juan, 2016) and para-transit travel (Sumaedi et al. 2012)
Additional findings			
Satisfaction-engagement relationship	➢ Satisfaction-engagement relationship stronger for behaviours facing social actors (i.e., advocacy) than TOCs (i.e., feedback intentions and future patronage)	~	• Customer engagement behaviours distinguished in terms of facing social actors / stakeholders and TOCs (Alexander and Jaakkola, 2014)
Value-engagement relationship	➢ Customer experience, rather than satisfaction, plays an important role in the value-engagement relationship ➢ Customer experience relates more strongly to engagement behaviours ($0.05 \leq v^2 \geq 0.19$) than holistic value creation and value co-creation ($0.02 \leq v^2 \geq 0.11$) ➢ Value-engagement relationship stronger for behaviours facing	• Customer experience, rather than customer satisfaction, should be considered as a key pillar of marketing strategy (Imhof et al. 2019)	~

Note. ~ denotes findings that to the best of the authors knowledge have not been examined by research

8.2 Holistic value creation and value creation processes

This section discusses the findings for holistic value creation and its underlying processes. Overall, value creation processes predict 64% of variation in holistic value creation. The finding is congruent with research proposing the construct encapsulates all other value creation processes in the customers' value sphere (Grönroos and Voima, 2013; Grönroos, 2017) but is incongruent with research which holds that negative value-in-use negatively contributes to customers' value creation (Plewa et al. 2015; Sweeney et al. 2018; Medberg and Grönroos, 2020).

For the relative strength of processes, value co-creation is the strongest contributor to holistic value creation, then social value co-creation and independent value creation. Prior services marketing research on value creation strongly focuses on value co-creation (Grönroos, 2017; Medberg and Grönroos, 2020) and the findings justify this focus in the wider value creation landscape. However, the findings also emphasise that social value co-creation and independent value creation significantly contribute to holistic value creation. In the wider context of value creation research, these receive less attention by comparison (Rihova et al. 2018; Heinonen et al. 2018; Pandey and Kumar, 2020; Pandey and Kumar, 2021).

8.2.1 Value co-creation

This thesis posits that value co-creation positively relates to holistic value creation:

H1: Value co-creation positively relates to holistic value creation (Supported)

The findings support H1, as value co-creation positively relates to holistic value creation with a strong effect size ($f^2 = 1.74$). The finding is congruent with research that conceptualises value co-creation as driving value creation for customers (Grönroos and Voima, 2013; Grönroos, 2017) although research has yet to empirically examine its relative contribution. The findings show that value co-creation forms the strongest contributor to holistic value creation. Furthermore, the findings show that co-production (weighting = 0.65) contributes more to value co-creation in public transport than positive value-in-use (weighting = 0.39).

8.2.2 Co-production

The thesis proposes that co-production positively relates to value co-creation:

H1a: Co-production positively relates to value co-creation (Supported)

The findings support H1a, as co-production positively relates to value co-creation. The finding is congruent with conceptual research emphasising customers must learn to use and amend value offerings during co-creation (Vargo and Lusch, 2004) and empirical research showing a similar strength relationship between the constructs (Ranjan and Read, 2014). Additionally, this finding is congruent with empirical public transport research that highlights the interaction practice of delivery, which matches the definition of co-production (Vargo and Lusch, 2004) positively contributes to value co-creation in public transport (Echeverri and Skålén, 2011). Considering the relative contributions of knowledge, equity and joint interaction to co-production, the findings are congruent with Ranjan and Read's (2014) research showing that all sub-dimensions offer significant contributions.

However, some notable differences emerge with regards to the strength of these contributions. Ranjan and Read (2014) show equity contributes the most to co-production. In contrast, the findings show joint interaction (weight = 0.41) is the strongest contributor to co-production in public transport, then knowledge (weighting = 0.31) and equity (weighting = 0.31). This discrepancy may be due to different service settings. Ranjan and Read (2014, p292) focus on medical, hospitality and educational services where equity, which represents "the extent stakeholders can feel a sense of ownership in the process" may be more central to co-production because service consumption focuses on individuals. In contrast, public transport represents a mass consumption context, focusing less on individual customers because it operates as a public good (Gebauer et al. 2010).

8.2.3 Positive value-in-use

The thesis proposes that positive value-in-use positively relates to value co-creation:

H1b: Positive value-in-use positively relates to value co-creation (Supported)

The findings support H1b, as positive value-in-use positively relates to value co-creation. The finding is congruent with conceptual and empirical research showing positive value-in-use contributes to value co-creation (Grönroos and Voima, 2013; Grönroos, 2017; Ranjan and Read, 2014). At present, public transport research has yet to examine the relative contributions of positive value-in-use, or the relative contributions of relationship,

personalisation and experience to the construct itself. The findings show that positive value-in-use contributes less to value co-creation in public transport than co-production. The relative contributions of its sub-dimensions are congruent with Ranjan and Read's (2014) findings, although some differences emerge.

The findings show personalisation (weighting = 0.55) is the strongest contributor to positive value-in-use in public transport, congruent with research highlighting the importance of customisable travel experiences for passengers (Lu et al. 2015). Next, relationship (weighting = 0.36) and experience (weighting = 0.16) are the second strongest and weakest contributors to passengers' positive value-in-use, respectively. In contrast, Ranjan and Read (2014) show experience most strongly contributes to positive value-in-use in medical, hospitality and educational services. The construct of experience measures customers encountering memorable experiences during service consumption (Ranjan and Read, 2014). Prior research on passengers' ideal transport experience suggests ideal journeys are automatic and seamless (Stradling et al. 2007) suggesting that memorable experiences are not central characteristics to passenger's ideal journey experience. Thus, the difference between the current findings and Ranjan and Read's (2014) may be due to the public transport service setting.

8.2.4 Independent Value Creation

The thesis proposes that independent value creation during self-service positively relates to holistic value creation:

H2: Independent value creation from self-service will positively relate to holistic value creation (Supported)

The findings support H2 as independent value creation during self-service positively relates to holistic value creation, with a moderate effect size ($f^2 = 0.17$). The finding is congruent with conceptual research proposing lone resource use supports customer's value creation (Grönroos, 2006; Grönroos and Voima, 2013; McCosker et al. 2014) and empirical research showing customers can create value from self-service (Turner and Shockley, 2014; Zainuddin et al. 2016). For the weightings of lower-order constructs, value from digital self-service (weighting = 0.70) more strongly contributes to passengers' independent value creation than value from physical self-service (weighting = 0.40). This is congruent with research on retail customers' self-service experiences, which shows technological drivers consistently influence service experiences at every journey stage (Akkeson et al. 2014).

Additionally, this finding is congruent with public transport research that highlights the important role of digital self-service features during passengers' value creation in public transport services (Gebauer et al. 2010; Lu et al. 2015).

8.2.5 Social value co-creation

The thesis proposes that social value co-creation positively relates to holistic value creation:

H3: Social value co-creation will positively relate to holistic value creation (Supported)

The findings support H3: social value co-creation positively relates to holistic value creation, with a strong effect size ($f^2 = 0.40$). The finding is congruent with research showing focal customers' value creation incorporates customer-to-customer interactions (Grönroos and Voima, 2013; Grönroos and Gummerus, 2014) and social contexts (Heinonen et al. 2010; Grönroos and Gummerus, 2014; Edvardsson et al. 2010; Pandey and Kumar, 2020).
The construct of social interaction is the strongest contributor to social value co-creation (weighting = 0.86) and measures passengers' perceptions of TOCs supporting customer-to-customer interactions for service development and passengers' own prosocial attitudes.

The construct's significant weighting is congruent with public transport research showing passengers prefer operators supporting interactions between passengers (Hildén et al. 2018) and research that emphasises the role of passengers' own prosocial attitudes during value creation (Carreria et al. 2013; Reichenberger, 2017). Additionally, the finding is congruent with research arguing service providers may moderate social value co-creation (Pandey and Kumar, 2021) and that public transport providers should make provisions for passenger-to-passenger interactions in service processes (Gebauer et al. 2010). Lastly, the significant contributions of helping (weighting = 0.12) and information seeking (weighting = 0.12) are congruent with research showing public and instrumental interactions that support knowledge exchanges between customers drive social value co-creation (Heinonen et al. 2018; Rihova et al. 2018).

8.2.6 Negative value-in-use

The thesis proposes that negative value-in-use negatively relates to holistic value creation:

H4: Negative value-in-use will negatively relate to holistic value creation (Not Supported)

The findings did not support H4; negative value-in-use does not relate to holistic value creation. The finding is incongruent with research proposing customer sacrifices impair value creation (Medberg and Grönroos, 2020; Plewa et al. 2015; Sweeney et al. 2018) and

public transport research on service quality showing passenger sacrifices diminish perceived value (Tam, 2004; Wen et al. 2005; Sumaedi et al. 2012). This incongruency may be due to methodological differences between this thesis and prior research. In this thesis, negative value-in-use forms a higher-order construct in relation to holistic value creation. In contrast, prior research examines negative value-in-use in terms of how its lower-order dimensions relate to marketing outcomes (Plewa et al. 2015; Sweeney et al. 2018). Thus, this incongruency may be due to the thesis estimating negative value-in-use as a higher-order construct.

This incongruency may also be attributed to measurement model issues for the construct. Satisfactory measurement models are present for the lower-order constructs of monetary and behavioural costs, congruent with prior research (Plewa et al. 2015; Sweeney et al. 2018). However, convergent validity is not present for negative value-in-use, itself, and its indicators show anomalous weightings. Hair et al. (2019) state formative indicators with weightings greater than 1 may suggest issues with collinearity, although neither indicator shows even potential collinearity issues. This may suggest negative value-in-use does not summate to a single higher-order construct, like positive value-in-use, a point on which the discussion elaborates in Chapter 9 in terms of its theoretical implications.

8.3 Holistic value creation, customer experience & passenger satisfaction

This section focuses on the findings for the relationship between holistic value creation, customer experience and passenger satisfaction (i.e., H5 – H7).

8.3.1 Holistic value creation & customer experience

The thesis proposes that holistic value creation positively relates to customer experience:

H5: Holistic value creation will positively relate to customer experience (Supported)

The findings support H5, as holistic value creation positively relates to customer experience, with a strong effect size ($f^2 = 1.13$). The findings are congruent with marketing research that shows a positive relationship between separate value creation processes and different stages of customer experience (Lemon and Verhoef; 2016; Ramaswamy, 2011; Jain et al. 2017; Akesson et al. 2014; Nysveen et al. 2012; Solakis et al. 2021). Additionally, the findings are congruent with public transport research showing a positive relationship between

value creation processes and passengers' brand, provider and post-purchase experiences (Roggeveen et al. 2011; Lu et al. 2015; Gebauer et al. 2010; Xu, Yap and Hyde, 2016).

8.3.2 Customer experience & passenger satisfaction

The thesis proposes customer experience positively relates to passenger satisfaction:

H6: Customer experience will positively relate to passenger satisfaction (Supported)

The findings support H6, as customer experience does indeed positively relate to passenger satisfaction, with a strong effect size ($f^2 = 39$). The findings are congruent with marketing research showing that separate stages of customer experience positively relate to customer satisfaction (Sahin et al. 2011; Ekinci and Dawes, 2008; Chen et al. 2013, Cheng et al. 2018). Additionally, the finding is congruent with transport research showing positive relationships between separate stages of customer experience and passenger satisfaction (Ittamalla and Kumar, 2021; Pabla and Soch, 2023; Ibrahim et al. 2020, Felleson and Friman, 2008; Wen and Chi, 2012). Lastly, the finding is congruent with research in transport services, showing a strong positive relationship between customer experience and traveller satisfaction, although the relationship is weaker than Solakis et al.'s (2021) findings.

8.3.3 Holistic value creation, customer experience and passenger satisfaction

The thesis proposes that holistic value creation positively relates to passenger satisfaction, with mediation from customer experience:

H7: Holistic value creation will positively relate to passenger satisfaction, with mediation from customer experience (Supported)

The findings support H7: holistic value creation positively relates to passenger satisfaction, with mediation from customer experience. The findings show holistic value creation predicts 52% of variance in customer experience and customer experience predicts 46% of variance in passenger satisfaction. The findings show holistic value creation holds a strong total effect on passenger satisfaction ($f^2 = 0.50$), which is stronger than the total effect of value co-creation on passenger satisfaction ($f^2 = 0.40$). In contrast, customer experience holds a stronger total effect on passenger satisfaction ($f^2 = 0.65$) than either holistic value creation or value co-creation.

The mediator analysis shows customer experience forms a direct only mediator of the relationship between holistic value creation and passenger satisfaction. Following Zhao et

al.'s (2010) framework for diagnosing mediators, as customer experience fully mediates this relationship, the presence of an absent mediator is unlikely. The model comparison analysis shows customer experience, as a direct only mediator, represents the dataset best. This supports the mediator analysis and suggests value creation — as a predictor of customer experience, which in turn predicts passenger satisfaction — is the most appropriate representation of these constructs in public transport services. These findings are congruent with research showing customer experience partially mediates the perceived value-WoM relationship (Kuppelwieser et al. 2021) and the relationship between specific dimensions of co-creation and satisfaction (Solakis et al. 2021). Additionally, the findings are congruent with public transport research that shows lower-order value creation processes – that make up holistic value creation - positively relate to passenger satisfaction via passengers' service experiences (Gebauer et al. 2010; Lu et al. 2015; Ittamalla and Kumar, 2021).

8.4 Customer engagement behaviours

This section focuses on the relationships between passenger satisfaction, feedback intentions, advocacy and future patronage (H8 – H10). Additionally, this section focuses on the value-engagement relationship.

8.4.1 Feedback intentions

The thesis proposes that passenger satisfaction positively relates to feedback intentions:

H8: Passenger satisfaction will positively relate to feedback intentions (Supported)

The findings support H8, as passenger satisfaction positively relates to feedback intentions, with a weak effect size ($f^2 = 0.12$). The finding is largely congruent with public transport research on service quality (Saha and Theingi, 2009), although the relationship is stronger in this thesis. This discrepancy may be due to Saha and Theingi (2009) assessing customer-personnel interactions, which forms the basis of value creation (Grönroos and Voima, 2013; Vargo and Lusch, 2014) separately from feedback intentions. Thus, this difference may arise from Saha and Theingi's (2009) research focus differing from the thesis.

Alternatively, this difference may be attributable to the different time periods Saha and Theingi (2009) and the thesis takes place in, with respect to platforms for collecting feedback. Saha and Theingi (2009) arguably examines the relationship before the rise of

social media, which offer passengers an accessible platform for voicing feedback (Lu et al. 2015). In contrast, the thesis examines the relationship after the rise of social media. This potentially explains the stronger relationship between passenger satisfaction and feedback in the thesis, as passengers can more readily offer feedback via social media.

8.4.2 Advocacy

The thesis proposes that passenger satisfaction positively relates to advocacy:

H9: Passenger satisfaction will positively relate to advocacy (Supported)

The findings support H9, as passenger satisfaction positively relates to advocacy, with a strong effect size ($f^2 = 0.80$). The finding is congruent with public transport research on service quality (Saha and Theingi, 2009, Suki, 2014) although Dölarslan (2014) shows a weaker satisfaction-WoM relationship in high-speed rail. Research on perceived value in airline services (Gürler and Ertgurgut, 2018) shows an almost equivalent satisfaction-WoM relationship to the current findings.

8.4.3 Future patronage

The thesis proposes that passenger satisfaction positively relates to future patronage:

H10: Passenger satisfaction will positively relate to future patronage (Supported)

The findings support H10; passenger satisfaction positively relates to future patronage, with a moderate effect size ($f^2 = 0.16$). The findings are congruent with public transport research on service quality (Saha and Theingi 2009; Wu et al. 2011; Dölarslan, 2014), although differences emerge in contrast with research using a theory of planned behaviour approach (Fu and Juan, 2016). In terms of service quality research, Saha and Theingi (2009) and Wu et al. (2011) show an almost equivalent strength relationship between satisfaction and behavioural intent in airline and highspeed rail services, respectively. However, Dölarslan (2014) shows a much stronger satisfaction-reuse intention relationship in highspeed rail services, in contrast with the findings of this thesis.

Fu and Juan (2016) adopt a theory of planned behaviour approach and find a much weaker satisfaction-reuse intention relationship. This incongruency may be due methodological and theoretical differences between the thesis and this study. Fu and Juan (2016) examine passengers' general attitudes to public transport use, rather than any specific medium. Although they focus on general attitudes, Fu and Juan (2016) note that only public

bus services and para-transit options (i.e. taxis) were available in its sampling region. Research on para-transit services shows no significant satisfaction-behavioural intent relationship (Sumaedi et al. 2012). Thus, the different findings of Fu and Juan (2016) may be due to their respondents considering paratransit alternatives where no satisfaction-reuse relationship exists (Sumaedi et al. 2012). In contrast, the thesis examines the satisfaction-reuse relationship in a monopolistic service setting where no alternative TOCs exist.

The difference may also be due to the different theoretical foci of the studies. Fu and Juan (2016) show significant relationships between satisfaction, behavioural intention and theory of planned behaviour constructs (i.e. perceived behavioural control and subjective norms), so this discrepancy may be due to their inclusion of that theory. Overall, the satisfaction-future patronage relationship largely aligns with research (Saha and Theingi 2009; Wu et al. 2011) though differences emerged with respect to research on specific transport modes (Sumaedi et al. 2012; Dölarslan, 2014) and literature adopting an alternative theoretical framework (Fu and Juan, 2016). This suggests, although the general trends present in public transport research are present in the current findings, the strength of the satisfaction-reuse relationship may be mode and context specific in transport services.

8.5 Satisfaction-Engagement relationship

The findings show a trend in satisfaction-engagement relationships to differ around the orientation of engagement behaviours. The findings show the satisfaction-engagement relationship is stronger for advocacy, which faces social actors or other stakeholders, versus those facing transport providers (i.e., feedback intentions and future patronage). This distinction is congruent with Alexander and Jaakkola (2014) who distinguish customer engagement behaviours in rail services in terms of facing social actors and stakeholders or transport providers, although this research does not examine the satisfaction-engagement relationship with regards to this distinction.

8.6 Value-Engagement relationship

The findings highlight the differing roles of value co-creation, holistic value creation, customer experience and passenger satisfaction in the value-engagement relationship. First,

the findings indicate that customer experience, rather than passenger satisfaction, plays an important role in the value-engagement relationship. Reviewing the specific indirect effects (Chapter 7) shows no significant specific indirect effect is present between value co-creation, holistic value creation and engagement behaviours without customer experience (Table 77). This is incongruent with travel research that finds passenger satisfaction mediates the perceived value-WoM relationship, although this travel research does not include customer experience in its analysis (Gürler and Ertgurgut, 2018).

Second, the findings show the differing magnitudes of value co-creation, holistic value creation and customer experience in the value-engagement relationship, with customer experience more strongly relating to all engagement behaviours. Reviewing the indirect effects (Chapter 7) highlights customer experience holds a stronger indirect effect on all three engagement behaviours ($0.05 \leq v^2 \geq 0.19$) than value co-creation ($0.02 \leq v^2 \geq 0.07$) and holistic value creation ($0.03 \leq v^2 \geq 0.11$) (Table 76). Value co-creation ($v^2 = 0.02$) and holistic value creation ($v^2 = 0.03$) hold small indirect effects on feedback intentions, whilst customer experience holds a stronger indirect effect on the construct ($v^2 = 0.05$). Value co-creation ($v^2 = 0.07$) and holistic value creation ($v^2 = 0.11$) hold medium and large indirect effects on advocacy, respectively. In contrast, customer experience holds a stronger indirect effect on advocacy ($v^2 = 0.19$). Finally, value co-creation ($v^2 = 0.02$) and holistic value creation ($v^2 = 0.04$) hold small indirect effects on future patronage. In contrast, customer experience holds a stronger indirect effect on future patronage ($v^2 = 0.06$) (Table 76).

Third, similarly to the satisfaction-engagement relationship, the value-engagement relationship is stronger for engagement behaviours facing social actors or stakeholders (i.e. advocacy) than transport providers (i.e. feedback intentions and future patronage). On this note, value co-creation, holistic value creation and customer experience more strongly relate to advocacy ($0.07 \geq v^2 \leq 0.19$) than feedback intentions ($0.02 \geq v^2 \leq 0.05$) and future patronage ($0.02 \geq v^2 \leq 0.06$) (Table 76). This distinction is congruent with Alexander and Jaakkola's (2014) conceptualisation of customer engagement behaviours as facing social actors or stakeholders versus transport providers (Chapter 4 – 4.7).

Fourth, the findings hold relevance to the multi-group analysis as it contextualises some of the significant differences between business and leisure passengers (Chapter 7 – 7.16). The multi-group analysis shows value co-creation contributes significantly more to holistic value creation in business ($\beta = 0.938$) than leisure passengers (($\beta = 0.763$).

Additionally, for indirect effects the analysis shows value co-creation relates significantly more to both customer experience and passenger satisfaction in business ($0.608 < v^2 < 0.815$) than leisure passengers ($0.344 < v^2 < 0.519$) (Table 88). Thus, during the value-engagement relationship, value co-creation may play a stronger role in value-engagement relationship for business passengers, compared with leisure passengers, via the construct's indirect effects on customer experience and passenger satisfaction.

8.7 Summary

Chapter 8 has discussed the findings of Chapters 7 within the contexts of prior research. The first section focused on findings for holistic value creation and its value creation processes. These show the importance of examining value creation holistically, as all processes except negative value-in-use offer significant contributions to the construct. The finding is largely congruent with prior research on value creation, except for negative value-in-use, and shows value co-creation is the dominant contributor, followed by social value co-creation and then independent value creation.

The second section focused on the relationships between holistic value creation, customer experience and passenger satisfaction. The findings show that customer experience fully mediates the value-satisfaction relationship, and more strongly relates to passenger satisfaction than either value co-creation or holistic value creation. The third section focused on the satisfaction-engagement and value-engagement relationships. In the former, passenger satisfaction most strongly relates to advocacy, but only weakly relates to feedback intentions and future patronage. In the latter, customer experience — rather than passenger satisfaction — plays an important role in the relationship between holistic value creation and engagement behaviours. Customer experience more strongly relates to all three engagement behaviours than value co-creation or holistic value creation. Both the satisfaction-engagement and value-engagement relationship show a trend. These relationships are stronger for behaviours facing social actors or stakeholders (i.e. advocacy) than transport providers (i.e. feedback intentions and future patronage).

Next, Chapter 9 reviews the contributions and implications of the thesis's findings.

Chapter Nine – Contributions and Implications

Chapter Nine – Contributions and Implications

9.1 Introduction

While Chapter 8 discussed the findings in terms of existing research, Chapter 9 focuses on their theoretical implications, main contributions, managerial implications, limitations and subsequent recommendations for future research. This chapter comprises eight sections. First, the discussion summarises the thesis's research aims, hypotheses and chapters. Second, it reviews the thesis's theoretical implications, then third, summarises the thesis's main contributions. Fourth, it reviews the thesis's methodological contributions, then fifth, its managerial implications. Sixth, the discussion addresses the thesis's limitations. Seventh, recommendations for future research are made, and eighth, the thesis finishes with a brief conclusion.

9.1.2 Summary of Thesis

The thesis's main objective was to advance a conceptual model that offers a broader understanding of rail passenger behaviour by incorporating value creation, customer experience, passenger satisfaction and three engagement behaviours (feedback intentions, advocacy and future patronage). From this model, the thesis aimed to understand how passengers' value creation processes relate to holistic value creation and, in turn, how this relates to satisfaction. Additionally, it also considers the role of customer experience in the value-satisfaction relationship, as well as the value-engagement relationship, and examines how satisfaction relates to engagement behaviours. To achieve these aims, the thesis's main research questions are:

Q1) How do the different value creation processes undertaken by passengers relate to holistic value creation?
Q2) How does their holistic value creation relate to passenger satisfaction and what is the role of customer experience in this relationship?
Q3) How does passenger satisfaction relate to customer engagement behaviours?

To address these aims and objectives, the following hypotheses were developed by reviewing literature in Chapters 2 – 4.

Chapter 1 introduces the research questions and the thesis's objectives in terms of estimating holistic value creation, its underlying processes, customer experience and customer engagement behaviours. At present, research has yet to examine how customers' value creation sphere, referred to as holistic value creation by the thesis, emerges from its underlying processes (Grönroos and Voima, 2013; Grönroos, 2017). While research examines the role of customer experience in the contexts of specific value dimensions, customer satisfaction and WoM (Kuppleweiser et al. 2021; Solakis et al. 2021), it has yet to comprehensively examine the role of customer experience in the contexts of holistic value creation and other marketing outcomes for customers (Kuppleweiser et al. 2021; Solakis et al. 2021). The thesis contributes to filling these gaps by developing and validating an integrative model that incorporates holistic value creation and its underlying processes, customer experience, passenger satisfaction and three customer engagement behaviours.

Chapter 2 discusses research from Service dominant logic (SDL), service logic and Customer dominant logic (CDL). SDL considers value creation from an economics perspective (Vargo and Lusch, 2008) and more recently in terms of service ecosystems (Vargo and Lusch, 2014). In contrast, service logic considers value creation from a marketing perspective (Grönroos, 2011) in terms of customer interactions (i.e., with providers, resources and social actors) and how customers can feel better or worse off from using services (i.e., positive and negative value-in-use) (Medberg and Grönroos, 2020). Lastly, CDL considers value creation from the customers' perspective (Heinonen et al. 2010; Heinonen and Strandvik, 2015) and offers insights on social value co-creation (Rihova et al. 2018; Heinonen et al. 2018).

Chapter 3 reviews literature on supporting co-creation in services and public transport. The chapter reviews research on the topics of experience environments, experience enablers (Prahalad and Ramaswamy, 2004), pillars of co-creation (Bharti et al. 2015) and customers' activities of co-creation (Tomasetti et al. 2017). Additionally, the chapter thoroughly reviews two key studies on value creation in public transport services (Gebauer et al. 2010; Echeverri and Skålén, 2011) and later how co-design and co-recovery are implemented in public transport services (Roggeveen et al. 2011; Mitchell et al. 2015; Bowen et al. 2022).

Chapter 4 focuses on the thesis's conceptual model and reviews literature on different value creation processes, customer experience, passenger satisfaction and customer engagement behaviours. This review conceptualises holistic value creation as a representation of the customers' value sphere (Grönroos and Voima, 2013) and examines it as a culmination of lower-order value creation processes (i.e., value co-creation, co-production, positive value-in-use, independent value creation, social value co-creation and negative value-in-use).

Additionally, this review considers customer experience in terms of passengers' brand, service provider and post-purchase experiences (Klaus, 2014) and reviews the scarce public transport research on passengers' service experiences (Carreria et al. 2013; Ittamalla and Kumar, 2021). In line with marketing research, passenger satisfaction is conceptualised in terms of affective and cognitive approaches (Friman et al. 2013). Lastly, the review considers engagement behaviours in terms of research in rail services (Jaakkola and Alexander, 2014) and conceptualises them in terms of passengers' feedback intentions, advocacy and future patronage. From the above literature review, the thesis proposes the twelve hypothesises of:

H1: Value co-creation will positively relate to holistic value creation

H1a: Co-production will positively relate to value co-creation

H1b: Positive value-in-use will positively relate to value co-creation

H2: Independent value creation from self-service will positively relate to holistic value creation

H3: Social value co-creation will positively relate to holistic value creation

H4: Negative value-in-use will negatively relate to holistic value creation

H5: Holistic value creation will positively relate to customer experience

H6: Customer experience will positively relate to passenger satisfaction

H7: Holistic value creation will positively relate to passenger satisfaction, mediated by customer experience

H8: Passenger satisfaction will positively relate to feedback intentions

H9: Passenger satisfaction will positively relate to advocacy

H10: Passenger satisfaction will positively relate to future patronage

Chapter 5 discusses the thesis's methodology in terms of its research philosophy of positivism, approach to reasoning and logic, research design and data collection. Later, Chapter 5 reviews operationalising constructs in the conceptual model, approaches to data analysis the thesis uses and closes with ethical considerations. Chapter 6 offers a descriptive analysis of the thesis's sample and describes procedures for data cleaning used by the thesis. The chapter also reviews the composition of the thesis's sample and shows the sample is largely representative of TfW's data and census information, with respect to demographic information. Chapter 6 closes by reviewing response patterns for survey indicators.

Chapter 7 presents the thesis's PLS-SEM analysis, and establishes satisfactory measurement models for all constructs, except negative value-in-use, according to research standards (Hair et al. 2014). A structural assessment supports almost all hypothesis, except H4, and shows no serious collinearity issues within the model. A mediator analysis confirms customer experience as a direct-only mediator of the value-satisfaction relationship. The specific indirect effects highlights the following: customer experience, rather than passenger satisfaction, plays an important role in value-engagement relationship; customer experience relates more strongly to engagement behaviours than value creation and the value-engagement relationship appears stronger for behaviours facing social actors versus transport operators (Table 77). Lastly, passenger satisfaction relates most strongly to advocacy, then future patronage and feedback intentions (H8 – 10). Similarly to the value-engagement relationship, the satisfaction-engagement relationship appears stronger for engagement behaviours facing social actors versus transport providers. Chapter 8 discusses the thesis's findings within the contexts of prior research and shows most results are congruent with marketing and public transport research (Table 91).

With respect to the thesis's main research questions, the analysis in Chapter 7 offers the followings answers:

Q1: Value co-creation is the strongest contributor to holistic value creation, then social value co-creation and independent value creation, highlighting the multi-faceted nature of passengers' value creation whilst using public transport.

Q2: Holistic value creation strongly relates to passenger satisfaction, and this relationship is fully mediated by customer experience.

Q3: Passenger satisfaction relates most strongly to advocacy, then future patronage and feedback intentions by a large margin, suggesting the satisfaction-engagement behaviour relationship is stronger for behaviours facing social actors versus transport providers.

A summary of the thesis's findings, with respect to contributions outlined in Chapter 1, is given bellow (Table 92)

Table 92. Summary of thesis's contributions and findings

Contributions		Findings
1.	Develops and empirically validates a model connecting holistic value creation, customer experience, satisfaction and engagement, which is lacking in research that addresses these relationships selectively but not comprehensively.	• Constructs can validly be incorporated into single cohesive model, providing steps are taken to mitigate collinearity, with satisfactory measurement models for almost all constructs. • Holistic value creation predicts ~53% of customer experience. • Customer experience predicts ~46% of passenger satisfaction. • Passenger satisfaction predicts 11- 44% of engagement behaviours.
2.	Estimates holistic value creation, showcasing the multi-faceted nature from customers' perspective.	• All value creation processes, except negative value-in-use, significantly contributes to holistic value creation. • Lower-order value creation processes predict ~64% of holistic value creation.
3.	Examines the relative contributions of each process to holistic value creation	• Value co-creation is the strongest contributor to holistic value creation, then social value co-creation and independent value creation.
4.	Examines passengers' holistic value creation in public transport, specifically, as prior research in public transport only focuses on specific value creation processes.	• In public transport, specifically, passengers' holistic value creation is dominated by value co-creation, but social value co-creation and independent value creation also offer significant contributions. • Co-production contributes more to value co-creation in public transport services than positive value-in-use. • Value from digital self-service contributes more to independent value creation versus value from physical self-service. • Passengers' pro-social attitudes and TOCs supporting C2C interactions significantly contributes to social value co-creation in public transport. • Negative value-in-use may not summate to a single higher-order construct, but instead represent distinct tangible and behaviour facets.

Contributions		Findings
5.	Analyses customer experience with respect to holistic value creation, satisfaction and customer engagement behaviours and, simultaneously, examines its role in the value-satisfaction and value-engagement relationships, evidencing its central role in both.	• Customer experience fully mediates the relationship between holistic value creation and passenger satisfaction • Customer experience, rather than passenger satisfaction, plays a central role in the value-engagement relationships. No significant relationship is present between holistic value creation and engagement behaviours without customer experience. • Customer experience relates more strongly to engagement behaviours than value creation. • Value-engagement relationship appears stronger for engagement behaviours facing social actors (advocacy) versus transport providers (feedback intentions and future patronage).
6.	Validates customer experience as a reflective multi-dimensional construct in terms of passengers' journey stages, which is only present in qualitative public transport research.	• Analysis empirically validates customer experience as a reflective higher-order construct during SEM whilst incorporating passengers' brand, service provider and post-purchase experiences.
7.	Considers different conceptual orders of value creation and customer experience, with respect to passenger satisfaction	• Comparisons of alternative conceptual orders for holistic value creation and customer experience, with respect to passenger satisfaction, validates: Value creation → customer experience → passenger satisfaction as the most appropriate conceptual order for examining these constructs in public transport.
8.	Examines the satisfaction-engagement relationship in public transport services in the contexts of value creation, which public transport research only considers in the contexts of service quality.	• Passenger satisfaction most strongly relates to advocacy, then future patronage and feedback intentions with a large margin. • Satisfaction-engagement relationships appears stronger for engagement behaviours facing social actors (advocacy) versus transport providers (feedback intentions and future patronage).

9.2 Theoretical implications

This section considers the theoretical implications of the thesis's contributions, as previously summarised (Table 92).

9.2.1 Holistic value creation indicators

The findings for holistic value creation hold theoretical implications for services marketing and public transport research. For services marketing, the findings empirically highlight that value creation truly represents a multi-faceted construct, previously only alluded to in conceptual research (Grönroos and Voima, 2013; Grönroos, 2017).

Services marketing research on value creation often focuses on value co-creation (Ranjan and Read, 2014; Grönroos, 2011; Grönroos and Voima, 2013). To a lesser extent, research examines social value co-creation, independent value creation and negative value-in-use separately (Rihova et al. 2018; Heinonen et al. 2018; Sweeney et al. 2018). However, research has yet to examine the relative contributions of these processes to customer's holistic value creation. The findings emphasise value co-creation forms the strongest contributor to holistic value creation, justifying its strong research focus, but social value co-creation and independent value creation also offer significant contributions as well. This theoretical implication relates to the thesis's second and third contributions, and particularly its fourth contribution as the finding pertains to passengers' value creation in public transport services (Table 92).

9.2.2 Value co-creation

The findings for value co-creation offer theoretical implications for public transport research. At present, public transport research only offers qualitative evidence on the role of value co-creation in passenger's value creation (Gebauer et al. 2010; Echeverri and Skålén, 2011). Although insightful, their use of qualitative methodologies limits the generalisability of their conclusions. The finding contributes to public transport research by offering quantitative evidence, and thus a more generalisable conclusion, supporting the positive role of value co-creation in passenger's holistic value creation. Additionally, the finding shows the relative contributions of value co-creation, which forms the dominant contributor to passenger's holistic value creation. These implications relate to the thesis's third contribution, as it relates to services marketing, and its fourth contribution, as it relates to public transport research (Table 92).

9.2.3 Co-production

For co-production, the findings hold important theoretical implications for public transport research on value creation. In public transport, Echeverri and Skålén (2011) highlight several interaction practices that drive value co-creation, with the practice of delivery matching definitions of co-production (Vargo and Lusch, 2016, Osborne et al. 2016). However, public transport research has yet to examine the relative contribution of co-production to value co-creation, or the relative contributions of knowledge, equity and joint interaction to co-production itself. This finding relates to the thesis's fourth contribution and fills the above research gaps in two manners (Table 92).

Firstly, the findings show that co-production contributes more to value co-creation in public transport than positive value-in-use. This suggests customer-provider interactions that support service delivery and development contribute more to co-creation in public transport than passenger's experiential value (i.e., value-in-use). Secondly, the findings show the relative contributions of knowledge, equity and joint interaction to co-production in public transport. The findings show joint interaction forms the strongest contributor to co-production in public transport, then knowledge and equity. Joint interaction measures customers active engagement in dialogue with providers (Ranjan and Read, 2014). Thus, passenger's active engagement in dialogue with transport providers contributes the most to co-production in this service setting. This finding holds implications for the practice of delivery, as it matches definitions of co-production (Vargo and Lusch, 2016, Osborne et al. 2016) but may also extend to the practices of informing, greeting, charging and helping that support service delivery (Echeverri and Skålén, 2011).

9.2.4 Positive value-in-use

The findings for positive value-in-use hold important theoretical implications for public transport research. Firstly, the findings show that passenger's experiential value during use contributes less to value co-creation than co-production. Secondly, the findings show that personalisation and experience offer the strongest and weakest contributions to passenger's positive value-in-use. This finding offers important theoretical implications for public transport research, given the scarce literature on passenger's value-in-use (Gebauer et al. 2010). The findings show personalisation contributes the most to passengers' feeling better off from using services (Grönroos, 2011) in public transport services, specifically (Gebauer et al. 2010). In rail services, Gebauer et al. (2010) notes the importance of flexibility in TOC's service processes and Lu et al. (2015) emphasises personalisation for promoting customisable

travel experiences. Thus, the finding emphasises personalisation as a key contributor to passenger's feeling better off from using public transport.

The weaker contribution of experience also offers the following theoretical implication. Experience measures customers encountering memorable experiences whilst using services (Ranjan and Read, 2014). The indicators low weighting suggests memorable experiences do not form a central component to passengers' feeling better off from using public transport. This implication is congruent with Stradling et al.'s (2007) finding that passenger's ideal travel experience is smooth and automatic in nature. Furthermore, it offers support to CDL research proposing customer's service experience emerges in mundane everyday contexts (Heinonen et al. 2010). The above findings relates to the thesis's fourth contributions, as it pertains to value creation in public transport services specifically (Table 92).

9.2.5 Independent value creation

Empirical research shows that both digital and physical self-service contributes to passenger's value creation (Gebauer et al. 2010; Lu et al. 2015). However, research has yet to examine the relative contributions of independent value creation to holistic value creation, or the relative contributions of digital and physical self-service to independent value creation itself. Thus, the findings fill this research gap and offers three theoretical implications. Firstly, the findings highlight that although lone resource use does not form the strongest contributor to holistic value creation, it still forms a significant contributor. This shows the relative importance of independent value creation in the wider landscape of value creation.

Secondly, the finding holds theoretical implications when considering public transport research on passenger's service experience. Carreira et al. (2013) shows passengers view self-service experiences as only supplementary to core service functions. However, the current findings suggest value from self-service represents a significant contributor to passenger's value creation. This suggests a disconnect between passenger's value creation and experiences whilst using self-service, congruent with research showing the relationship between value creation and experience is not always linear (Abid et al. 2022). A potential explanation is that independent value creation represents an experiential hygiene factor. Under this rational, passenger's may perceive self-service experiences as only supplementary, per Carreira et al.'s (2013) findings, whilst their absence may impair value creation.

Thirdly, the findings show that value from digital self-service offers a stronger contribution to independent value creation than value from physical self-service. Public transport research outlines value outcomes from digital self-service at each journey stage (Lu et al. 2015). However, research has yet to examine the relative contribution of both self-service mediums to independent value creation. The findings show value from digital self-service forms the dominant contributor to passenger's independent value creation. These implications relate to the thesis's third contribution, as it relates to services marketing, and its fourth contribution as it relates to public transport research (Table 92).

9.2.6 Social value co-creation

Research on social value co-creation is scarce, in contrast with other processes, and has yet to examine its relative contributions to holistic value creation. Firstly, the findings show social value co-creation forms the second strongest contributor to holistic value creation. This empirically evidences the relative importance of value creation emerging from social contexts (Heinonen et al. 2010; Edvardsson et al. 2011) and relates to the study's third contribution (Table 92).

Secondly, the findings offer theoretical implications with regards to its lower-order constructs. The study estimates social value co-creation in terms of social interaction, helping and information seeking, with social interaction forming the strongest contributor to social value co-creation. Social interaction measures passenger's perceptions of a provider's role in social value co-creation and the necessity of their pro-active engagement whilst using services (Pandey and Kumar, 2021; Reichenberger, 2017).

Prior research considers social value co-creation as occurring beyond a provider's line of visibility (Heinonen and Strandvik, 2015). However, more recent conceptual research suggests providers may indirectly influence the process by acting as moderators or supporting firm-induced drivers (Heinonen et al. 2018; Pandey and Kumar 2021). Hildén et al. (2018) highlights that passenger's show a preference for operators supporting interactions between passengers. Additionally, research alludes to value outcomes from the process to differ around passenger's prosocial attitudes (Carreria et al. 2013; Reichenberger, 2017). The finding that social interaction forms the strongest contributor to social value co-creation empirically highlights the important role of TOCs during social value co-creation, contrary to it residing beyond a provider's line of visibility (Heinonen and Strandvik, 2015).

Additionally, the finding empirically highlights the importance of passenger's own prosocial attitudes in the process in transport services, which prior research only alludes to (Carreria et al. 2013; Reichenberger, 2017). These implications relate to the thesis's fourth contribution as they pertain to public transport services, specifically (Table 92).

9.2.7 Negative value-in-use

The findings suggest that negative value-in-use does not significantly contribute to passengers' holistic value creation. This is incongruent with research showing that negative value-in-use diminishes value creation (Medberg and Grönroos, 2020) as it leaves customers feeling worse off (Plewa et al. 2015; Sweeney et al. 2018). The lack of significant contribution may be due to methodological issues. Lower-order dimensions of negative value-in-use show acceptable measurement models (Chapter 7 – 7.7). However, negative value-in-use itself, as a high-order construct, summating these dimensions, fails to show adequate convergent validity (Chapter 7 – 7.4).

Owing to the various dimensions of negative value (Leroi-Werelds, 2019), it is possible that negative value-in-use does not represent a single higher-order construct in public transport. This differs from positive value-in-use, which the findings show summates to a single higher-order construct in public transport services (Chapter 7 – 7.4). Instead, the construct may comprise distinct tangible and behavioural sacrifices for passengers that do not summate to a single higher-order construct. This offers a minor contribution to the scarce public transport research on value creation, as it may suggest the factors that contribute to passengers' feeling worse off from using services hold distinct tangible and behavioural nomological nets (Jarvis et al. 2003). This implication relates to the thesis's fourth contribution (Table 92).

9.2.8 Holistic value creation & customer experience

Public transport research has yet to examine the relationships between value creation and customer experience as higher-order constructs. The findings show the significant relationships between value creation processes and separate experience stages also extend to their respective higher-order constructs. This implication relates to the study's first contribution as it comes from its integrative approach to examining the constructs, and its fourth contribution as it pertains to public transport services (Table 92).

An additional theoretical implication comes from thesis's model comparison. At present, public transport research has yet to examine the conceptual order of value creation

and customer experience with respect to passenger satisfaction. Conceptual marketing research considers this relationship as experience being antecedent to value (De Keyser et al. 2015) and also posits the constructs hold a cyclical relationship (Akkeson et al. 2014). More recent empirical research suggests value to be antecedent to experience (Kuppelwieser et al. 2021). The findings suggest value creation as antecedent to customer experience, with respect to passenger satisfaction, represents the conceptual order of these constructs best in public transport. This indicates Kuppleweiser et al.'s (2021) ordering of the constructs extends to public transport services, and the implication relates to the thesis's seventh contribution (Table 92).

9.2.9 Holistic value creation, customer experience and passenger satisfaction

The findings for holistic value creation, customer experience and passenger satisfaction offers the following theoretical implications. Firstly, the findings highlight the role of customer experience in the relationship between holistic value creation and passenger satisfaction. At present, research on consumer behaviour in services marketing examines the role of customer experience in terms of the relationships between perceived value or the specific dimensions of value co-creation and WoM (Kuppleweiser et al. 2021) and satisfaction (Solakis et al. 2021).

However, it has yet to comprehensively examine the role of customer experience in the relationship between holistic value creation and other marketing outcomes for customers. The findings show that customer experience fully mediates the relationship between holistic value creation and passenger satisfaction. Customer experience therefore not only mediates the relationship between static value outcomes, specific dimensions of co-creation and select marketing outcomes (Kuppleweiser et al. 2021; Solakis et al. 2021), it would appear, but also mediates the relationship between holistic value creation and passenger satisfaction as well.

Secondly, the findings have theoretical implications for public transport research. Prior public transport research suggests passenger satisfaction mediates the perceived value-WoM relationship (Gürler and Ertgurgut, 2018). However, Gürler and Ertgurgut (2018) does not consider value creation holistically, or incorporate the role of customer experience. Thus, the finding emphasises the importance of including customer experience when examining the relationships between value creation and marketing outcomes for passengers. These implications relate to the study's fifth contribution, as it relates to services marketing, and its

fourth contribution as it is especially apposite to public transport research on value creation with regards to passenger outcomes (Table 92).

9.2.10 Customer experience & passenger satisfaction

The findings for customer experience and passenger satisfaction have the following theoretical implications for public transport research. Public transport research offers a bespoke scale for measuring rail passengers' experiences, namely the HPX scale (Ittamalla and Kumar, 2021), which heavily relies on service quality dimensions (Barabino and Francesco, 2016; Eboli and Mazzulla, 2014; Bakti and Sumaedi, 2015). Although insightful, the HPX scale does not incorporate passengers' different journey stages in terms of pre, during and post-use (Lemon and Verhoef, 2016; De Keyser et al. 2020; Kuppelwieser et al. 2021) and this approach to conceptualising customer experience is only present in qualitative public transport research (Carreria et al. 2013; Lu et al. 2015).

The thesis conceptualises customer experience in terms of passengers' brand, service provider and post-purchase experience (Klaus, 2014) and the construct shows a satisfactory measurement model in public transport services. Conceptualised in this manner, customer experience predicts passenger satisfaction similarly to the HPX scale without relying upon service quality dimensions (Ittamalla and Kumar, 2021). Thus, the findings highlights that public transport researchers may validly conceptualise passengers' service experience in terms of journey stages, in line with marketing research (Klaus, 2014; Kuppleweiser et al. 2021), with respect to marketing outcomes like passenger satisfaction. Furthermore, this approach offers public transport researchers a means of examining customer experience and value creation simultaneously, whilst mitigating concerns of collinearity between value creation and service quality (Medberg and Grönroos, 2020) that may arise from using the HPX scale (Ittamalla and Kumar, 2021). This represents an important implication given the scarcity of research on passengers' service experience and relates to the thesis's sixth contribution (Table 92).

9.2.11 Feedback intentions

The findings for passengers' feedback intentions have the following theoretical implications for public transport research. During value creation, feedback on service consumption forms a provider's value-in-use (Grönroos, 2011) and in public transport it enables co-designing service improvements (Hildén et al. 2018; Nalmpantis et al. 2019; Bowen et al. 2022).

However, public transport research has yet to examine the satisfaction-feedback intentions relationship during value creation and customer engagement behaviours.

The findings show, despite the importance of feedback for transport providers (Alexander and Jaakkola, 2014; Bowen et al. 2022), that passenger satisfaction only acts as a weak determinant of the construct. Firstly, this suggests passenger satisfaction only weakly determines feedback intentions as a form of voluntary citizenship behaviour during co-creation in public transport (Yi and Gong, 2013). Secondly, it suggests passenger satisfaction only weakly determines feedback intentions as an initial stage of co-design as an engagement behaviour in rail services (Alexander and Jaakkola, 2014).

This implication holds relevance for research on co-design in public transport services. Alexander and Jaakkola (2014) shows the CEB of co-design elicits value outcomes like monetary rewards and access to better services for passengers. These may act as stronger determinants of feedback intentions than satisfaction. Alternatively, the specific indirect effects in Chapter 7 highlight that customer experience, rather than passenger satisfaction, plays an important role in the value-engagement relationships. Thus, customer experience may act as a stronger determinant of passengers' feedback intentions than satisfaction as well. These implications relate to the thesis's eighth contribution (Table 92).

9.2.12 Advocacy

The findings for advocacy have the following theoretical implications for public transport research. The findings show the satisfaction-advocacy relationship to be the strongest satisfaction-engagement relationship in the thesis, which has two implications. Firstly, this suggests passenger satisfaction strongly determines advocacy as a form of voluntary citizenship behaviour during co-creation in public transport (Yi and Gong, 2013). Secondly, public transport research conceptualises advocacy as a CEB (i.e. influencing) that faces stakeholders or social actors and elicits value outcomes like expertise signalling, social prestige and attention (Alexander and Jaakkola, 2014). Thus, the finding suggests passenger satisfaction strongly determines influencing as a CEB, which may hold social dynamics given the engagement behaviour can elicit social value outcomes like expertise signalling, social prestige and attention from other passengers (Alexander and Jaakkola, 2014). This implication relates to the thesis's eighth contribution (Chapter 1).

9.2.13 Future patronage

The findings for future patronage have the following theoretical implications for public transport research. The findings show the satisfaction-future patronage relationship represents the weakest satisfaction-engagement relationship in the study, suggesting passenger satisfaction only weakly determines intent to reuse public transport. This may potentially derive from the monopolistic setting of public transport in the study, per the prior discussion of the finding in Chapter 8. This implication relates to the thesis's eighth contribution (Table 92).

9.2.14 Satisfaction-Engagement relationship

The findings show a trend in satisfaction-engagement relationships to differ between engagement behaviours facing social actors (i.e., advocacy) versus transport providers (i.e., feedback intentions and future patronage). The findings show passenger satisfaction relates more strongly to advocacy ($\beta = 0.67$) than feedback intentions ($\beta = 0.33$) and future patronage ($\beta = 0.38$).

Both feedback intentions and future patronage face service providers (Yi and Gong, 2013; Mathwick et al. 2001) whilst advocacy faces social actors (Yi and Gong, 2013; Alexander and Jaakkola, 2014). At present, public transport research on customer engagement behaviours conceptualises them along the distinction of facing social actors or transport providers (Alexander and Jaakkola, 2014). However, it has yet to examine how the satisfaction-engagement relationship plays into this distinction. The findings suggest this distinction may hold some bearing on the satisfaction-engagement relationship in public transport, as the findings show satisfaction relates more strongly to advocacy than feedback intentions or future patronage, by a notable margin. This implication relates to the thesis's eighth contribution (Table 92).

9.2.15 Value-Engagement relationship

The findings have theoretical implications for both services marketing and public transport research on the value-engagement relationship. Firstly, the analysis highlights that customer experience, rather than passenger satisfaction, plays an important role in the value-engagement relationship. No significant value-engagement relationship is present without customer experience. This is highlighted by the lack of significant specific indirect effects between holistic value creation and all three engagement behaviours without customer experience (Chapter 7) (Table 77).

Prior public transport research suggests passenger satisfaction mediates the perceived value-WoM relationship, although this does not include customer experience (Gürler and Ertgurgut, 2018). Thus, this finding extends on public transport research and places customer experience, rather than passenger satisfaction, in the centre of the value-engagement relationship in public transport. This implication is congruent with marketing research that posits customer experience, rather than customer satisfaction, is a key pillar of marketing strategy (Imhof and Klaus, 2019).

Third, the findings highlight the differing roles of value co-creation, holistic value creation and customer experience in the value-engagement relationship. The findings show customer experience more strongly relates to all three engagement behaviours than either value co-creation or holistic value creation.

Fourth, the findings suggest the value-engagement relationship differs between the orientation of engagement behaviours. Alexander and Jaakkola (2014) distinguish engagement behaviours as facing social actors and stakeholders or transport providers in rail services. The value-engagement relationship appears stronger for engagement behaviours facing social actors or stakeholders (i.e. advocacy) than transport providers (i.e. feedback intentions and future patronage). Alexander and Jaakkola (2014) underline that value outcomes differ between the CEBs of influencing and co-design, with the former relating to social value outcomes (e.g. social prestige and expertise signalling) and the latter to more tangible value outcomes (e.g. monetary rewards and accessing better services). Thus, the above trend may emerge from social contexts and their social value outcomes. The above theoretical implications relate to the thesis's eighth contribution (Table 92).

9.4 Summary of main contributions and theoretical implications

The thesis makes several contributions, with significant theoretical implications, to literature on value creation and consumer behaviour in services marketing, as well as public transport research.

9.4.1 Main contributions and theoretical implications for research in services marketing on value creation

Early research in SDL highlights the active role of customers during value creation and service delivery (Vargo and Lusch, 2004; Vargo and Lusch, 2008). This active role emerges

through various processes (i.e. jointly, socially or independently) that contribute to customers' value creation sphere (Grönroos and Voima, 2013), which is coined by the thesis as holistic value creation. However, research has yet to empirically examine holistic value creation, or the relative contributions of its underlying processes. The thesis contributes to filling this gap by estimating holistic value creation as a summation of these processes and shows value co-creation is the dominant contributor, then social value co-creation and independent value creation. This highlights the multi-faceted nature of value creation for customers, which extends beyond interactions with providers to include interactions with social actors and resources.

For social value co-creation, the findings highlight that providers may play an active role in this value creation process, so far only conceptualised in the literature to date (Heinonen et al. 2018; Pandey and Kumar, 2021). For independent value creation, the findings show value from digital self-service forms the strongest contributor for this process. This contributes to literature on value from self-service (Turner and Shockley, 2014; Zainuddin et al. 2016) and suggests digital self-service mechanisms play an important role in customers' independent value creation. The thesis contributes to this research area in three main ways. Firstly, it highlights the multi-faceted nature of value creation, with value co-creation dominating the construct, but it demonstrates that social value co-creation and independent value creation offer significant contributions as well. Secondly, the findings highlight the important role of service providers, and customers' prosocial engagement, during social value co-creation. Thirdly, the findings show the important role of digital self-service during independent value creation. The above insights relate to the thesis's second and third contributions (Table 92).

9.4.2 Main contributions and theoretical implications for research in services marketing on consumer behaviour

This thesis advances a model that connects value creation, customer experience, passenger satisfaction and customer engagement behaviours. It also examines the role of customer experience in the value-satisfaction relationship. The findings show that customer experience fully mediates the relationship between holistic value creation and passenger satisfaction, building on prior research that focuses on specific value constructs and select marketing outcomes (Kuppelwieser et al. 2021; Gürler and Ertgurgut, 2018; Solakis et al. 2021). The findings also show that customer experience more strongly relates to passenger satisfaction than either value co-creation or holistic value creation.

Furthermore, the thesis offers insights into the value-engagement relationship by emphasising customer experience, rather than passenger satisfaction, as central. The findings show customer experience more strongly relates to engagement behaviours than value creation, extending this insight. The value-engagement relationship appears to differ between the orientation of engagement behaviours and to be stronger for those facing social actors and stakeholders than transport providers, thus indicating that the value-engagement relationship holds social nuance. The above insights relate to the thesis's fifth contribution (Table 92).

9.4.3 Main contributions and theoretical implications for research on value creation in public transport services

Value creation research typically focuses on competitive services (e.g. retail, banking) (Ranjan and Read, 2014; Sweeney et al. 2018; Medberg and Grönroos, 2021). In contrast, public transport research on value creation is scarce, and often focuses on specific processes (Gebauer et al. 2010; Alexander and Jaakkola, 2014; Lu et al. 2015). Thus, a main contribution of the thesis is estimating holistic value creation and how it emerges from its underlying processes in public transport, specifically. The thesis also contributes to public transport research via its model comparisons analysis (Chapter 7 – 7.13). This analysis shows value creation as antecedent to customer experience, in relation to passenger satisfaction, to be the most appropriate interpretation in public transport services. This informs future public transport researchers on the most appropriate approach to modelling value creation and customer experience with respect to passenger satisfaction. The above insights relate to the thesis's fourth and seventh contributions (Table 92).

9.4.4 Main contributions and theoretical implications for research on satisfaction and customer engagement behaviours in public transport services

Although public transport research examines these relationships using service quality (Saha and Theingi, 2009; Wu et al. 2011; Dölarslan, 2014; Suki, 2014), it has yet to examine these relationships during value creation. The thesis finds that passenger satisfaction strongly determines advocacy — but only weakly determines feedback intentions and future patronage — during value creation. The findings also highlight a trend in the satisfaction-engagement relationship in terms of the orientation of engagement behaviours. Alexander and Jaakkola (2014) allude to this distinction, but public transport research has yet to consider its impact on the satisfaction-engagement relationship. Social contexts may influence the satisfaction-engagement relationship, as evidenced by the findings. This may derive from the social value

outcomes of engagement behaviours facing social actors and stakeholders in public transport. The above insights relate to the thesis's eighth contribution (Table 92).

9.5 Methodological contributions

The thesis makes several methodological contributions by way of its findings. Firstly, the study shows the feasibility of operationalising value creation holistically for customers, as a representation of their value creation sphere. This represents a significant contribution to services marketing research on value creation, which previously only alludes to value creation holistically (Grönroos and Voima, 2013; Grönroos, 2017). In this regard, the study suggests that holistic value creation represents a formative construct comprising distinct facets (Jarvis et al. 2003). Additionally, the two-stage approach offers a means of estimating holistic value creation, providing collinearity is dealt with in lower-order constructs, as it has been here.

Secondly, the findings offer a means of estimating the relative contributions of each value creation process to customers' holistic value creation. The value creation component of the thesis's model incorporates generalisable scales that are not service specific. Thus, researchers may use it to examine the relative contributions of each value creation process to holistic value creation in other service contexts. These implications relate to the study's second and third contributions (Table 92).

Thirdly, the thesis makes methodological contributions to services marketing research on consumer behaviour by developing and validating an integrative model connecting value creation, customer experience, passenger satisfaction and customer engagement behaviours. Overall, the model shows satisfactory measurement models for all constructs, except negative value-in-use, despite their overlapping natures (De Keyser et al. 2015; Akkesson et al. 2014). Only the satisfaction with travel scale is specific to transport services (Friman et al. 2013; Singleton, 2019). Thus, researchers may readily apply the model to other services contexts to gain a broader understanding of customer behaviours whilst using services. This implication relates to the thesis's first contribution as it derives from its development of an integrative model (Table 92).

9.6 Managerial implications

This section focuses on how rail managers may benefit from the findings via strategic options for supporting co-production, independent value creation and social value co-creation to increase passenger satisfaction. To propose strategic options, this section refers to literature in Chapters 2, 3 and 4. The discussion focuses on how rail managers may integrate experience enablers to support value creation processes and increase passenger satisfaction. Where applicable, the discussion refers to the wider policy implications of recommendations.

9.6.1 Co-production

In public services, co-production refers to co-delivery, as customers support service delivery, and co-design, as customers design service features alongside providers (Osborne et al. 2016). Of these, managers may choose to focus on supporting co-delivery as passengers can offer TOCs real-time updates and aid service delivery (Gebauer et al. 2010; Nunes et al. 2014). For experience enablers, linkages may offer a means of supporting co-delivery. Linkages focus on supporting connections between services events, like transitioning between different modes of transport or different public transport services, to make them fast, easy and seamless (Prahalad and Ramaswamy, 2004) (Figure 46).

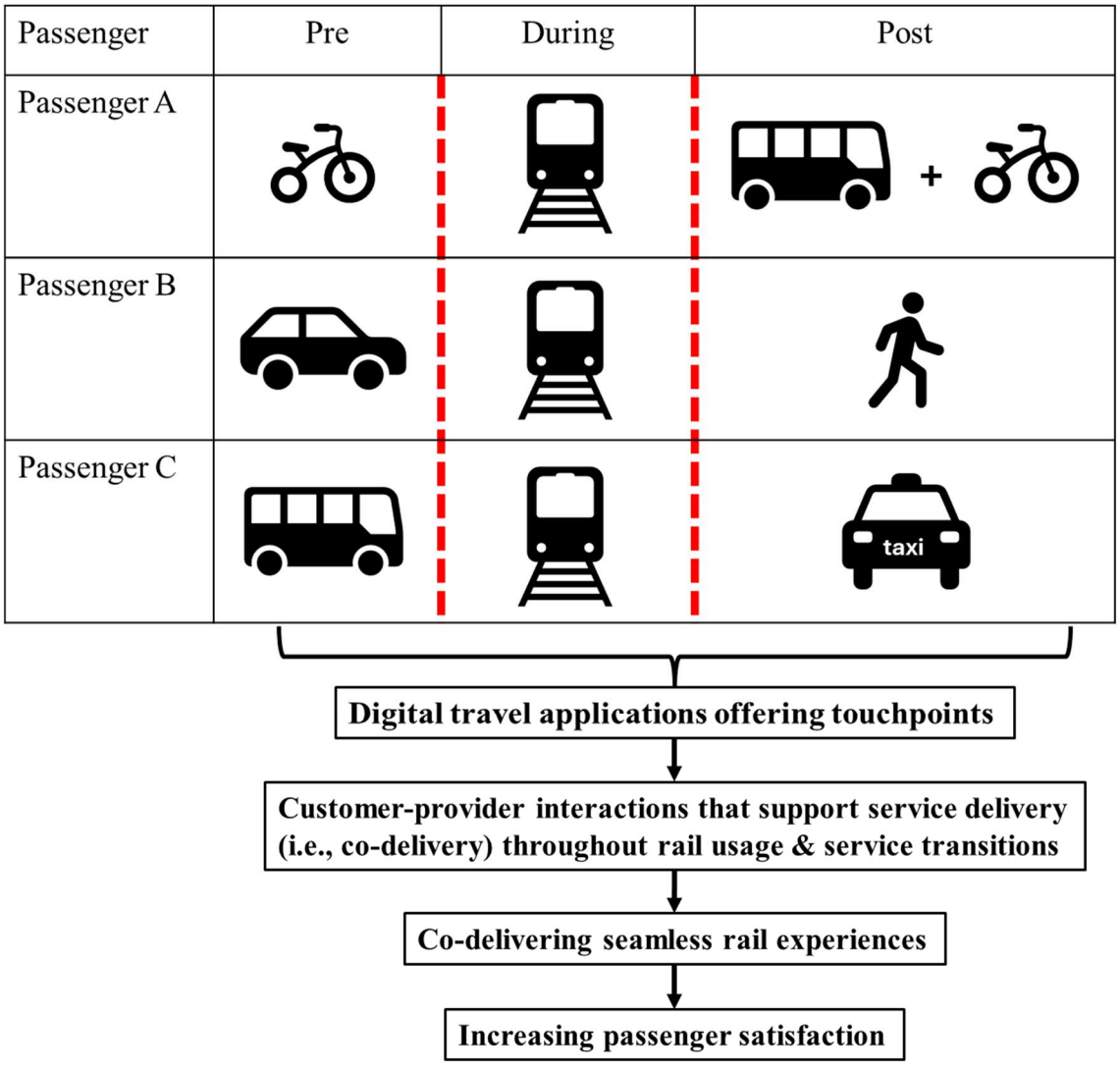
The notion of fast, easy and seamless experiences is in line with passengers' ideal transport experience and it contributes to passenger satisfaction (Stradling et al. 2007). When combining these concepts, managers should aim to allow passengers to support service delivery as they seamlessly transition between service events. This notion resonates with the wider policy ambitions of the Welsh Government that seeks to create a unified network of public transport services in Wales, which has been described as the one network, one timetable, one ticket initiative (Welsh Government, 2022a).

Passenger-provider interactions (i.e. joint interaction) is the strongest contributor to co-production. Developing on the previous point, managers should aim to support passenger touchpoints that enable interactions with providers throughout rail services and during event transitions. Managers should consider embedding these touchpoints into the different interaction contexts passengers encounter whilst using rail services (Prahalad and Ramaswamy, 2004). These interaction contexts drive co-production (Bharti et al. 2015) and particularly co-delivery after service use (Tomasetti et al. 2017). Grönroos (2008) highlights that digital self-service can enable customer-provider interactions outside service use (i.e. pre and post stages). Additionally, public transport research shows digital travel applications can

increase passenger satisfaction by promoting customisable travel experiences (Gebauer et al. 2010; Lu et al. 2015). This last point holds particular importance because personalisation is also the strongest contributor to passengers feeling better off (i.e. positive value-in-use), having used rail services.

Overall, managers should aim to support passengers co-delivering rail services, particularly during seamless transitions between service events. To do this, they might consider integrating passenger-provider touchpoints into the different environments passengers encounter whilst using rail services and as they transition between service events. A potential medium for this is digital travel applications that can promote customisable travel experiences and increase passenger satisfaction (Figure 46).

Figure 46. Different experience environments encountered by passengers, with digital travel applications promoting passenger touchpoints that enable seamless transition experiences and co-delivery



9.6.2 Independent value creation

Independent value creation is a one-sided process where customers use resources (Grönroos and Voima, 2013), particularly via self-service (McCosker et al. 2014; Zainuddin et al. 2016). Research shows value from self-service plays an important role in passengers' journey experience (Lu et al. 2015; Ittamalla and Kumar, 2021) and satisfaction (Gebauer et al. 2010). The study shows that value from digital self-service is the strongest contributor to independent value creation. Managers should focus on this medium of self-service to support passengers' independent value creation and increase satisfaction. An experience enabler that lends itself to supporting digital self-service is granularity, which represents customers reconfiguring value offerings to match their usage preference (Prahalad and Ramaswamy, 2004). When combining these concepts, rail managers should aim to design digital self-service features to be reconfigurable by passengers to better meet their usage needs (Figure 47).

This recommendation may be useful to managers during service recovery where customers can co-recover service outcomes via self-service features (e.g. to report service errors, gain compensation, etc) (Dong et al. 2008). In transport services, co-recovery can increase passenger satisfaction with recovery outcomes (Roggeveen et al. 2011). Its underlying processes are resource provisions, interaction platforms and recovery updates (Tronvoll and Edvardsson, 2019). To support granularity during co-recovery, managers should shape these processes around passengers' preferences whilst using digital self-service to increase satisfaction with recovery outcomes. This recommendation falls in line with TfW's 24-hour chat bot, which offers bilingual instant responses to passenger enquiries (Transport for Wales, 2020a) and may be a readily tailored method for supporting passengers' preferences during co-recovery.

Co-design, a form of co-production in public services (Osborne et al. 2016), may help managers shape these processes around passengers' preferences. For example, passengers show a preference for automatic refund mechanisms (Oliveria et al. 2019) similar to TfW's Delay Repay scheme (Transport Focus, 2020a) and such preferences can help TOCs prioritise potential service improvements (Nalmpantis et al. 2019). Overall, managers should consider making digital self-service features reconfigurable to better meet each passenger's preferences and to increase satisfaction (Figure 47). This recommendation may hold utility for service recovery by shaping co-recovery processes around passenger preferences, increasing their satisfaction with recovery outcomes (

Figure 48).

Figure 47. Illustration of digital travel applications being designed to be reconfigurable by passengers

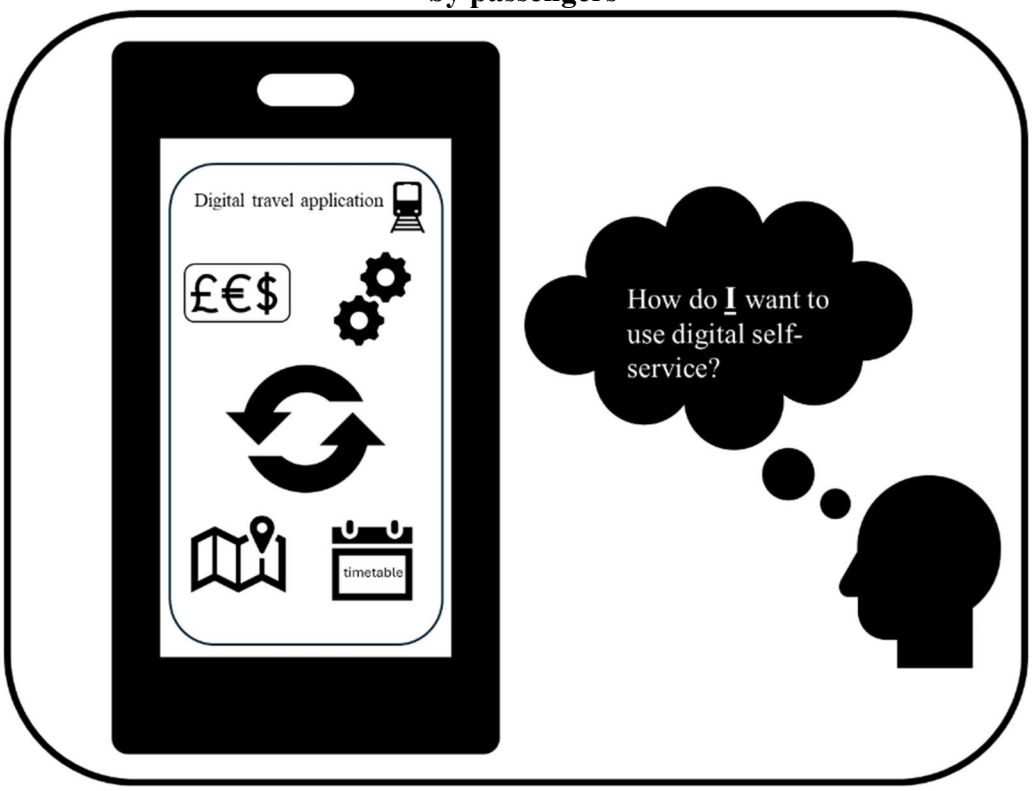
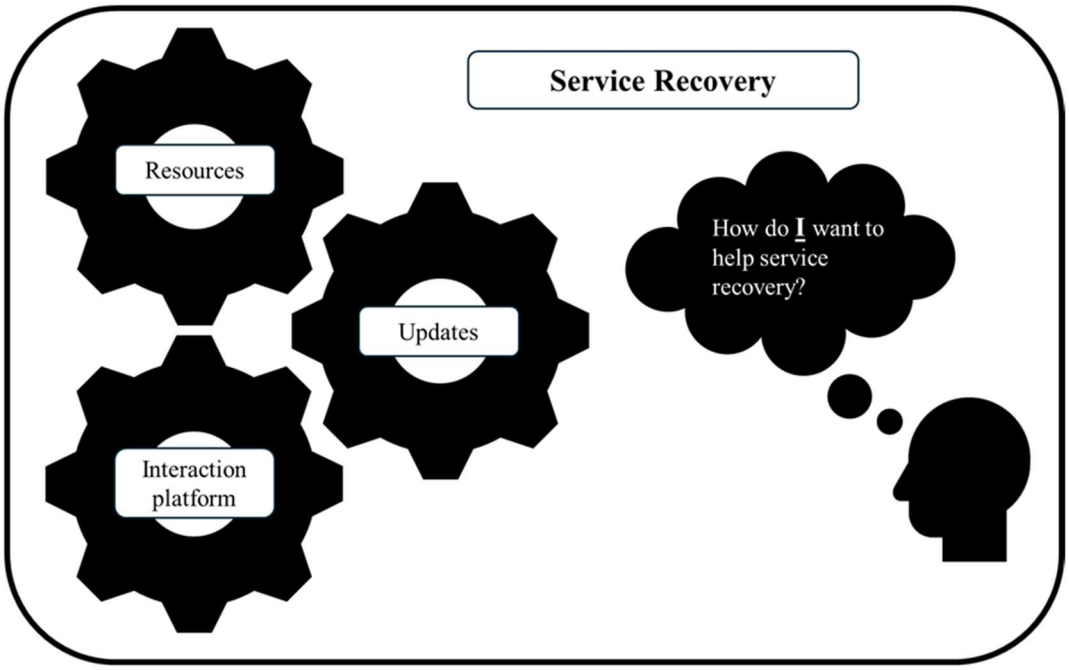


Figure 48. Illustration of configuring service recovery process around passenger preferences



9.6.3 Social value co-creation

Social value co-creation happens when customers interact to create value (Grönroos and Voima, 2013; Grönroos and Gummerus, 2014). In public transport, these interactions can contribute to passengers' value creation and experiences (Gebauer et al. 2010; Lu et al. 2015; Carreria et al. 2013) and increase passenger satisfaction (Ittamalla and Kumar, 2021). The thesis shows that social interaction is the strongest contributor to social value co-creation and involves TOCs allowing enough C2C interactions for service development and passengers' own prosocial attitudes. The experience enabler of extensibility, or exploring how existing service functions can offer novel experiences (Prahlad and Ramaswamy, 2004), may lend itself to supporting social value co-creation. When combining these concepts, managers should aim to encourage interactions between passengers that generate novel rail experiences and increase satisfaction.

Research shows that interactions between passengers can offer novel rail experiences by mobilising resources at a community level (Alexander and Jaakkola, 2014), which TfW Rail already supports (i.e. via an Adopt-A-Station scheme) (Transport for Wales, 2021). Uhrich (2014) shows that interactions between passengers can orientate around external factors like sports games and popular events. Managers should consider integrating passengers' wider social contexts into rail services by closely allying themselves with event

organisers to increase passenger satisfaction (Gebauer et al. 2010). This point is in line with value creation research that underscores the importance of providers recognising their role in customers' wider social ecosystems (Heinonen and Strandvik, 2015; Grönroos, 2017) and wider experience environment (Prahalad and Ramaswamy, 2004). Additionally, this point is in line with the wider policy ambitions of the UK and Welsh Government, which aims to fund grassroots initiatives that increase community engagement in local rail services to promote social and economic development (UK Government, 2020).

Interactions can also offer novel service experiences that increase satisfaction at a more local level. Outside public transport, research on mass service consumption shows the quality of interactions between customers influences the degree to which service experiences increase satisfaction (Kim and Choi, 2016). In public transport, these interactions can offer onboard entertainment for leisure passengers, with environment design like seating options promoting satisfaction in this passenger group (Carreria et al. 2013). As TOCs allowing enough interactions between passengers for service development is a strong contributor to social interaction, managers should consider the role of service environments in promoting passenger-to-passenger interactions that increase satisfaction.

Overall managers should consider both large scale (e.g. Adopt-A-Station scheme, popular events and wider social contexts) and small scale (e.g. environment design) options for promoting interactions between passengers that generate novel service experiences and increase satisfaction.

9.7 Limitations

Research should consider the thesis's findings in the context of the following limitations. First, the thesis examines holistic value creation in terms of its constituent processes. Although best efforts are made to comprehensively capture each process, some conceptual parameters are put in place for social value co-creation and negative value-in-use. For social value co-creation, research shows the process can vary between different conditions and contexts (Uhrich, 2014; Reichenberger, 2017; Rihova et al. 2018; Heinonen et al. 2018). Thus, it is impractical to capture all possible instances in the thesis. Instead, the thesis focuses on public and instrumental interactions between passengers that support rail use, as these are within TOCs' line of visibility. For negative value-in-use, research shows negative value can

emerge under a broad range of dimensions (Leroi-Werelds, 2019), making it impractical to capture all passenger sacrifices. Instead, the thesis focuses on passengers' tangible costs (i.e. monetary costs) and behavioural costs (i.e. emotional costs and time and effort costs) (Plewa et al. 2015; Sweeney et al. 2015).

Second, the thesis uses the EXQ-revised scale to conceptualise customer experience (Kuppelwieser and Klaus, 2021). This supports the model's applicability to other service contexts and incorporates pre, during and post journey stages (Lemon and Verhof, 2016; De Keyser et al. 2020). An alternative option is to use the HPX scale that focuses on rail services specifically (Ittamalla and Kumar, 2021). However, the HPX scale is inappropriate for use in the thesis as it uses service quality dimensions that closely align with value-in-use (Medberg and Grönroos, 2020). This represents a potential theoretical limitation that is justifiable given the thesis's inclusion of both value creation and customer experience.

Third, the thesis adopts quota sampling for its main data collection, with quotas forming around TfW's passenger experience data. This produces an end-sample that largely aligns with TfW's data for journey purpose and census data for age groups, residential settings and regional population density (England and Wales, 2021; Wales, 2021). However, representation issues are present in the dataset, with South-East Wales being under-representative of the region's population density (Wales, 2021).

Fourth, the sample focuses on passengers of TfW in Wales, although a relational criterion includes respondents in England that use TfW's as well (Chapter 5 – 5.5). Additionally, respondents in the thesis's sample may hold specific pre-conceptions of TfW as a rail provider that is not representative of other train operating companies. Thus, the sample holds limitations for representing passengers of other train operators, or passengers outside the thesis's sampling frame. Next, although concerted efforts were made to avoid rail strikes during data collection, significant differences are present between respondents in the first and last quartiles for engagement behaviours. This was not present for indicators of value creation processes, which represents the thesis's focus. Lastly, despite considerable efforts to support survey engagement from respondents, a large proportion either did not finish or showed poor quality responses, with the latter having notably shorter response times than the pilot study. A review of these responses show the issue is consistent across all sources, but is particularly acute for TfW's passenger panel, and after omission all scales show satisfactory psychometrics (Chapter 6 – 6.2).

Fifth, the end sample satisfies the minimum sample size according to multiple research standards (Hair et al. 2014; Kock and Hadya, 2016) and shows satisfactory measurement and structural models for almost all constructs (Hair et al. 2019). This supports the empirical validity of the thesis's analysis, and the model satisfies standards for assessing model quality during PLS-SEM (Shmueli et al. 2016). However, two limitations are present in the thesis's statistical analysis. The only construct that does not hold a satisfactory measurement model is negative value-in-use. This may be attributable to collinearity in the construct, although collinearity measures are below possible collinearity thresholds. Alternatively, the lack of satisfactory measurement model for negative value-in-use may be attributable to the construct itself not summating to a single higher-order construct, per the earlier discussion.

Lastly, sixth, some potential collinearity issues are present between co-production and positive value-in-use. The analysis opts to retain these indicators to offer theoretical and managerial contributions, and to test respective hypotheses, given only potential collinearity was present between the indicators. Despite the above limitations, the PLS-SEM analysis strongly adheres to research guidelines and shows adequate model quality (Shmueli et al. 2016; Hair et al. 2019).

9.8 Directions for future research

The findings offer multiple avenues for future research. Firstly, research should assess the generalisability and replicability of the thesis's findings in terms of other types of rail services (e.g. high-speed rail) and transport mediums (e.g. buses, trams). Additionally, researchers should assess the generalisability and replicability of the thesis's findings in other geographical areas, where perceptions of public transport may be different to Wales and the UK. By doing so, researchers may examine the extent relationships in the model are generalisable across transport mediums and different cultures. This recommendation extends to researchers outside public transport services. As the model mostly uses generalisable scales, only minimal modifications should be needed to be applicable to other service contexts (e.g., retail, finance, etc).

The second recommendation relates to future research on negative value-in-use. Prior research examines the construct in terms of its underlying dimensions in relation to marketing

outcomes (Plewa et al. 2015; Sweeney et al. 2018). Research has yet to conceptualise it in terms of higher-order constructs like positive value-in-use (Ranjan and Read, 2014). The findings suggest negative value-in-use may not summate to a single higher-order construct, but instead represents distinct tangible and behavioural facets. Thus, future research should consider conceptualising negative value-in-use in terms of customers' tangible and intangible sacrifices.

The third recommendation is for researchers to further examine the role of customer experience in the value-satisfaction and value-engagement relationships. The thesis estimates customer experience using its own latent variable score, to mitigate collinearity, and is unable to examine how its lower-order dimensions contribute to the construct's role in these relationships. Future research should examine how these underlying dimensions, or others like cognitive and emotional experiences (Ittamalla and Kumar, 2021), contribute to the role of customer experience in the value-satisfaction and value-engagement relationships.

Fourth, research should further examine the trend for the satisfaction-engagement and value-engagement relationships to differ between the orientation of engagement behaviours. The findings show both relationships to be stronger for engagement behaviours facing social actors or stakeholders versus transport providers. This suggests the relationship may hold social nuance. Thus, research in services marketing and public transport should ascertain the extent to which this trend is apparent in other service contexts and transport mediums, respectively.

9.9 Conclusion

The main objectives of the thesis were as follows: to examine how passengers' value creation processes relate to holistic value creation; to examine how holistic value creation relates to satisfaction and the role of customer experience in this relationship; and to examine how passenger satisfaction relates to engagement behaviours in public transport. Alongside these aims, the thesis also examines the role of customer experience in the value-engagement relationship. To achieve these aims, the thesis develops and empirically tests a conceptual model that links value creation, customer experience, passenger satisfaction and three engagement behaviours.

The findings show that all value creation processes, except negative value-in-use, significantly contribute to rail passengers' holistic value creation. Value co-creation most strongly contributes to holistic value creation, and then social value co-creation and independent value creation. This empirically emphasises the multi-faceted nature of value creation for customers, and specifically public transport passengers. Customer experience fully mediates the relationship between holistic value creation and passenger satisfaction. Passenger satisfaction most strongly relates to advocacy, then future patronage and feedback intentions. This may suggest the satisfaction-engagement relationship is stronger for engagement behaviours facing social actors or stakeholders versus transport providers, which may relate to social contexts in the case of the former.

The results also show that customer experience, rather than passenger satisfaction, plays a central role in the value-engagement relationship. Customer experience more strongly relates to all engagement behaviours than holistic value creation and value co-creation. This further emphasises the importance of customer experience in the value-engagement relationship. Similar to the satisfaction-engagement relationship, the value-engagement relationship appears stronger for engagement behaviours facing social actors or stakeholders versus transport providers. This, too, may relate to the social contexts in which social actors are enmeshed.

This thesis highlights the multi-faceted nature of passengers' holistic value creation as they interact with providers, other passengers and self-service mechanisms. Its findings accentuate the integral nature of customer experience in both value-satisfaction and value-engagement relationships in public transport. These insights, along with the thesis's model, may apply to other service contexts and transport mediums to offer a broader understanding of service use from the perspective of customers and passengers, respectively. Additionally, these insights, along with the thesis's model, hold practical insights for service providers and transport operators by offering a broader perspective on customers and passengers' behaviours, respectively.

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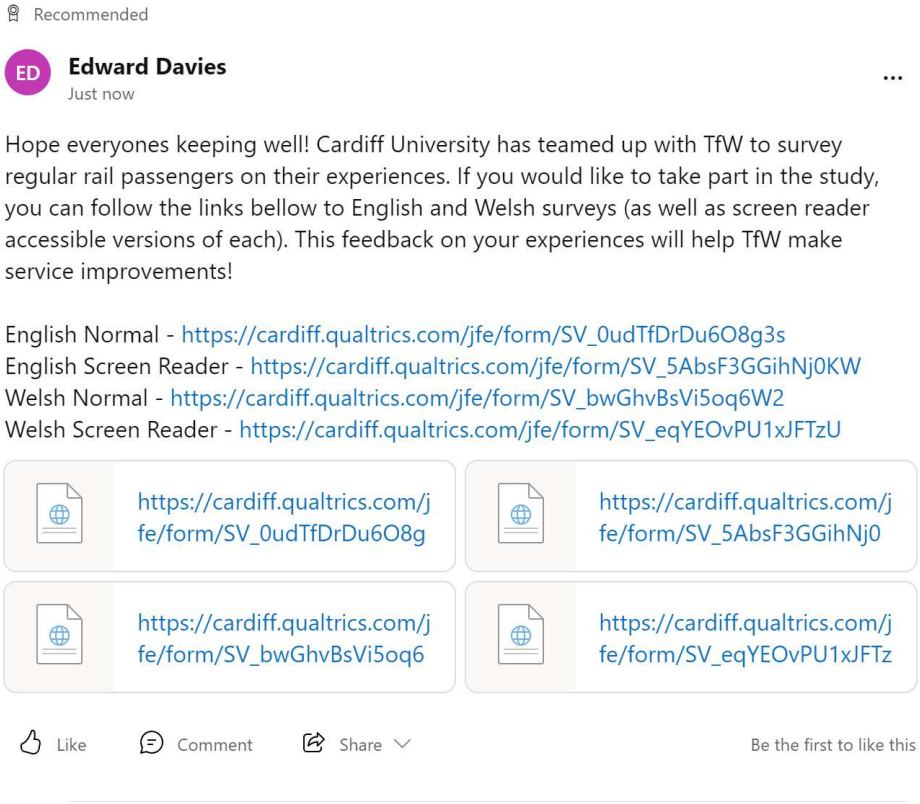
Appendices

Appendix 1. Distribution of survey for pilot data collection on Yammer to Cardiff University students



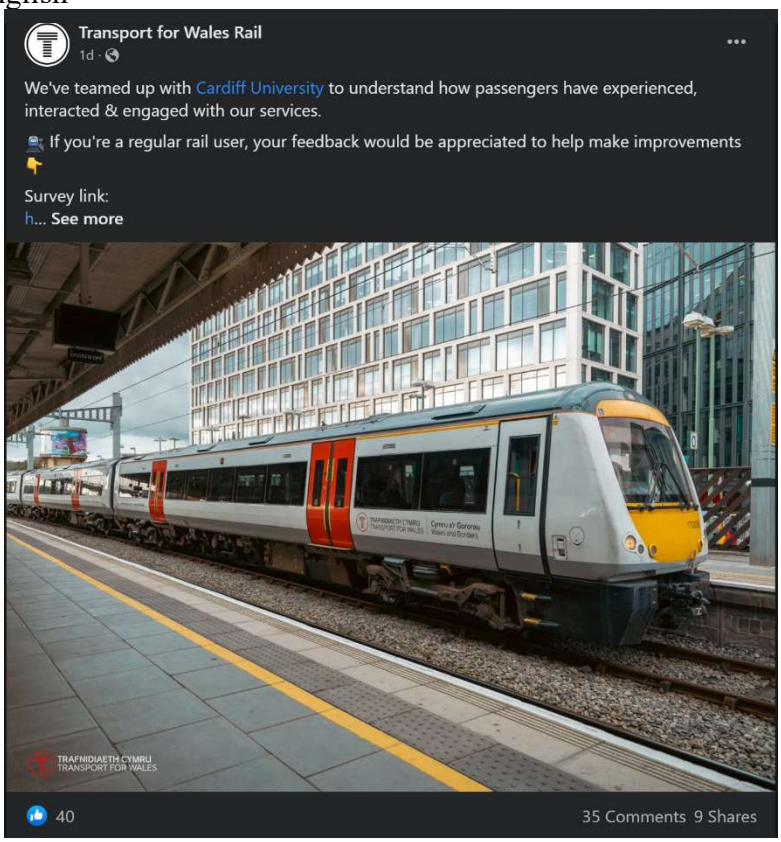
Appendix 2. Distribution of survey for main data collection by Traveline Cymru on Facebook in Welsh

Appendix 3. Distribution of survey for main data collection by Traveline Cymru on Facebook in English

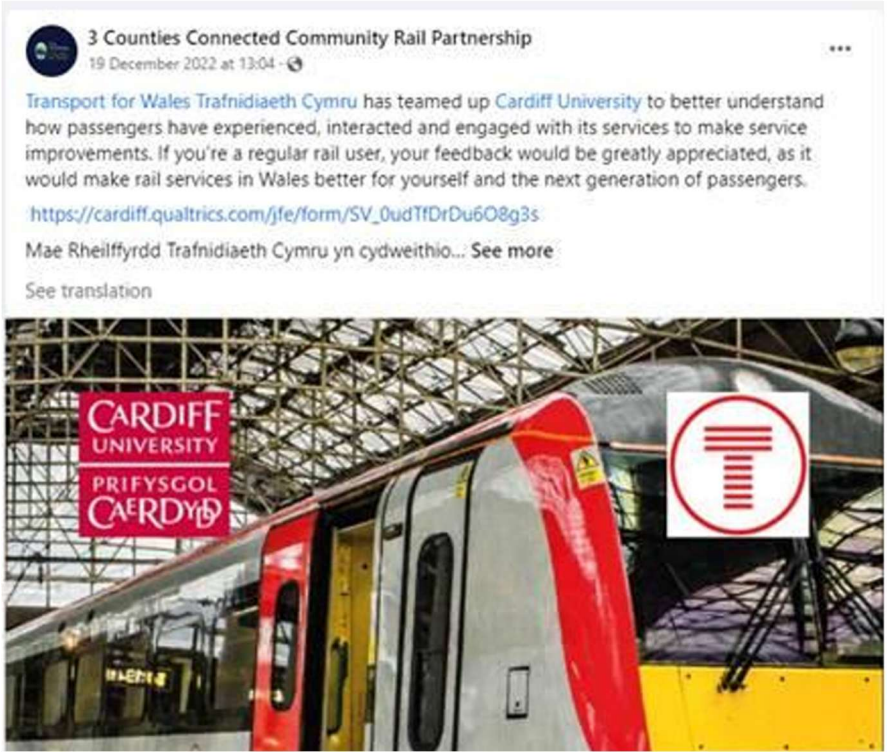
Appendix 4. Distribution of survey for main data collection by Traveline Cymru on Twitter in Welsh

Appendix 5. Distribution of survey for main data collection by Traveline Cymru on Twitter in English

Appendix 6. Distribution of survey for main data collection by Transport for Wales on Facebook in English



Appendix 7. Distribution of survey for main data collection by 3 Counties Connected Community Rail Partnership on Facebook in English



Appendix 8. Distribution of survey for main data collection by Heart of Wales passenger community group via its digital newsletter in English. Link to survey in bottom left corner

Welcome

Welcome to your Winter newsletter from the Heart of Wales Line.

Thank you to Helen Pryor for this wonderful picture of Cynghordy Viaduct amongst the glistening fields of snow. Here is the latest news from the Hear Wales Line. We wish all our passengers, supporters and local communities Merry Christmas and a Happy New Year. Nadolig Llawen a Blwyddyn Nev Oda.

Heart of Wales Line sees additional services in the new December timetable

We are pleased to announce that from 11th December the Heart of Wales Line will benefit from an extra return service (Monday-Saturday) between Swansea and Shrewsbury.
Read More

Walking the Trail as a solo female walker

Michelle Gollins recently comple the Heart of Wales Line Trail as solo female walker, here is Mich account of becoming a solo fema walker and her experience on th Heart of Wales Line Trail.
Read More

Sugar Loaf holds its title as Least Used Station in Wales

The remote Sugar Loaf railway station has been named the least used station in Wales according to the annual estimated station usage report released by the Office of Rail and Road.
Read More

Llanelli Railway Goods Shed – Have your say!

Llanelli Railway Goods Shed Trust (LRGST) are working on a funding application to the Big Lottery Fund to create and develop jobs and services for the community based at the Goods Shed.
Read More

Passenger feedback wanted in survey by Transport for Wales Rail and Cardiff University

Transport for Wales (TfW) Rail and Cardiff University have collaborated to look at passenger experience with rail services in Wales.
Read More

Full steam ahead for Partnership that won a Community Rail Award

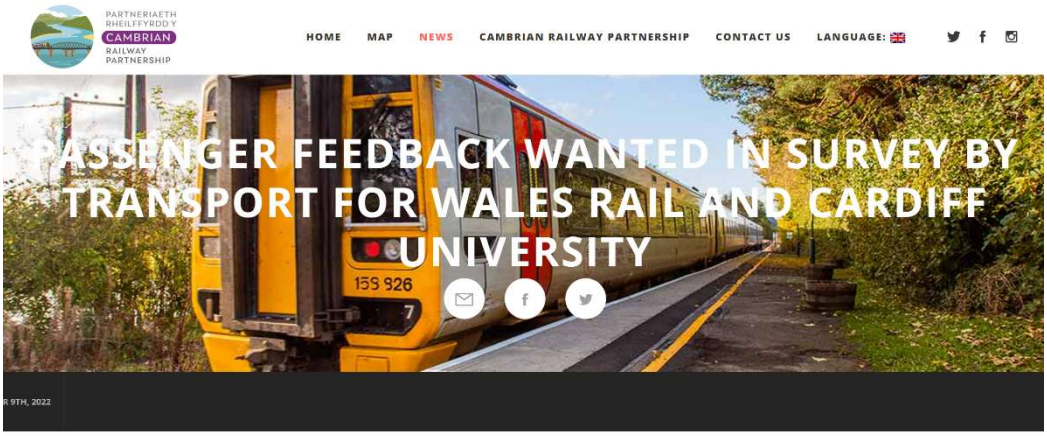
Congratulations to Wales on Rails who won at The Community Rail Awards in the tourism and leisure category.
Read More

Appendix 9. Distribution of survey for main data collection by Heart of Wales passenger community group on its website in English

Passenger feedback wanted in survey by Transport for Wales Rail and Cardiff University

rebecca.butcher • Dec 11, 2022

Appendix 10. Distribution of survey for main data collection by Conwy Valley and North West Wales Coast Community Rail Partnership on its website in English



TfW Rail and Cardiff University have collaborated to look at how passengers have experienced, interacted and engaged with rail services in Wales. The aim of this collaboration is to guide service improvements to directly support passengers needs. If you're a regular rail user, your feedback would be greatly appreciated.

The survey will ask you about how you have experienced TfW rail services at different journey stages and how you have interacted with rail services (e.g. with personnel, other passengers and self-service features). Additionally, the survey will ask you about how satisfied you are with rail services and your attitudes towards engaging with it (e.g. using rail services in the future). By looking at how these topics relate to each other, TfW will be able to develop strategies that

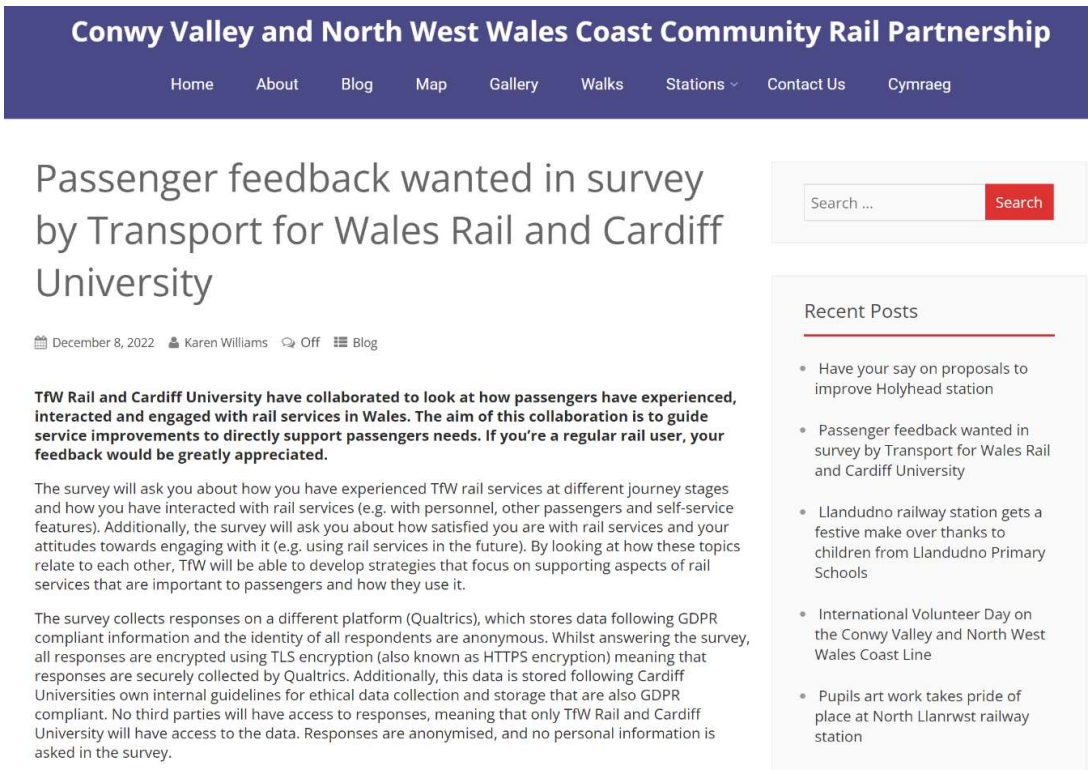
Search for ...

Recent Posts

Passenger feedback wanted in survey by Transport for Wales Rail and Cardiff University

Railway partnership secures funding to

Appendix 11. Distribution of survey for main data collection by Cambrian Railway Partnership on its website in English



Appendix 12. Promotional Message for survey distribution in English and Welsh

"Transport for Wales has teamed up Cardiff University to better understand how passengers have experienced, interacted and engaged with its services to make service improvements. If you're a regular rail user, your feedback would be greatly appreciated, as it would make rail services in Wales better for yourself and the next generation of passengers."

"Mae Rheilffyrdd Trafnidiaeth Cymru yn cydweithio â Phrifysgol Caerdydd i gael gwell dealltwriaeth o sut mae teithwyr wedi defnyddio eu gwasanaethau, a'u profiad ohonynt, er mwyn gwella gwasanaethau. Os ydych yn defnyddio trenau yn rheolaidd, byddem yn"

Appendix 13. Co-production from the perspective of De Keyser et al.'s (2020) touchpoint analysis in terms of firm controlled, human and digital touchpoints at pre, purchase and post-purchase stages

Nature - Human, Physical, Digital	Quality - Participation (passive Vs active), Valence (pos / neg), Time flow (short / long)	
Pre-purchase (Nature, Quality)	Purchase	Post-Purchase
Human Touchpoints	Human Touchpoints	Human Touchpoints
TfW Ticket Staff / Customer Information Services - B2C (Human, pos / neg, active participation, short)	TfW Frontline (e.g. Stations, platforms) Personnel - B2C (Human, pos / neg, active participation, short / long)	TfW Phone - B2C (Human, pos / neg, active participation, short)
TfW Phone - B2C (Human, Pos / Neg, active participation, short)	TfW Customer Information Centre Personnel - B2C (Human, pos / neg, active participation, short)	
	TfW Auxiliary (e.g. Security, cleaning) Personnel - B2C (Human, pos / neg, passive participation, short)	
Digital Touchpoints		Digital Touchpoints
TfW Email - B2C (Digital, post / neg, active participation, short)		TfW Email - B2C (Digital, post / neg, active participation, short)
TfW Social Media (Facebook, Twitter, Instagram, WhatsApp) - B2C (Digital, pos / mostly neg, active participation, short)		TfW Social Media (Facebook, Twitter, Instagram, WhatsApp) - B2C (Digital, pos / mostly neg, active participation, short)
Customer Panel (Sgwrs) - B2C (Digital, active participation, pos / neg, short / long)		Customer Panel (Sgwrs) - B2C (Digital, active participation, pos / neg, short / long)

Source: this study

Appendix 14. Independent value creation from the perspective of De Keyser et al.'s (2020) touchpoint analysis in terms of firm controlled, physical and digital touchpoints at pre, purchase and post-purchase stages

Nature - Human, Physical, Digital	Quality - Participation (passive Vs active), Valence (pos / neg), Timeflow (short / long)	
Pre-purchase (Nature, Quality)	Purchase	Post-Purchase
Human Touchpoints	Human Touchpoints	Human Touchpoints
Physical Touchpoints	Physical Touchpoints	Physical Touchpoints
Digital Touchpoints • Capacity Checker (passive, pos / neg, short) • Timetable Info (passive, pos / neg, short) • TfW Travel App (passive, pos / neg, short / long)	• Station Signage (passive, pos / neg, short) • Connections to other Public Transport (passive, pos / neg, short / long) • Disabled Accessibility (e.g. ramps) (active, pos / neg, short / long) • ATM (Automated Ticket Machines) (active, pos / neg, short) • Wifi (passive, pos / neg, short) • Toilets (passive, pos / neg, short) • Station-Platform-Train Step (passive, pos / neg, short) • Car Parking (passive, pos / neg, short / long) • Additional Station Facilities (e.g. Shops) (active, pos / neg, short / long) • Ticket Gates (passive, pos / neg, short) • Cleanliness (Station, Platform, Train) (passive, pos / neg, short / long) • Comfort (Station, Platform, Train) (passive, pos / neg, short / long) • Service / Fare Ratio (passive, pos / neg, short / long) • Information Services (passive, pos / neg, short / long)	Digital Touchpoints • Delay Repay (digital, active, neg, short) • unidirectional feedback mechanisms (e.g. happy / sad face buttons)
	Digital Touchpoints • Timetable Info (passive, pos / neg, short) • TfW Travel App (passive, pos / neg, short / long) • TfW Website (Travel Updates) (passive, pos / neg, short)	

Source: this study

Appendix 15. Social value co-creation from the perspective of De Keyser et al.'s (2020) touchpoint analysis in terms of non-firm controlled, human, physical and digital touchpoints at pre, purchase and post-purchase stages

Nature - Human, Physical, Digital	Quality - Participation (passive Vs active), Valence (Pos / Neg), Time flow (Short / Long)	
Pre-purchase (Nature, Quality)	Purchase	Post-Purchase
Human Touchpoints	Human Touchpoints	Human Touchpoints
• Friends, Family, Social Acquaintances (active / passive, pos / neg, short / long) • Passenger Communities	Other Passengers (active / passive, pos / neg, short)	• Friends, Family, Social Acquaintances (active / passive, pos / neg, short / long --> Feeds back into Pre-purchase)

Physical Touchpoints	Physical Touchpoint
	Adopt-A-Station Scheme (physical, passive / active, pos / neg, short / long)
Digital Touchpoints	
Customer Panel (Sgwrs) - C2C (Digital, active)	
Passengers' social media content (may / may not use TfW social media platforms) - Seeking / Sharing - Digital, active / passive, pos / neg, short / long)	

Source: this study

Appendix 16. Information Sheet and Briefing Form

PARTICIPANT INFORMATION SHEET & BREIFING

An exploration of rail passengers' experiences and value creation processes

You are being invited to take part in a research project. Before you decide whether or not to take part, it is important for you to understand why the research is being undertaken and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish.

Thank you for reading this.

1. What is the purpose of this research project and why have you been invited?

The purpose of this research project is to **explore how TfW's passengers have experienced its rail services**. By analysing these experiences, the study aims to help TfW's to incorporate these experiences into its rail services. As a rail passenger of TfW, you have been invited to take part to share your experiences. **Your participation is highly valuable, as your feedback will improve rail services throughout the country both for yourself and the next generation of passengers**.

2. Do I have to take part?

You do not have to take part, and your **participation is entirely voluntary**. If you decide to take part, the research project will be discussed in this information sheet that also contains the briefing and you will be asked to sign a consent form. If you **decide not to take part, you do not have to explain your reasons** and it will not affect your legal rights. If you are a **student at Cardiff University**, choosing **not to participate** in this research project will **not affect** your **education or progression through your degree course**. During the project you are **free** to **withdraw your consent** to participate at any time without giving a reason **even after signing** the **consent form and after completing the questionnaire**, resulting in your data being removed from the study.

3. What will taking part involve?

Taking part will take **no long than 30 minutes** and will involve **filling out a questionnaire** that will ask **you screening questions** to assess your eligibility, your **background demographics** and your **personality characteristics**. Next, the questions will ask about: your **experiences of TfW's rail services**; the different **types of interactions** during your rail journey; your perceptions of **rail services** being **useful**; your **satisfaction with rail services** and different forms of **engagement with TfW** beyond just using rail (e.g. giving feedback). As this is a questionnaire, you will not be recorded as you give your answers.

4. Will I be paid for taking part, and what are the possible benefits and risks of participating?

You will receive a **£5 Love2Shop voucher, and receiving this voucher does not affect your right to withdraw).** Outside of this, you will not benefit financially from your participation, but you will help TfW to **improve its services**, enabling passengers across Wales to benefit from your participation. There are **no risks to participating** in this study.

5. Will my participation be kept confidential?

All information will be kept **confidential** by being stored following data protection legislation (**GDPR compliance**) and **no personal information (name, address, etc) will be collected.** Additionally, all responses will be anonymised by **participants** being assigned a **randomised code** to ensure the **anonymity of your identity**. If you decide to receive a voucher, your **email address will not** be **linked** to your **responses**, maintaining your anonymity, and your **email address** will be **deleted** once vouchers are sent out after data collection finishes.

Although the current project **will not be collecting any personal data**, Cardiff University is the Data Controller and is committed to respecting and protecting your personal data in accordance with your expectations and Data Protection legislation. Further information about Data Protection, including:

- your rights
- the legal basis under which Cardiff University processes your personal data for research
- Cardiff University's Data Protection Policy
- how to contact the Cardiff University Data Protection Officer
- how to contact the Information Commissioner's Office

may be found at https://www.cardiff.ac.uk/public-information/policies-and-procedures/data-protection

If you do not have access to the internet, printed copies of the above-mentioned documentation and privacy notices are readily available from the researcher.

Summary results of the questionnaire will be **shared** with **TfW Rail** to help with **service improvements**. Following Cardiff Universities guidelines regarding non-clinical data, your **anonymised responses** may be **retained** for **upto 5-years**.

If you choose to **withdraw** from the study **after completing** the questionnaire, your **anonymised code and responses** will be **deleted** from the data set. If, however, the decision to withdraw from the study occurs after summary results have been published, it will not be possible to remove your anonymised responses from these publications, but they can be removed from future publications.

6. What happens to the data at the end of the research project and when will it be published?

Your **anonymised responses** will **not be available** to the **general public** and will **only** be **accessible** to **designated researchers** providing **ethical approval** has been **granted**. The summary results of the study will likely be published in 2024 in **academic journals and conferences**. **Participants will not** be **identifiable** in any of these reports, publications, or presentations.

7. What if there is a problem, who is organising and funding the research and who is reviewing it?

Any complaints can be forwarded to the **main researcher (Mr J P Edward Davies)**, and these will be reviewed by themselves and their supervisors. If you feel that your **complaint** has **not** been **handled satisfactorily**, you may also **contact** a **party independent** of the research team (e.g. the **Chair of the School Research Ethics Committee** – bosangitc@cardiff.ac.uk).

The research is organised by the **Business School** in Cardiff University and funded by the ESRC (Economic Social Research Council). The primary student researcher is Mr J P Edward Davies and the academic supervisory team are Professor Mirella Yani-de-Soriano, Dr Nicole Koenig-Lewis and Professor Andrew Potter. The research is currently funded by the Economic Social Research Council (ESRC).

The project has been reviewed and given a favourable opinion by the **Business School Research Ethics Committee, Cardiff University**.

Should you have any questions relating to this research project, you may contact us during normal working hours:

Mr J P Edward Davies
Email: DaviesJP12@cardiff.ac.uk

Thank you for considering taking part in this research project. If you decide to participate, you will be given a copy of the Participant Information Sheet and a signed consent form to keep for your records.

To show our **appreciation** for you will receive a £5 Love2Shop voucher that will be sent out upon data collection finishing by 15th March 2023.

Receiving this voucher will **not negate** your **right** to **withdraw** yourself or your data from the study, either during or after completing the study.

This research is conducted by:

J. P. Edward Davies

PhD Student, Cardiff Business School,

Cardiff University, UK

Main supervisor for this research is:

Prof. Mirella Yani-de-Soriano

Professor of Marketing

Cardiff Business School, Cardiff University, UK

E-mail: yani-de-sorianoM@cardiff.ac.uk

Appendix 17. Survey Consent Form

CONSENT FORM

Research Project Title: An exploration of rail passengers' experiences and value creation processes.

SREC reference and committee: 851

Name of Chief/Principal Investigator: J. P. Edward Davies

	Please initial box
I confirm that I have read the information sheet dated …… for the above research project.	
I confirm that I have understood the information sheet dated ……. for the above research project and that I have had the opportunity to ask questions and that these have been answered satisfactorily.	
I understand that my participation is voluntary and I am free to withdraw at any time without giving a reason and without any adverse consequences (e.g. to medical care or legal rights, if relevant).	
I understand who will have access to my responses, how the data will be stored and what will happen to the data at the end of the research project.	
I understand that after the research project, anonymised data will be stored for upto 5 years and may be used for purposes on different research projects following ethical approval. I understand that it will **not be possible to identify me from this data** that is seen and used by other researchers, for ethically approved research projects, on the understanding that confidentiality will be maintained.	
I understand how the findings and results of the research project will be written up and published.	
I agree to take part in this research project.	

Q1. Do you consent to participating in the study?

- ○ Yes
- ○ No

Appendix 18. Survey Instructions

Questionnaire Instructions

The questionnaire consists of different questions each having a set of statements or options.
For each statement, **please select a number that best describes the extent you agree with the statement or your thoughts and feelings regarding the question**. Please answer all the information truthfully and as fully as possible.
It will begin with screening questions**,** then questions on your general demographics, personality characteristics and rail usage.
Then, after filling out these questions, the questionnaire will begin.
Please answer all questions based upon your rail journeys overall in the last 30 days and if you have not used TfW rail services in this time-period answer questions based upon your most recent journey.
All we are interested in is the **number** that **best shows your attitudes or behaviours**. For each question, please make a separate and independent judgement.
Please answer all the information truthfully and as fully as possible. There are no right or wrong answers, but if you do not wish to answer any question then just leave it question blank.
Additionally, please make sure to **answer questions based upon using TfW's rail services specifically** rather than any other rail service provider (e.g. Great Western Railway).
There are no right or wrong answers, but if you do not wish to answer any question then just leave it question blank.

Appendix 19. Survey Prompt

Please **answer** questions based on your **experiences** of **TfW's Rail specifically** (and not other train operators).

Please try to **finish** the **questionnaire** (8 parts taking approximately 20 minutes) as **complete responses** are **needed** for the study.

Please base your answers on your **journeys overall** in the **last 30 days** or your **most recent journey** if you have **not travelled** in this **time-period**.

Appendix 20. Survey Questions

Part 1 / 8: About your Journey.
Q4. On weekdays generally what was the purpose of your journey? (If more than one answer applies, please choose your most common purpose)

- ○ Weekday Leisure
- ○ Weekday Commuter
- ○ Weekday Business (e.g. work travel outside daily commute)
- ○ I did not use weekday rail services

Q5. Did you commonly travel at peak (before 9:30am) or off-peak (9:30am – 4:00pm / 6:30pm+) times on weekdays? (If more than one answer applies, please choose your most commonly travelled time period).

- ○ Peak times
- ○ Off-Peak Times

Q6. How frequently did you travel on weekdays?

- ○ Less than 1 day per month
- ○ 1 day per month
- ○ 1-3 days per month
- ○ 1-2 days per week
- ○ 3-5 days per week

Q7. On weekends generally what was your purpose of your journey? (If more than one answer applies, please choose your most common purpose of journey on weekends)

- ○ Weekend Leisure
- ○ Weekend Commuter
- ○ Weekend Business (e.g. work travel outside daily commute)

Q8. On weekend services, how frequently did you travel?

- ○ Less than 1 day per month
- ○ 1-2 times per weekend
- ○ 3-4 times per weekend
- ○ 5+ times per weekend

Q9. What setting do you live in?

- ○ Rural
- ○ Village
- ○ City / Town

Q10. What region do you commonly travel in? (if more than one, state the most common one)

- ○ South-East Wales
- ○ South-West Wales
- ○ Mid-Wales
- ○ North-East Wales
- ○ North-West Wales
- ○ Wales or England Border areas

Q11. Do you commonly travel on South Wales Valley's routes? (e.g. Cardiff to Rhymney or vice vera)

- ○ Yes
- ○ No

Q12. How did you find this survey?

- ○ TfW's Rail (social media, professional network)
- ○ Transport Focus / Rail Future
- ○ Traveline Cyrmu
- ○ Community Rail Passengers Association (e.g. South-West Wales Connected, Heart of Wales, Groundworks North Wales, etc.)
- ○ Higher Education Institute / Organisation (E.g. Cardiff University, Swansea University, etc.)
- ○ TfW's Rail Accessibility Panel

Part 2 / 8: Your Experiences of TfW's rail services.
Q13. What are your experiences of TfW's rail services? To what extent do you agree with each statement?

	Strongly disagree (1)	Moderately disagree (2)	Disagree a little (3)	Neither agree nor disagree (4)	Agree a little (5)	Moderately agree (6)	Strongly agree (7)
TfW has a good reputation. (1)	○	○	○	○	○	○	○
I am confident in the expertise of TfW and its personnel. (2)	○	○	○	○	○	○	○
TfW and its personnel gives effective advice on how to make rail services best suit my needs (e.g. advice on	○	○	○	○	○	○	○

train times, railcards, etc.). (3)							
I use TfW not only because of the price. (4)	○	○	○	○	○	○	○
The personnel who work at TfW represent their brand well. (5)	○	○	○	○	○	○	○
TfW's rail services are good quality. (6)	○	○	○	○	○	○	○
TfW and its personnel advises(d) me throughout their services (e.g. advice on train times, railcards, journey disruption, etc.). (7)	○	○	○	○	○	○	○
Dealing with TfW and its personnel is easy. (8)	○	○	○	○	○	○	○
TfW and its personnel keeps me informed. (9)	○	○	○	○	○	○	○
TfW and its personnel are flexible when dealing with me. (10)	○	○	○	○	○	○	○

I always deal with the same personnel at TfW. (11)	○	○	○	○	○	○	○
TfW's personnel can relate to my wishes and concerns. (12)	○	○	○	○	○	○	○
The personnel I deal with at TfW have good people skills. (13)	○	○	○	○	○	○	○
TfW and its personnel delivers good customer service. (14)	○	○	○	○	○	○	○
I have built a personal relationship with the personnel at TfW. (15)	○	○	○	○	○	○	○
TfW's online (e.g. TfW's travel app, capacity checker, etc.) and/or offline (e.g. station timetables, real-time announcements, disabled access, seating availability, etc.) services are as efficient as possible for me. (16)	○	○	○	○	○	○	○

I feel that at TfW they know me. (17)	○	○	○	○	○	○	○
TfW knows exactly what I want. (18)	○	○	○	○	○	○	○
TfW keeps me up-to-date about their latest services. (19)	○	○	○	○	○	○	○
TfW and its personnel will look after me in the long run. (20)	○	○	○	○	○	○	○
TfW and its personnel deal(t) with me well when things go / went wrong. (21)	○	○	○	○	○	○	○
I am happy with TfW's rail services. (22)	○	○	○	○	○	○	○
Using TfW's rail services gives me social approval. (23)	○	○	○	○	○	○	○

Part 3 / 8: Your interactions with TfW's rail services & other passengers
Q14. What are you attitudes to interating with TfW or its personnel during rail services. To what extent do you agree with each statement?

	Strongly disagree (1)	Moderately disagree (2)	Neither agree nor disagree (3)	Moderately agree (4)	Strongly agree (5)
TfW was open to my ideas and suggestions about existing rail services or developing new rail services. (1)	○	○	○	○	○
TfW provided enough illustrations and information to me (e.g. route maps, timetables, signage, etc.). (2)	○	○	○	○	○
I would be willing to spare time and effort to share my ideas and suggestions with TfW or personnel to improve rail services. (3)	○	○	○	○	○
TfW offered a suitable environment and opportunity to give suggestions and ideas. (4)	○	○	○	○	○
TfW or its personnel had easy access to	○	○	○	○	○

information about my preferences (e.g. how I have used or like to use rail services). (10)					
TfW's rail services are how I wish them to be. (8)	○	○	○	○	○
TfW considered my role to be as important as its own during rail services. (11)	○	○	○	○	○
I could conveniently state what I need(ed) during dialogue with TfW or its personnel. (7)	○	○	○	○	○
TfW's personnel gave passengers the relevant information during dialogue. (9)	○	○	○	○	○
TfW or its personnel allowed enough interactions with passengers during dialogue (i.e. for improving rail services, marketing, etc). (5)	○	○	○	○	○

To get the most from rail services I had to actively engage in dialogue with TfW or its personnel (i.e., I have to apply my skills, knowledge, time, etc.) (6)	○	○	○	○	○

Q15 What are your attitudes to interactions with other passengers during rail services? To what extent do you agree with each statement?

	Strongly disagree (1)	Moderately disagree (2)	Neither agree nor disagree (3)	Moderately agree (4)	Strongly agree (5)
TfW allowed enough interactions between myself and other passengers during rail services (i.e. for improving rail services, marketing, etc.) (1)	○	○	○	○	○
To get the most from rail services, I had to actively engage in dialogue with other passengers? (i.e., I have to apply my skills, knowledge, time, etc.) (2)	○	○	○	○	○
I help other passengers if they seem to have problems using rail services. (3)	○	○	○	○	○
I teach other passengers to use rail services correctly. (4)	○	○	○	○	○

I give advice on rail services to other passengers. (5)	○	○	○	○	○
I have asked other passengers for information on what rail services offer. (6)	○	○	○	○	○
I have searched for information from other passengers on where rail services are located. (7)	○	○	○	○	○
I have paid attention to how other passengers behave to use rail services well. (8)	○	○	○	○	○

Part 4 / 8: Using self-service during TfW's rail services.
PQ16. What are your attitudes to using self-service features? To what extent do you agree with each statement?

Did you use digital self-service features? (e.g. Wi-Fi, TfW's Travel app, Capacity Checker, etc)

○ Yes (1)

○ No (2)

Q17. To what extent do you agree with each statement?
Overall, the digital self-service features (Wi-Fi, Travel apps, Capacity Checker, etc)....

	Strongly disagree (1)	Moderately disagree (2)	Neither agree nor disagree (3)	Moderately agree (4)	Strongly agree (5)
Gives me the rail services I want. (1)	○	○	○	○	○
Let me use rail services in a timely manner. (2)	○	○	○	○	○
Let me use rail services better. (3)	○	○	○	○	○

Q18. Overall, I like using the digital self-service features (Wi-Fi, Travel apps, Capacity checker, etc) throughout my rail journey.

- ○ Strongly disagree (1)
- ○ Moderately disagree (2)
- ○ Neither agree nor disagree (3)
- ○ Moderately agree (4)
- ○ Strongly agree (5)

Q19. Did you use physical self-service features (Ticket machines, automated gates, car parking, signage, announcements, etc)

- ○ Yes (1)
- ○ No (2)

Q20. To what extent do you agree with each statement?
Overall, the physical self-service features (Ticket machines, automated gates, car parking, signage, announcements, etc).....

	Strongly disagree (1)	Moderately disagree (2)	Neither agree nor disagree (3)	Moderately agree (4)	Strongly agree (5)
Gives me the rail services I want. (1)	○	○	○	○	○
Let me use rail services in a timely manner. (2)	○	○	○	○	○
Let me use rail services better. (3)	○	○	○	○	○

Q21. Overall, I like using the physical self-service features (Ticket machines, automated gates, car parking, signage, announcements, etc) throughout my rail journey.

- ○ Strongly disagree (1)
- ○ Moderately disagree (2)
- ○ Neither agree nor disagree (3)
- ○ Moderately agree (4)
- ○ Strongly agree (5)

Part 5/8: Usefulness of TfW's rail services.
Q22. How useful do you find them and how satisfied you are with TfW's rails services? To what extent do you agree with each statement?

	Strongly disagree (1)	Moderately disagree (2)	Neither agree nor disagree (3)	Moderately agree (4)	Strongly agree (5)
TfW's assistance is needed to fully enjoy rail services (e.g. to get tickets, find seating, use disabled access, use station and/or train facilities, etc.). (3)	○	○	○	○	○
I felt an attachment or relationship with TfW and its personnel. (8)	○	○	○	○	○
There was usually a group, community, or network of passengers who are fans of TfW. (11)	○	○	○	○	○
TfW is renowned because passengers usually speak positively about them. (10)	○	○	○	○	○
The benefit, value, or fun from rail services depended on the passenger and their usage. (5)	○	○	○	○	○
TfW tried to serve each passengers' individual needs (e.g. to help them get tickets, find seating, use disabled access, use	○	○	○	○	○

station and/or train facilities, etc.). (2)					
Different passengers, depending on their preferences or knowledge of rail travel, get involved differently in rail services. (7)	○	○	○	○	○
TfW provided an overall good experience, beyond the functional benefit of rail services. (1)	○	○	○	○	○
It was a memorable experience for me that lasted quite a while (e.g. getting tickets, finding seating, using station and/or train facilities, etc.). (9)	○	○	○	○	○
Depending on my own participation, my experiences of rail services might differ from other passengers. (4)	○	○	○	○	○
It was possible for passengers to improve rail services by experimenting and trying new things. (6)	○	○	○	○	○
TfW's rail services are expensive. (12)	○	○	○	○	○

TfW's rail services charges too much. (18)	○	○	○	○	○
TfW's rail services are highly priced. (15)	○	○	○	○	○
Dealing with TfW or its personnel is a stressful experience. (13)	○	○	○	○	○
I get stressed about using TfW's rail services (e.g. to get tickets, find seating, use disabled access, use station and/or train facilities, etc.). (14)	○	○	○	○	○
Dealing with TfW or its personnel is challenging for me. (16)	○	○	○	○	○
I spend a lot of time waiting or queuing to use TfW's rail services (e.g. to get tickets, find seating, use disabled access, use station and/or train facilities, etc.). (17)	○	○	○	○	○
I spend a lot of time filling out forms to use TfW's rail services. (19)	○	○	○	○	○
I see lots of advantages to using TfW's rail services. (20)	○	○	○	○	○

I like TfW's rail services because it benefits me in the end. (21)	○	○	○	○	○
TfW's rail services are relevant to my needs. (22)	○	○	○	○	○

Part 6 / 8: Satisfaction with TfW's rail services.
Q23. The following are words that describe different emotions and thoughts relating to your rail journey. Please state the number that reflects the extent you felt or thought this way.

	(-3) very stressed, worried, hurried (1)	-2 (2)	-1 (3)	**Neutral** (4)	+1 (5)	+2 (6)	**(+3) very relaxed, calm, confident** (7)
I felt (1)	○	○	○	○	○	○	○

Q24. To what extent did you feel or thought this way?

	(-3) very bored, tired, fed-up (1)	-2 (2)	-1 (3)	**Neutral** (4)	+1 (5)	+2 (6)	**(+3) very enthusiastic, alert, engaged** (7)
I felt (1)	○	○	○	○	○	○	○

Q25. To what extent did you feel or thought this way?

	(-3) very poorly, held low standard, was the worst imaginable (1)	-2 (2)	-1 (3)	**Neutral** (4)	+1 (5)	+2 (6)	**(+3) very well, held high standard, was the best imaginable** (7)
My trip worked (1)	○	○	○	○	○	○	○

Part 7 / 8: Engaging with TfW's rail services.
Q26. What are your attitudes to engaging with TfW beyond just using rail service?

To what extent do you agree with each statement?

	Strongly disagree (1)	Moderately disagree (2)	Neither agree nor disagree (3)	Moderately agree (4)	Strongly agree (5)
If I have a useful idea on how to improve rail services, I let TfW or its personnel know. (1)	○	○	○	○	○
When I received good rail services from TfW or its personnel, I comment about it. (2)	○	○	○	○	○
When I experience a problem, I let TfW or its personnel know about it. (3)	○	○	○	○	○
I encouraged friends and relatives to use TfW. (9)	○	○	○	○	○
I recommended TfW or its personnel to others. (8)	○	○	○	○	○

I said positive things about TfW or its personnel to others. (7)	○	○	○	○	○
I aim to use TfW in the long-term. (10)	○	○	○	○	○
I would like to use TfW's rail services again. (11)	○	○	○	○	○
I intend to travel with TfW in the future. (12)	○	○	○	○	○

Part 8 / 8: Demographic Questions
Q27. You are?

○ Male

○ Female

○ Other (please specify)_____

Q29. Do you consider yourself a disabled passenger? (i.e. physical and / or mental disability)

- ○ Yes
- ○ No

Q30. What is your ethnicity?

- ○ White
- ○ Black
- ○ Asian
- ○ Mixed Ethnicity
- ○ Other (please specify) _____
- ○ Prefer not to Say

Q31. What is your highest educational attainment?

- ○ Primary Education
- ○ Secondary Education
- ○ A-levels / College
- ○ Higher Education (Degree)
- ○ Postgraduate Degree (Masters, PhD)

Q32. What is your approximate combined household income in pounds?

- ○ Less than £10K
- ○ £10-20K
- ○ £20K - £30K
- ○ £30K - £40K
- ○ £40K - £50K
- ○ £60K - £70K
- ○ £70 - £80K
- ○ £80K - £90K
- ○ £100K +
- ○ Prefer not to disclose

Q33. Working status?

- ○ Student
- ○ Unemployed
- ○ Part-time Employed
- ○ Full-time Employed
- ○ Self-Employed
- ○ Retired
- ○ Other (please specify) _____

Q34. Marital status?

- ○ Single
- ○ In a relationship
- ○ Married
- ○ Civil Partnership
- ○ Divorced
- ○ Widowed

Debriefing

Exploring the experiences and value processes and experiences of rail passengers to enhance satisfaction and service engagement.

This study aims to explore how rail passengers have experienced TfW's rail services and the different forms of value creation that occur during service usage as you interact with them. In the study, passengers' experiences were measured in terms of brand experiences, service provider experiences and post-purchase experiences. The forms of value creation included in the study are as follows. Firstly, value can emerge during dialogue (e.g. information enquiries) with TfW or its personnel (joint value co-creation). Secondly, value can also emerge outside of these interactions as you use resources during your rail journey (e.g. self-service functions like travel apps or automated gates) that reflects independent value creation. Thirdly, value can emerge through dialogue with other passengers during your rail journey (social value co-creation).

The study hypothesises that value creation would positively relate to passengers' experiences (i.e. at pre, during and post stage), which would positively relate to satisfaction. Lastly, the study also looked at how these concepts related to your engagement with TfW Rail outside of just train journeys (recommending TfW to others, feeling emotionally committed to TfW, offering feedback and intentions to use rail services in the future). The study hypothesised that satisfaction would positively relate to these engagement behaviours. By understanding how the above concepts relate to each, TfW can make service improvements to enhance your experiences at different stages of rail journeys (pre, during and post) and how you interact with the service. The study will use a within-subjects design (all respondents answered the same questions) and a quantitative methodology (using metrics to sample attitudes and statistical analysis to assess the relationships described above).

All responses are stored following GDPR compliant guidelines and are anonymised to maintain confidentiality. Additionally, you also have the right for your responses to be withdrawn after completing the questionnaire for any reason.

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Appendix 21. Analysis of non-response bias for all items showing non-significant differences

Construct	Item	First 25% (Group A)	Last 25% (Group B)	Z-score	p. value
Knowledge	K1	133.92	145.08	-1.298	0.194
	K2	142.41	136.59	-0.635	0.525
	K4	137.05	141.95	-0.549	0.583
Equity	E1	139.66	139.34	-0.037	0.970
	E2	137.40	141.60	-0.460	0.646
	E3	136.91	142.09	-0.570	0.569
Joint Interaction	JI1	148.26	130.74	-1.907	0.057
	JI2	146.28	132.72	-1.466	0.143
	JI3	137.19	141.81	-0.514	0.607
	JI3	147.04	131.96	-1.641	0.101
Relationship	R1	144.50	134.50	-1.063	.288
	R2	144.19	134.81	-1.007	.314
	R3	135.33	143.67	-.914	.361
	R4	138.45	140.55	-.228	.820
Personalisation	P1	137.27	141.73	-.485	.628
	P2	141.05	137.95	-.334	.738
Experience	EX1	135.37	143.63	-.892	.372
	EX3	134.14	144.86	-1.178	.239
Value from Digital Self-Service	DSS1	123.51	110.40	-1.587	.113
	DSS2	123.33	110.55	-1.563	.118
	DSS3	118.06	115.15	-.353	.724
	DSS4	115.93	117.00	-.125	.900
Value from Physical Self-Service	PSS1	114.73	107.37	-.893	.372
	PSS2	118.98	103.23	-1.924	.054
	PSS3	113.37	108.69	-.565	.572
	PSS4	114.44	107.65	-.814	.415
Social Interaction	SI1	140.51	138.49	-.244	.807
	SI2	137.07	141.93	-.535	.593
Helping	H2	141.59	137.41	-.453	.650

Information Seeking	IS1	130.93	148.07	-1.833	.067
	IS2	132.54	146.46	-1.484	.138
	IS3	144.82	134.18	-1.147	.251
Monetary Cost	MC1	132.71	146.29	-1.456	.145
	MC2	135.85	143.15	-.782	.434
	MC3	132.36	146.64	-1.526	.127
Emotional Cost	EC1	130.75	148.25	-1.873	.061
	EC2	131.07	147.93	-1.789	.074
	EC3	131.21	147.79	-1.771	.077
Time & Effort Cost	TEC2	131.05	147.95	-1.856	.063
Perceived Value	PV3	145.95	133.05	-1.404	.160
Brand Experience	BX1	144.4	134.6	-1.034	.301
	BX2	147.38	131.62	-1.662	.096
	BX6	148.63	130.37	-1.921	.055
Service Provider Experience	SPE1	139.46	139.54	-.009	.993
	SPE2	142.66	136.34	-.666	.505
	SPE3	143.79	135.21	-.903	.366
	SPE4	135.73	143.27	-.808	.419
	SPE6	144.18	134.82	-1.000	.317
	SPE7	145.58	133.42	-1.293	.196
	SPE9	139.24	139.76	-.054	.957
Post-Purchase Experience	PPE1	142.68	136.32	-.682	.495
	PPE2	136.32	143.73	-.907	.365
	PPE4	146.19	132.81	-1.422	.155
	PPE5	145.61	133.39	-1.287	.198
	PPE7	138.81	140.19	-.154	.877

Source: this study

Appendix 22. Cross-loading of customer experience indicators

	Factor	
	1	2
BX1	0.578	
BX2	0.814	
BX3	0.805	
BX5	0.828	
BX6	0.580	0.312
SPE1	0.776	
SPE2	0.935	
SPE3	0.817	
SPE4	0.726	
SPE5		0.793
SPE6	0.644	
SPE7	0.782	
SPE8	0.870	
SPE9		0.772
SPE10	0.484	
PPE1		0.915
PPE2		0.792
PPE3	0.538	
PPE4	0.570	0.356
PPE5	0.583	0.311
PPE6	0.509	0.387
PPE7		0.565

Source: this study

Appendix 23. Shapiro-Wilks test for normality of distribution for all constructs

	Shapiro-Wilks Statistic	df	Sig.
Advocacy	0.924	406	0.000
Behavioural cost	0.976	406	0.000
Brand experience	0.973	406	0.000
Co-production	0.987	406	0.001
Customer experience	0.985	406	0.000
Digital self-service	0.959	406	0.000
Equity	0.969	406	0.000
Experience	0.986	406	0.000
Feedback intentions	0.969	406	0.000
Future patronage	0.902	406	0.000
Helping	0.952	406	0.000
Independent value creation	0.980	406	0.000
Information seeking	0.961	406	0.000
Joint interaction	0.981	406	0.000
Knowledge	0.984	406	0.000
Monetary cost	0.928	406	0.000
Negative viu	0.989	406	0.004
Passenger satisfaction	0.966	406	0.000
Personalisation	0.974	406	0.000
Physical self-service	0.959	406	0.000
Positive viu	0.984	406	0.000
Post-purchase experience	0.977	406	0.000
Relationship	0.968	406	0.000
Service provider experience	0.980	406	0.000
Social interaction	0.948	406	0.000
Social value co-creation	0.989	406	0.003
Value co-creation	0.988	406	0.003
Value creation	0.986	406	0.001

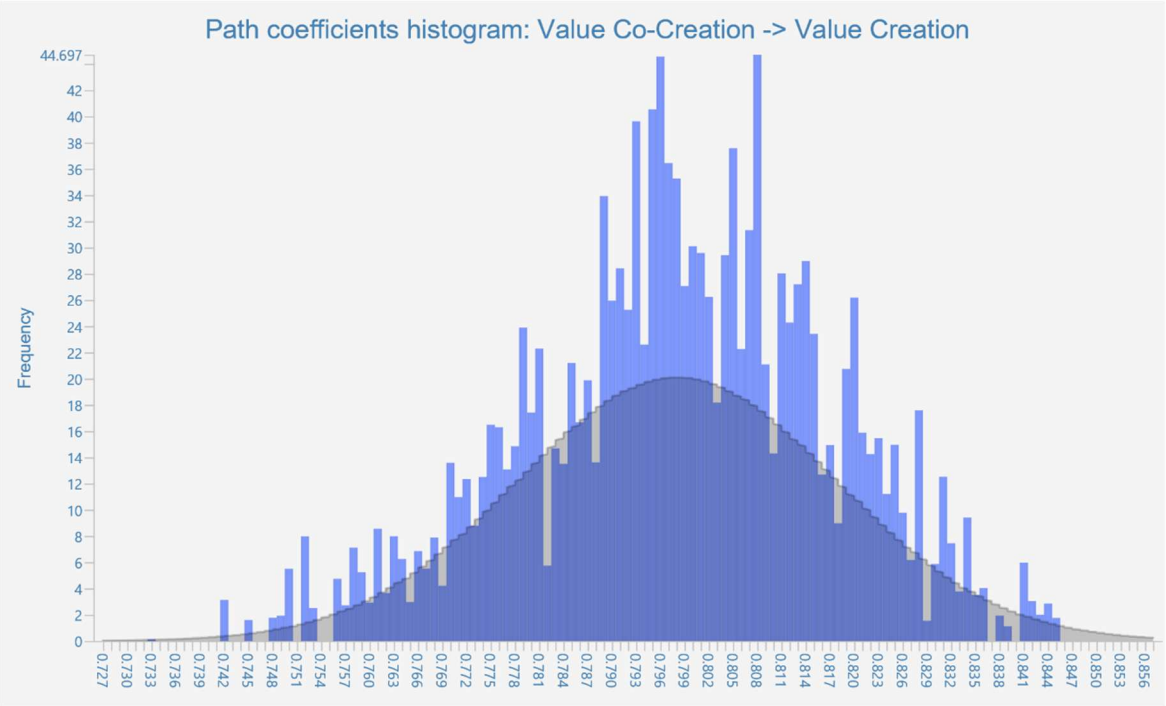
Source: this study

Appendix 24. Summary of CTA-PLS output with interpretation of result

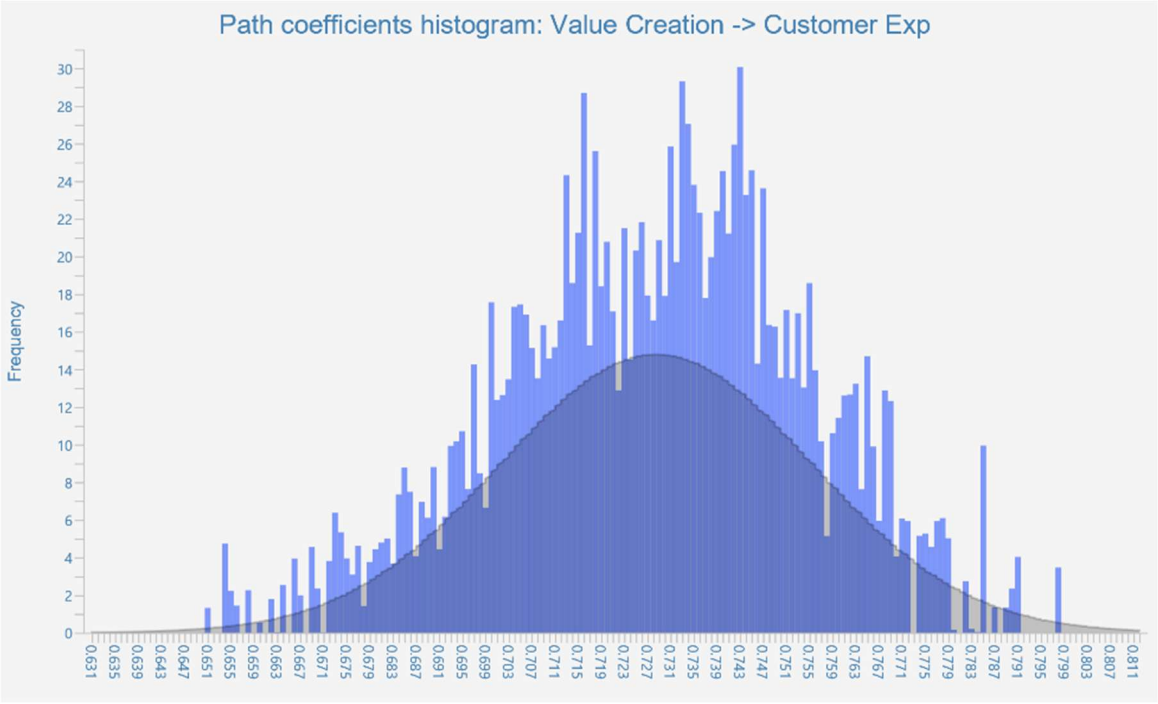
Constructs	N.S tetrads	Sig. tetrads	Total tetrads	All tetrads vanished	CTA-PLS Interpretation
Co-production	30	14	44	No	Formative
Equity	1	1	2	No	Formative
Joint interaction	1	1	2	No	Formative
Positive viu	35	9	44	No	Reflective
Relationship	0	2	2	No	Formative
Personalisation	2	0	2	Yes	Reflective
Independent value creation	10	10	20	No	Formative
Digital self-service	2	0	2	Yes	Reflective
Physical self-service	1	1	2	No	Formative
Social value co-creation	1	1	2	No	Formative
Negative Value-in-use	12	8	20	No	Formative
Behavioural cost	4	1	5	No	Formative
Customer experience	98	111	209	No	Formative
Brand experience	4	5	9	No	Formative
Service provider experience	25	10	35	No	Formative
Post-purchase experience	5	9	14	No	Formative

Source: this study

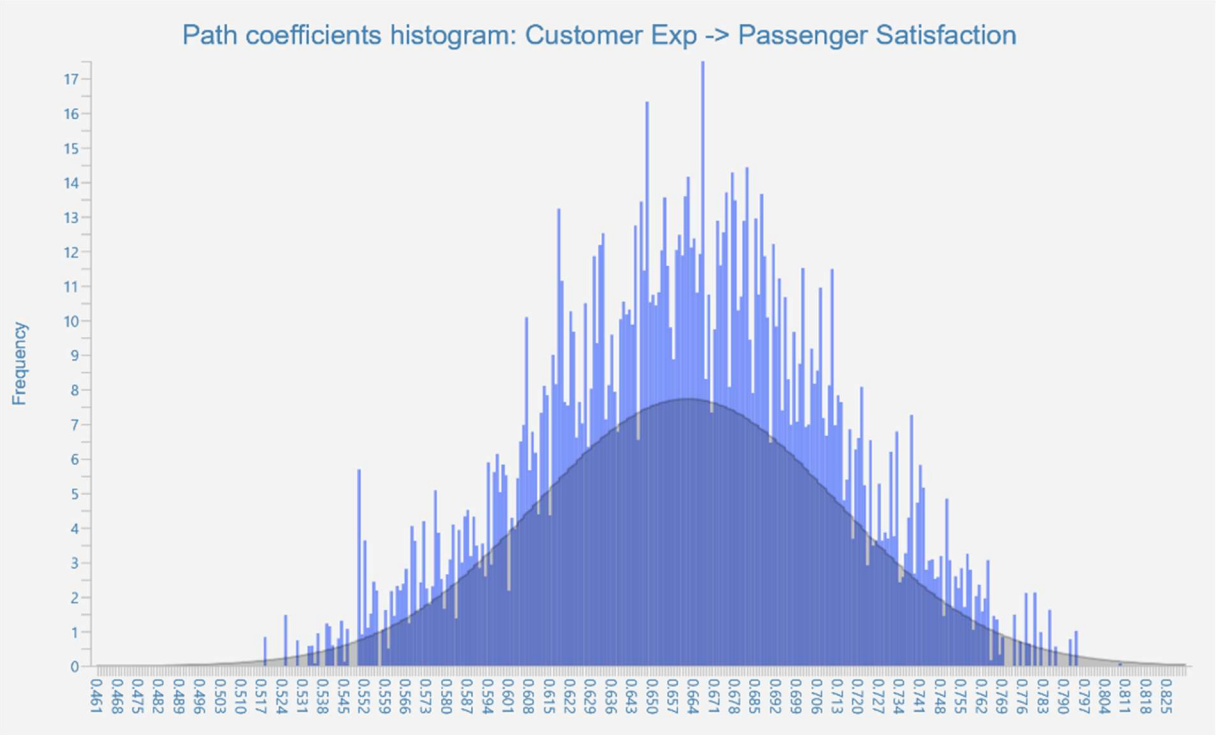
Appendix 25. Histogram of frequency of path coefficient between value co-creation and customer experience



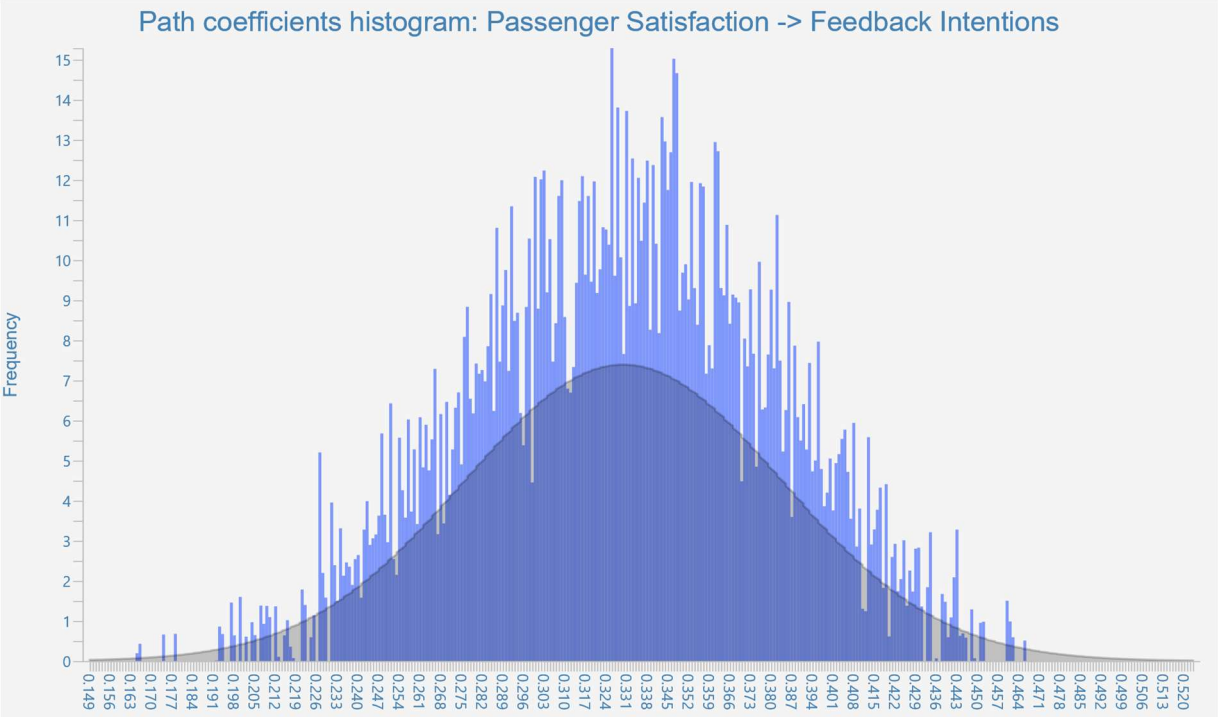
Appendix 26. Histogram of frequency of path coefficient between holistic value creation and customer experience



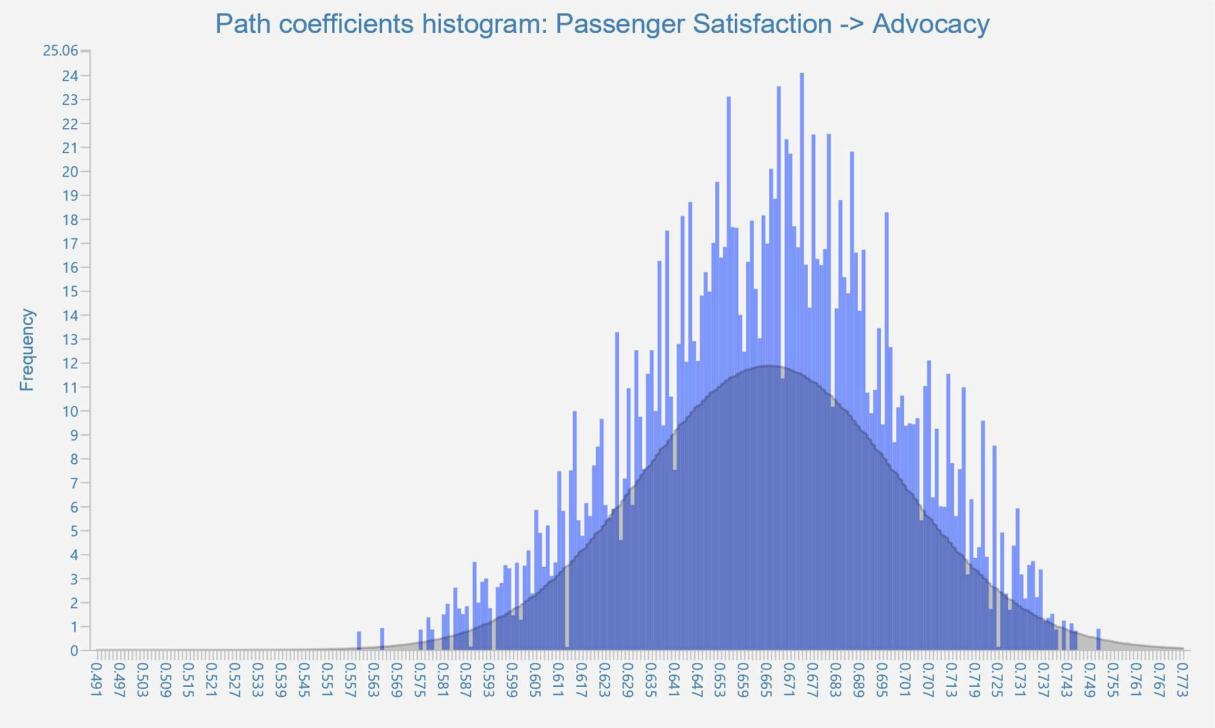
Appendix 27. Histogram of frequency of path coefficient between customer experience and passenger satisfaction



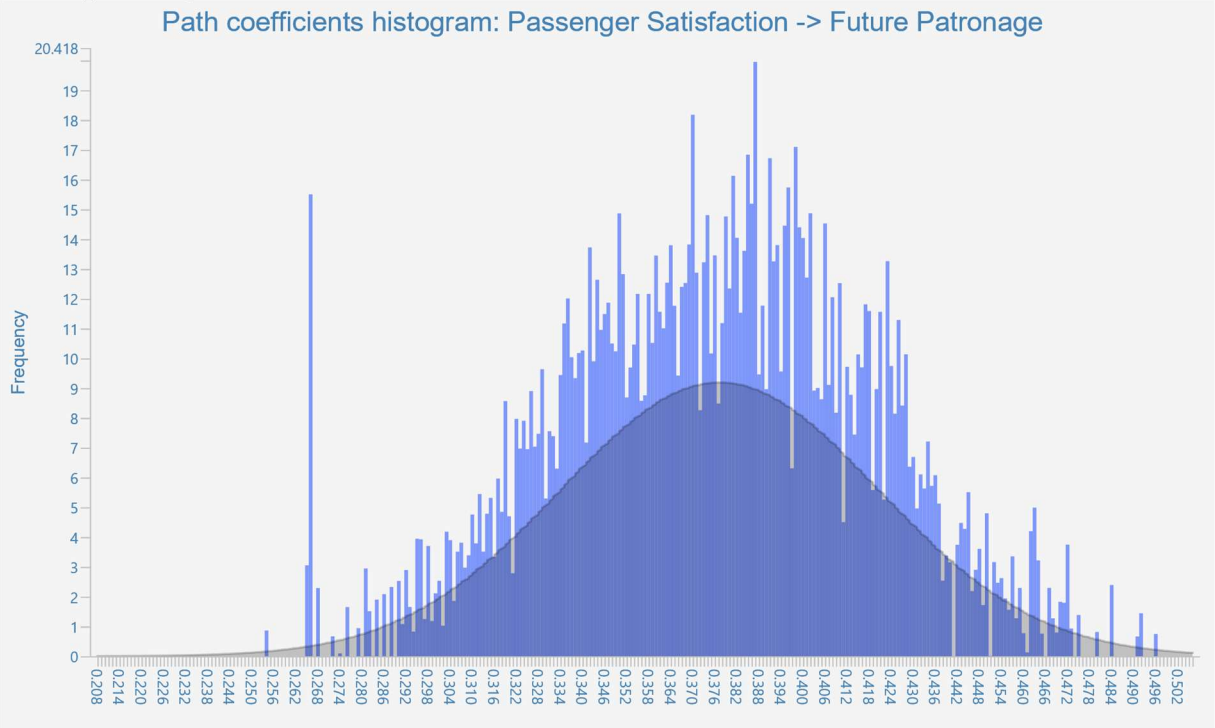
Appendix 28. Histogram of frequency of path coefficient between passenger satisfaction and feedback intentions



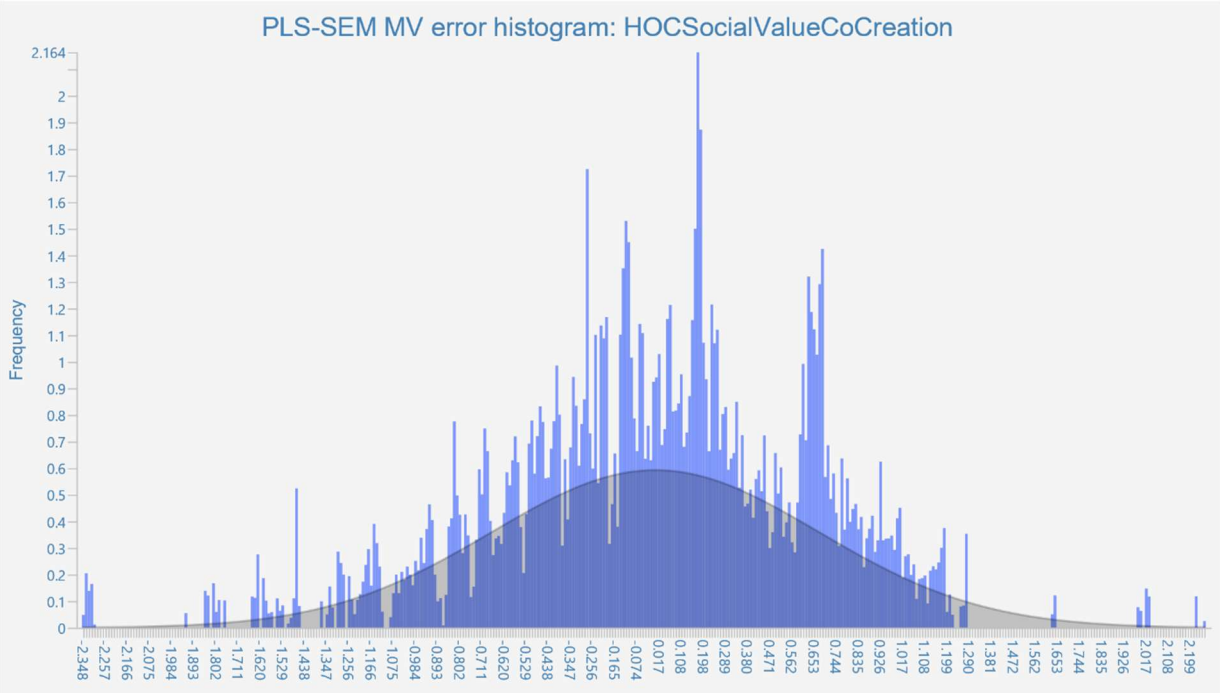
Appendix 29. Histogram of frequency of path coefficient between passenger satisfaction and advocacy



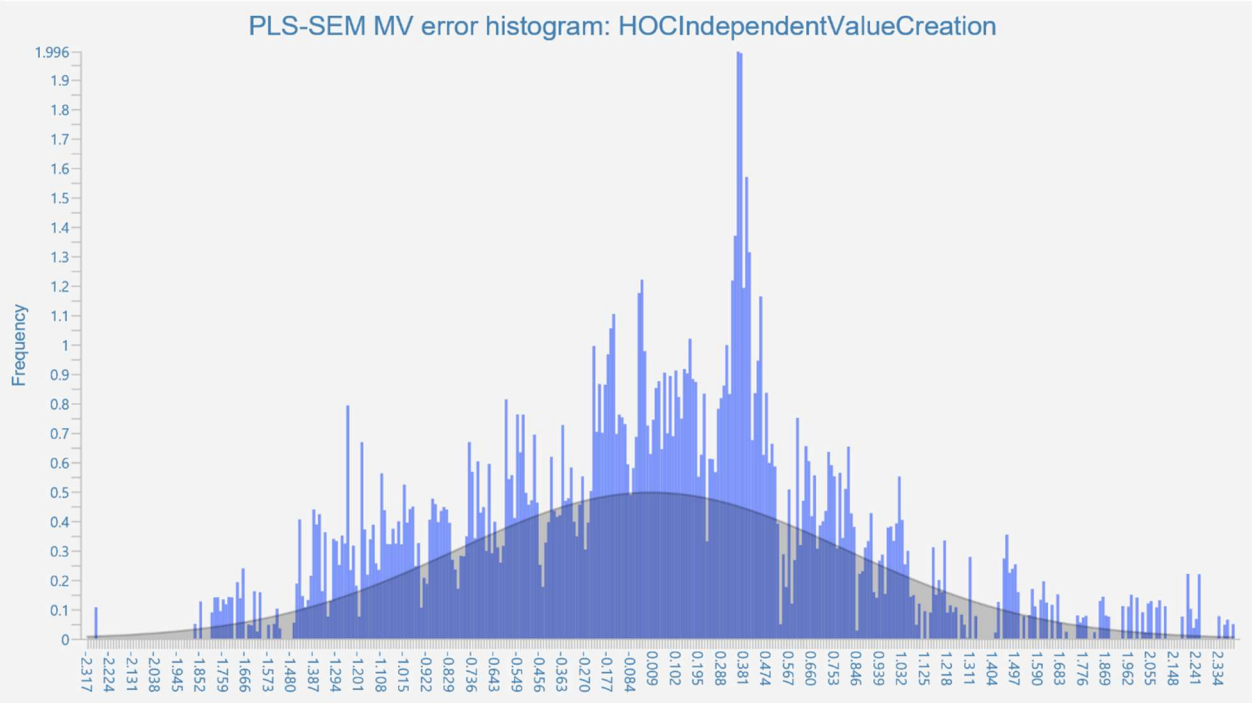
Appendix 30. Histogram of frequency of path coefficient between passenger satisfaction and future patronage



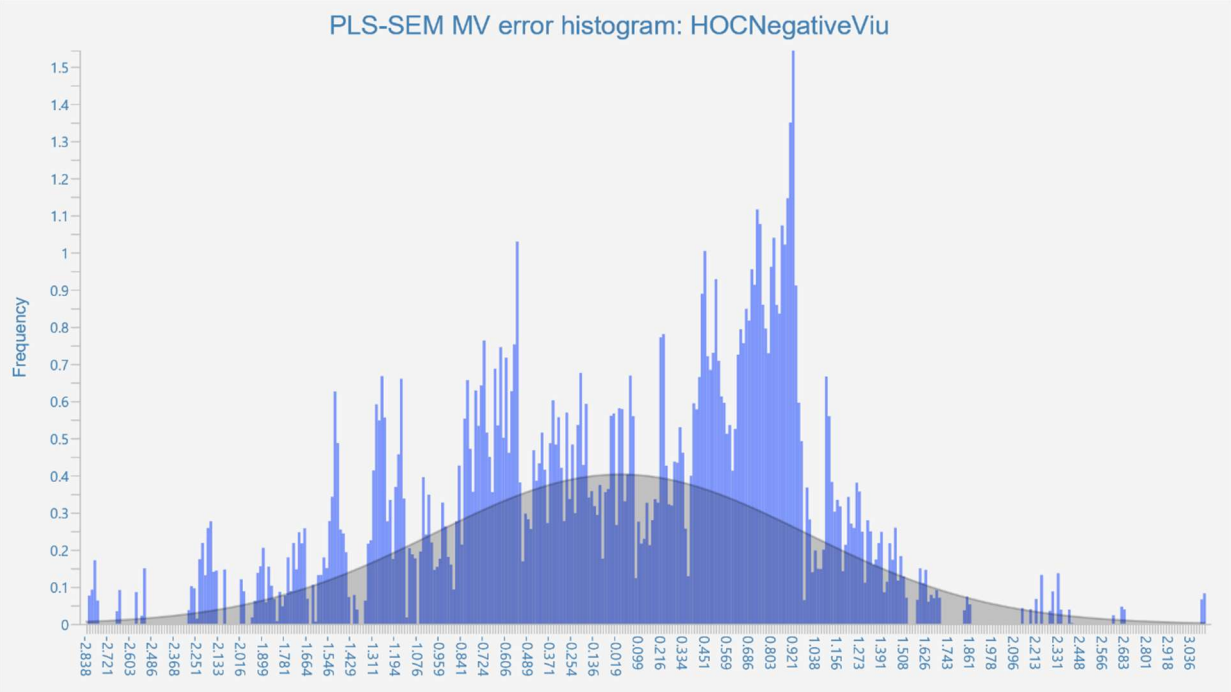
Appendix 31. Histogram of social value co-creation MV error with normal distribution curve overlayed



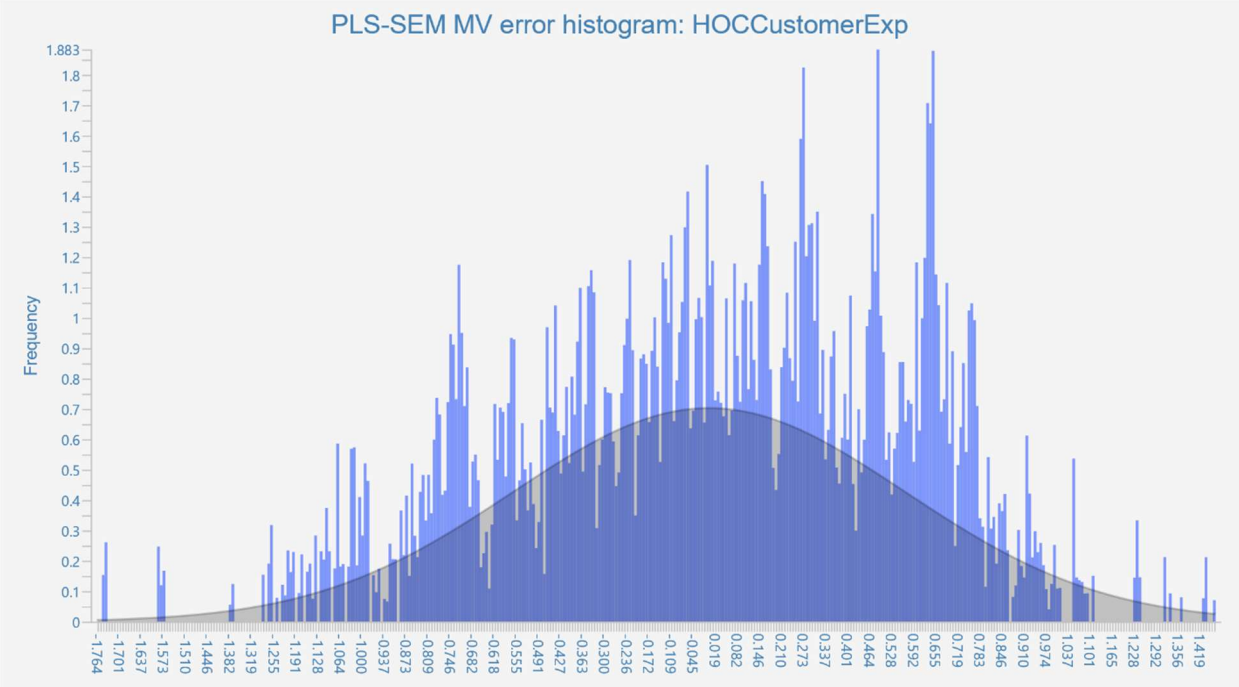
Appendix 32. Histogram of independent value creation MV error with normal distribution curve overlayed



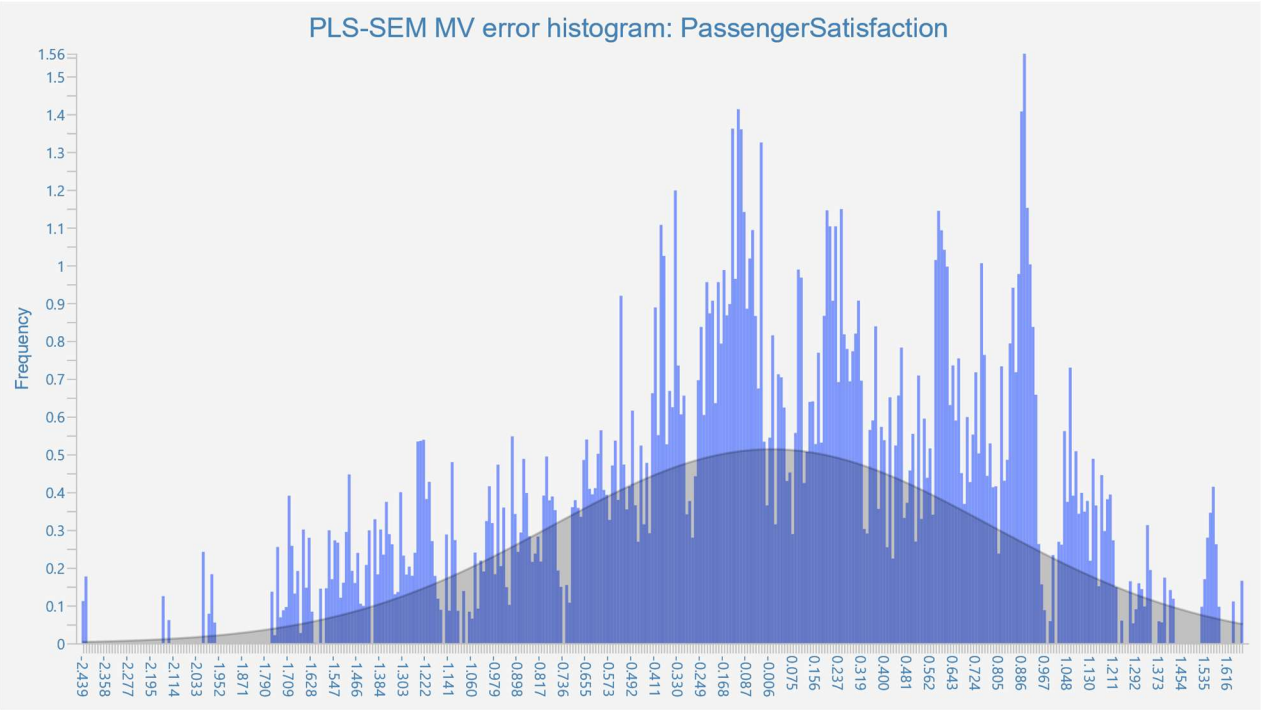
Appendix 33. Histogram of negative viu MV error with normal distribution curve overlayed



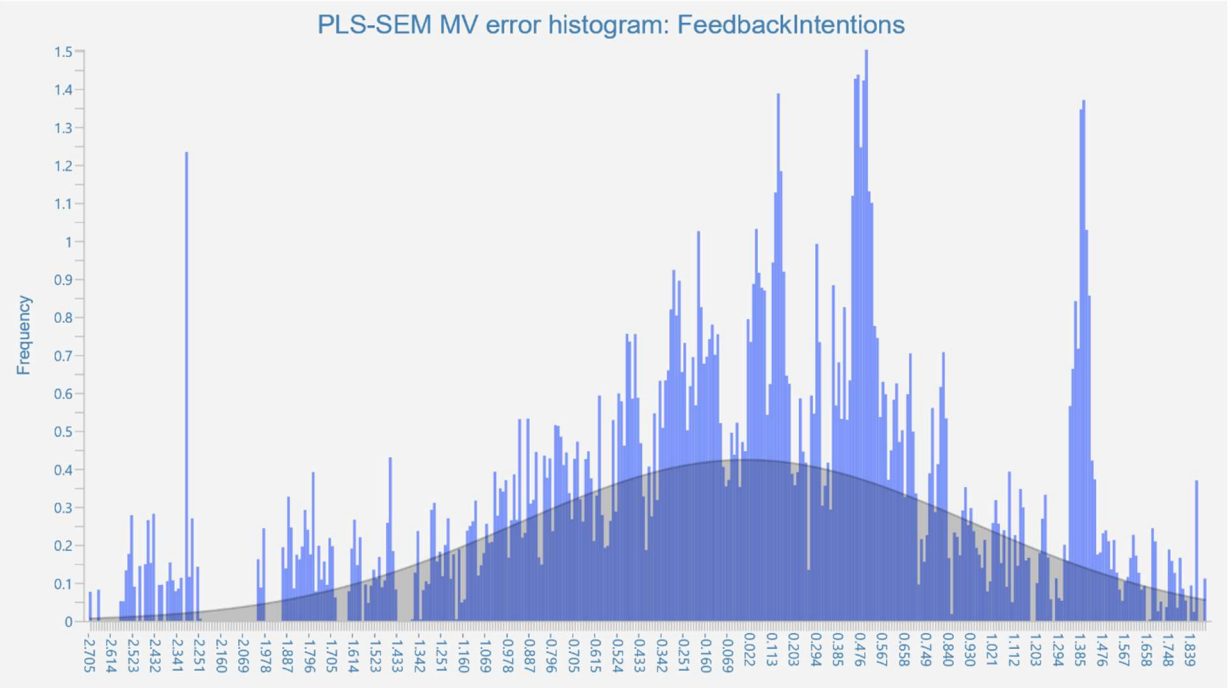
Appendix 34. Histogram of customer experience MV error with normal distribution curve overlayed



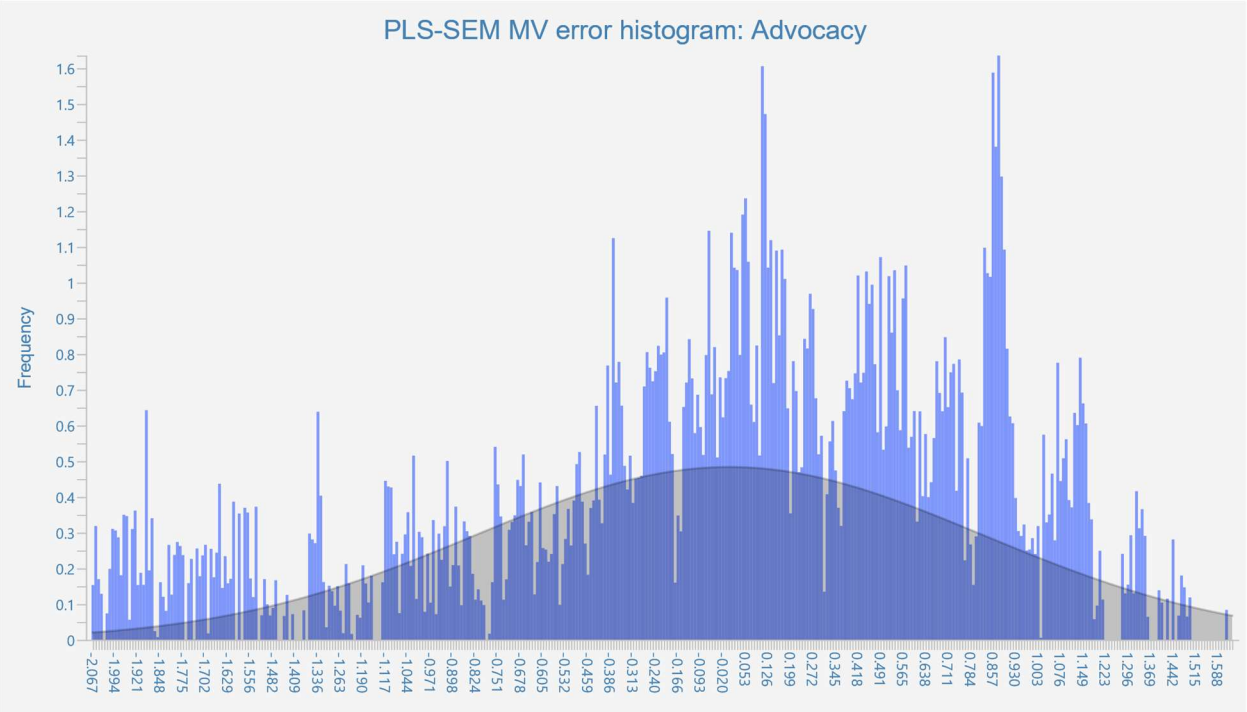
Appendix 35. Histogram of passenger satisfaction MV error with normal distribution curve overlayed



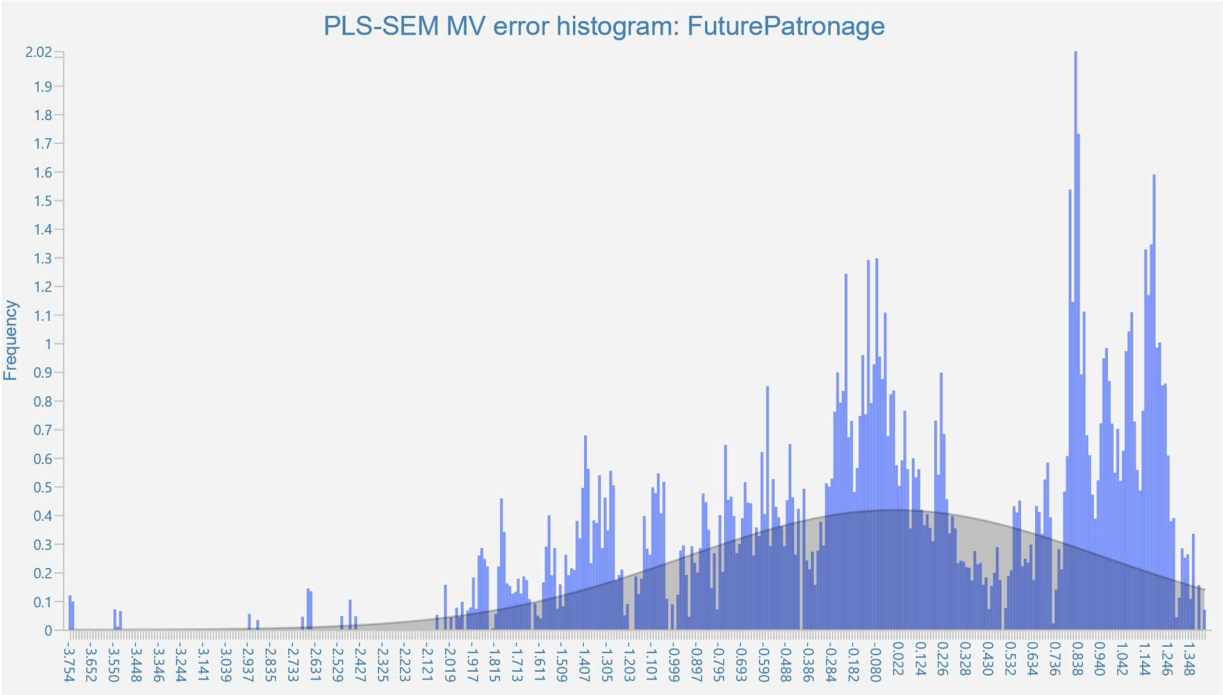
Appendix 36. Histogram of feedback intentions MV error with normal distribution curve overlayed



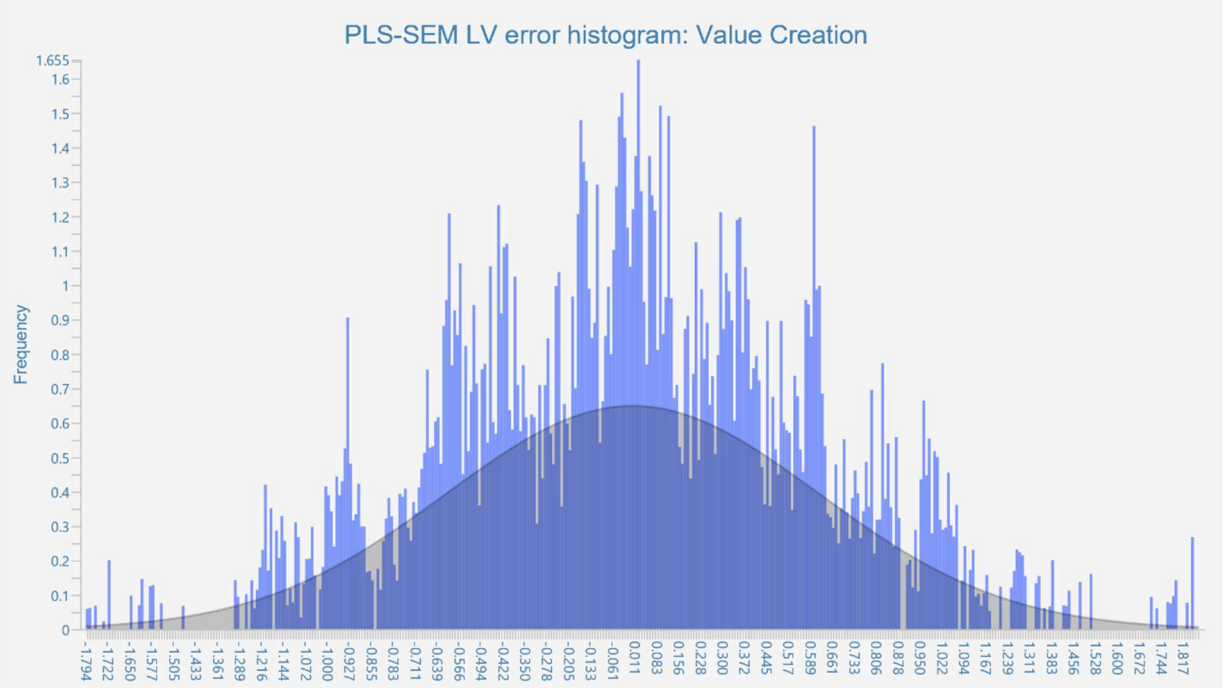
Appendix 37. Histogram of advocacy MV error with normal distribution curve overlayed



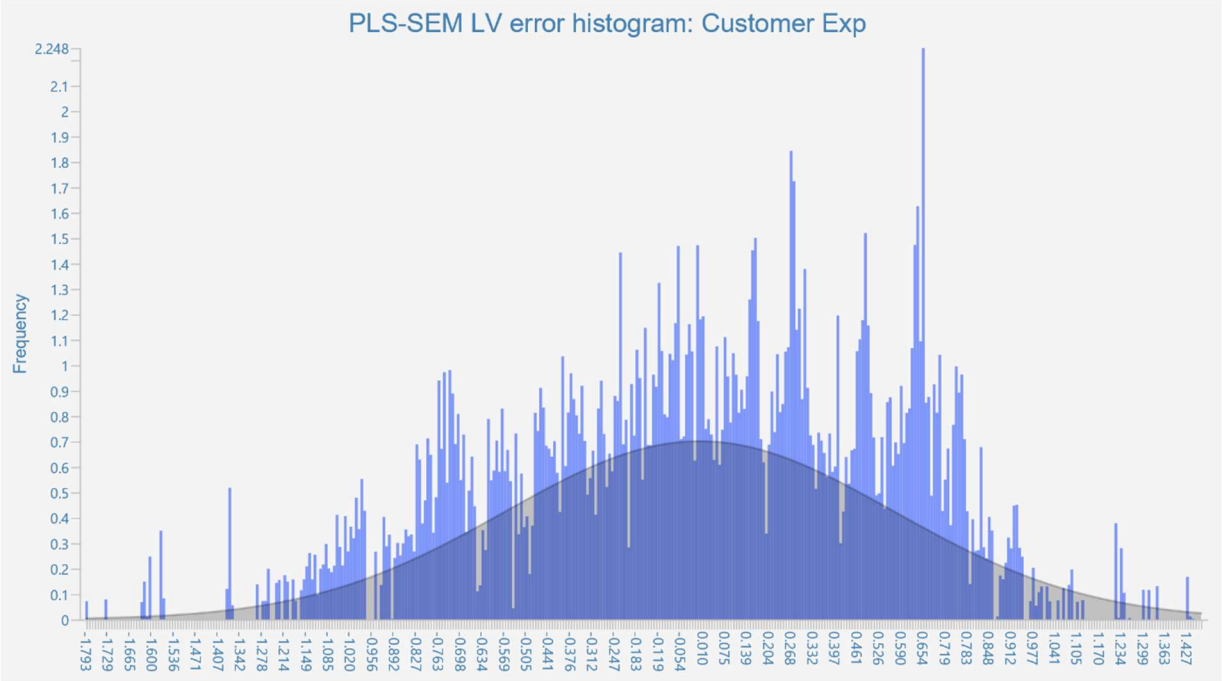
Appendix 38. Histogram of future patronage MV error with normal distribution curve overlayed



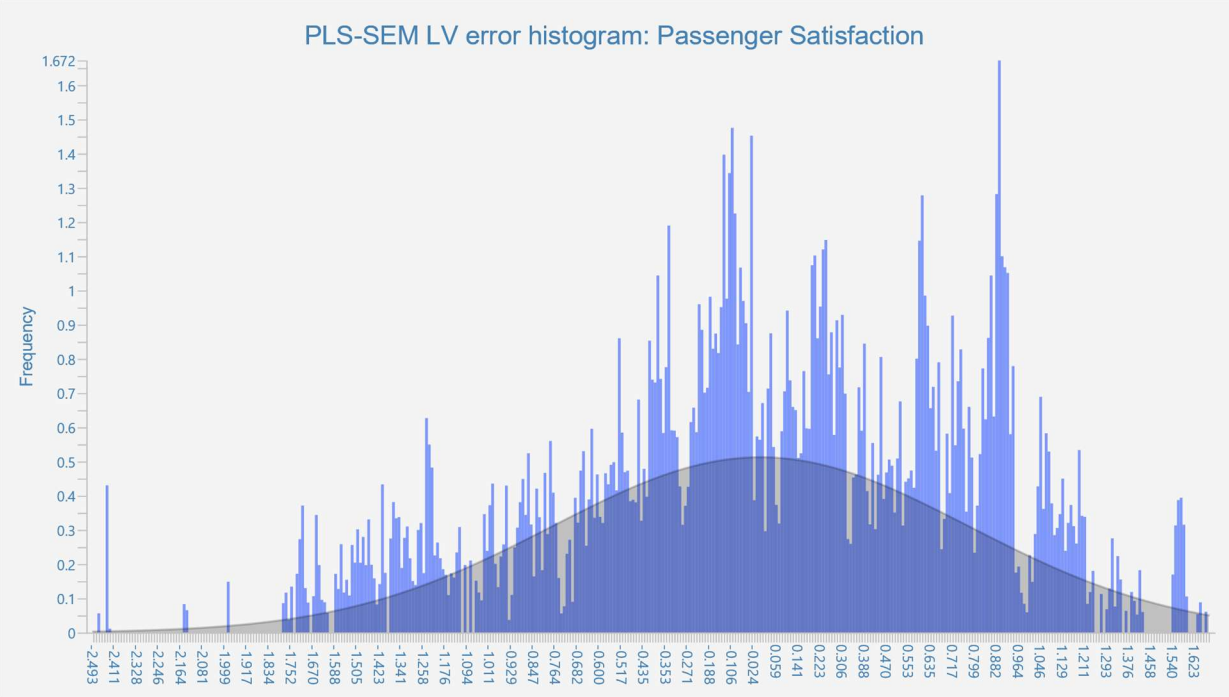
Appendix 39. Histogram of holistic value creation LV error with normal distribution curve overlayed



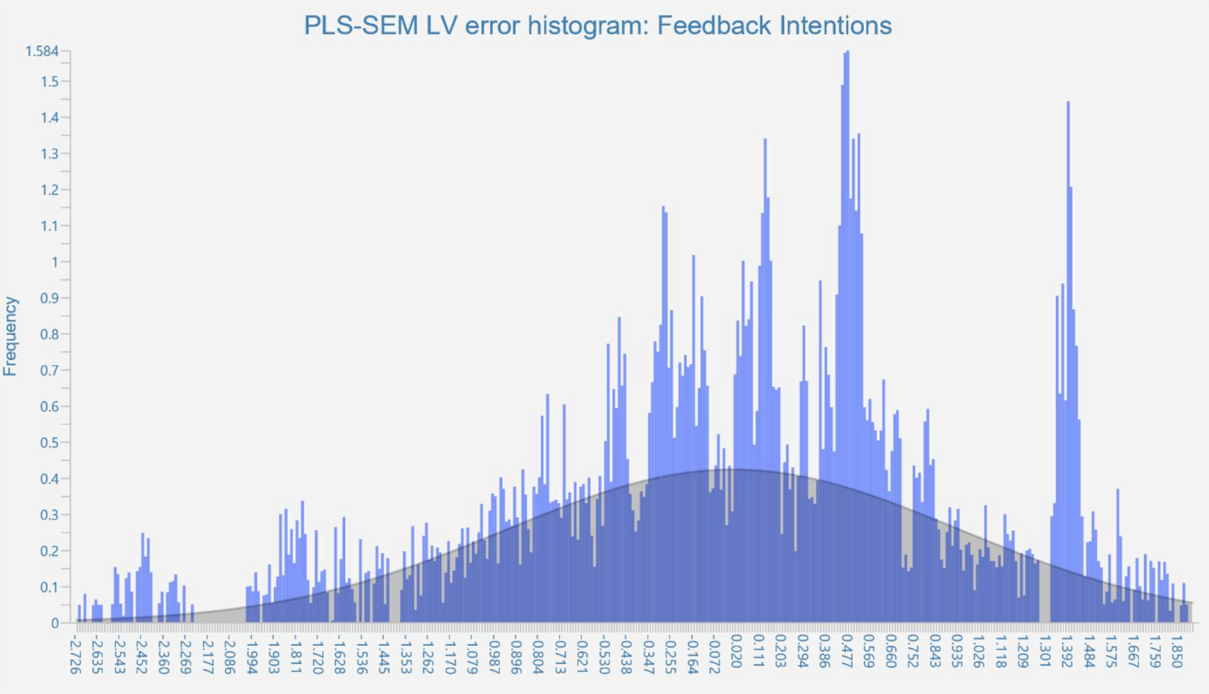
Appendix 40. Histogram of customer experience LV error with normal distribution curve overlayed



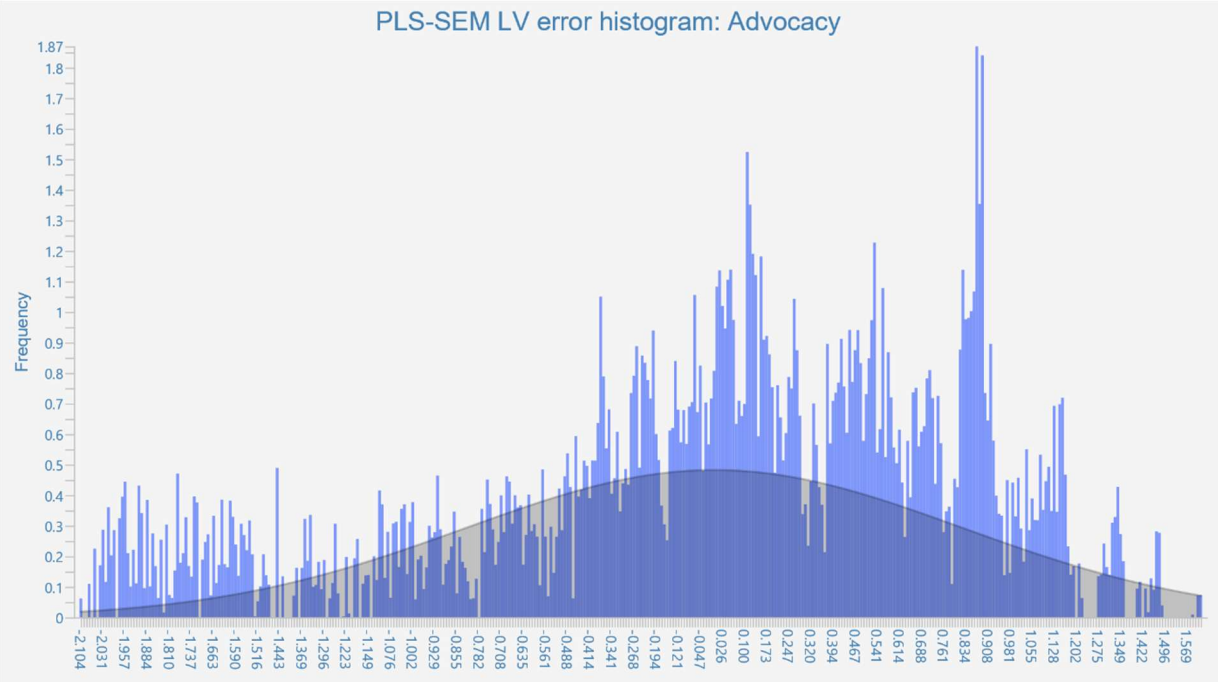
Appendix 41. Histogram of passenger satisfaction LV error with normal distribution curve overlayed



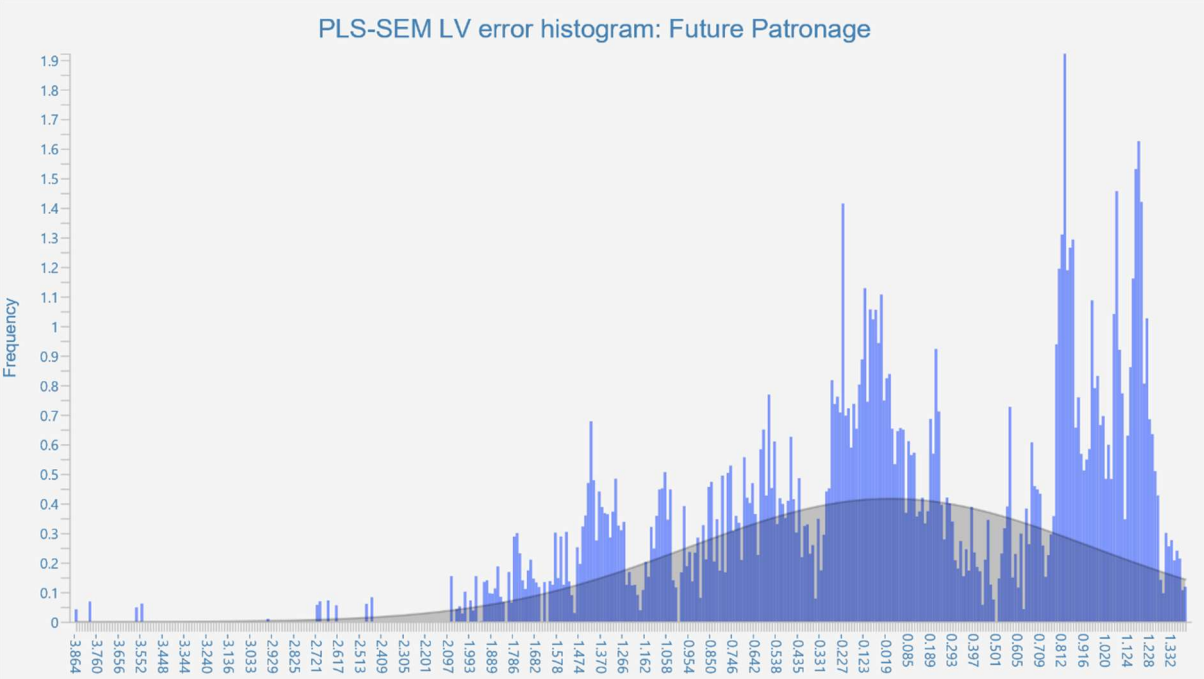
Appendix 42. Histogram of feedback intentions LV error with normal distribution curve overlayed



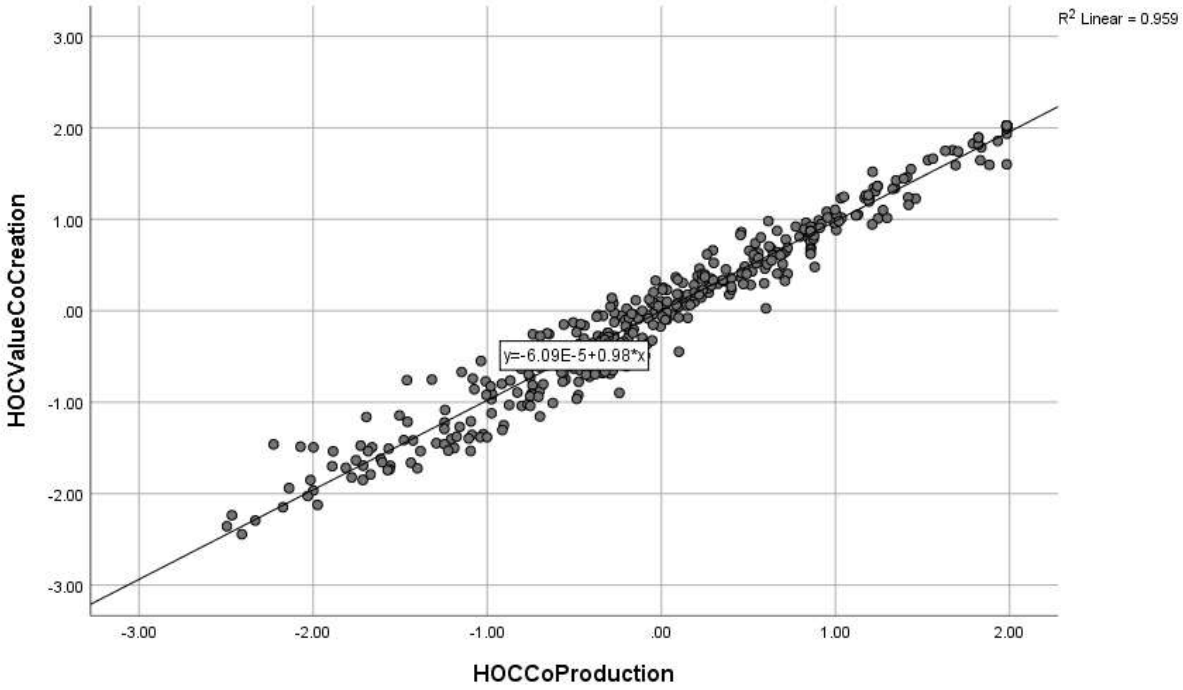
Appendix 43. Histogram of advocacy LV error with normal distribution curve overlayed



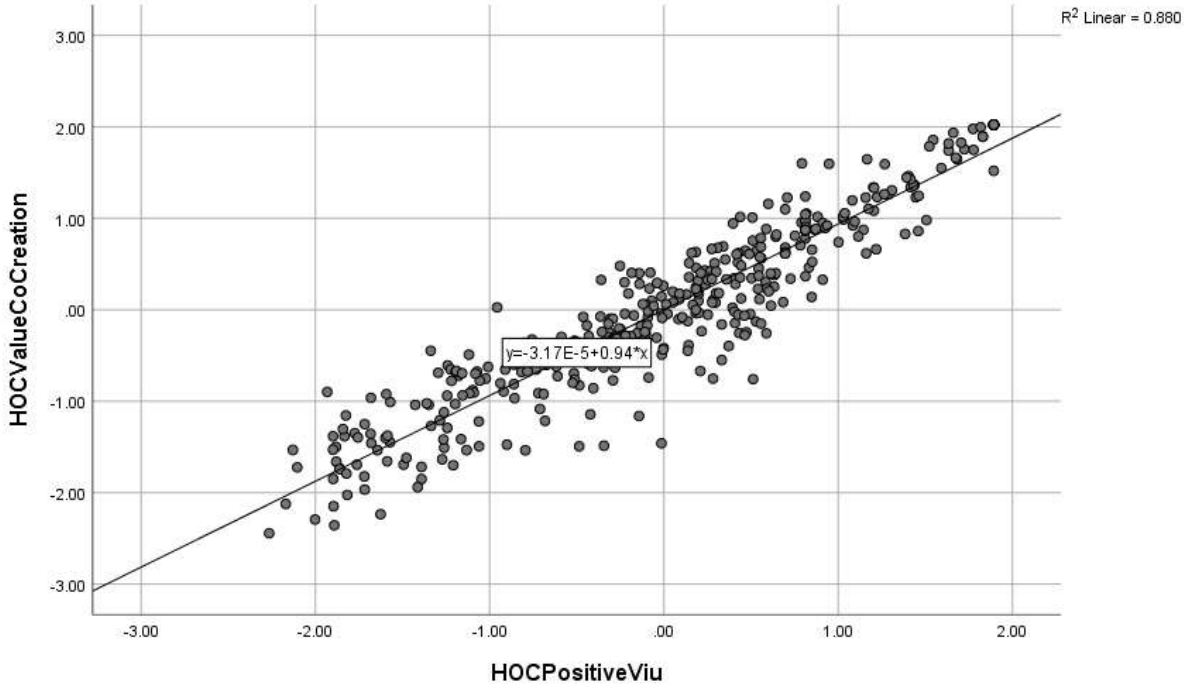
Appendix 44. Histogram of future patronage LV error with normal distribution curve overlayed



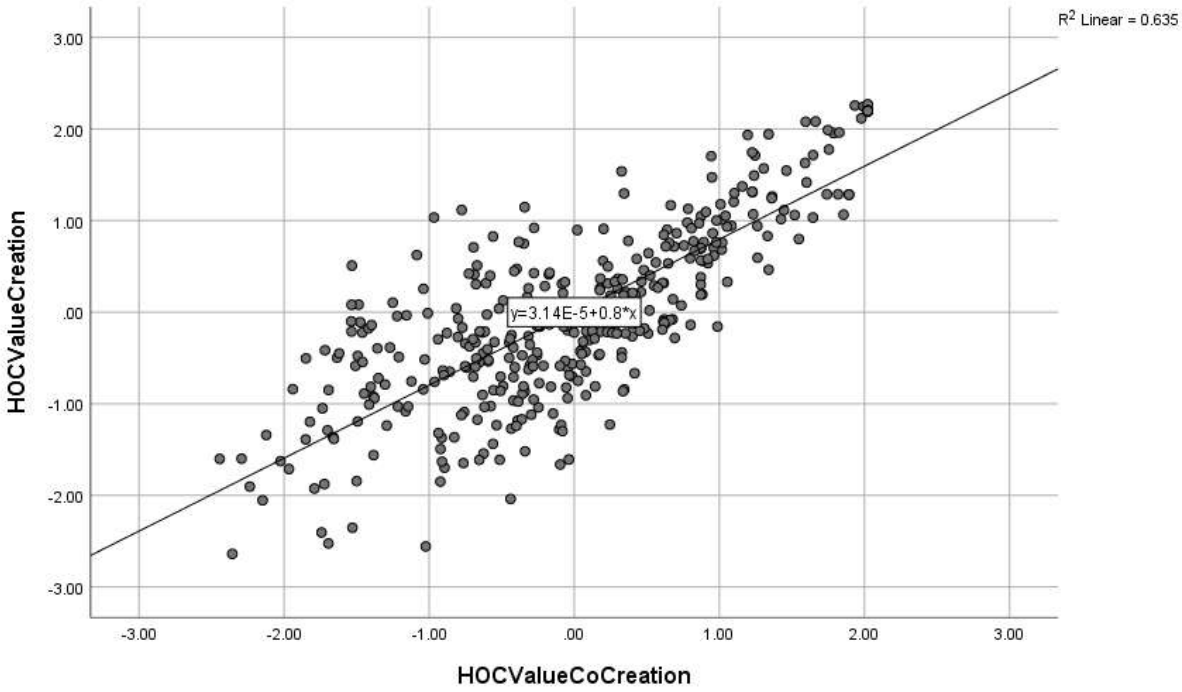
Appendix 45. Scatterplot diagram of co-production scores plotted against value co-creation scores



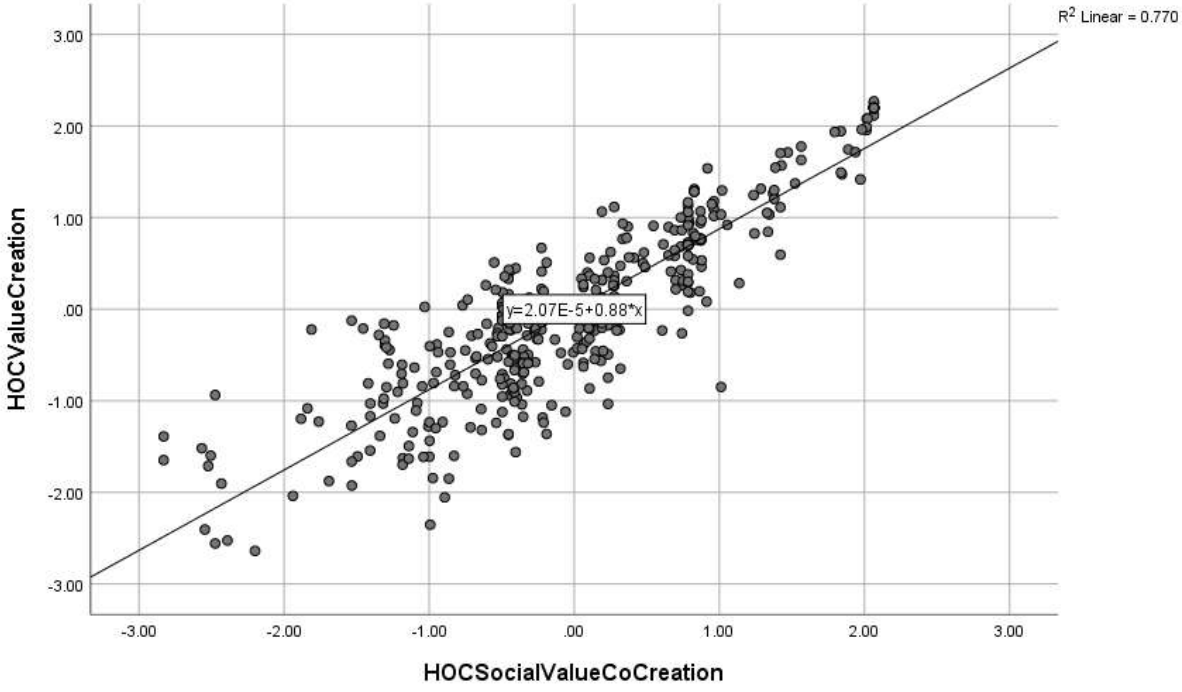
Appendix 46. Scatterplot diagram of positive viu scores plotted against value co-creation scores



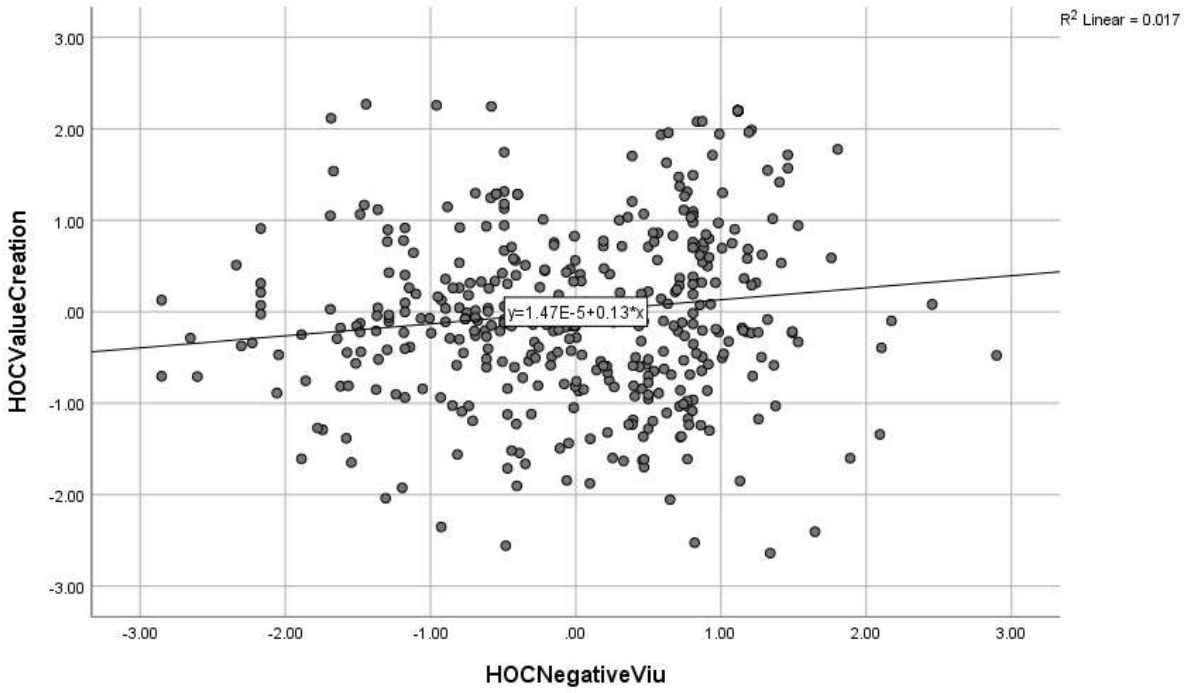
Appendix 47. Scatterplot diagram of holistic value creation scores plotted against value co-creation scores



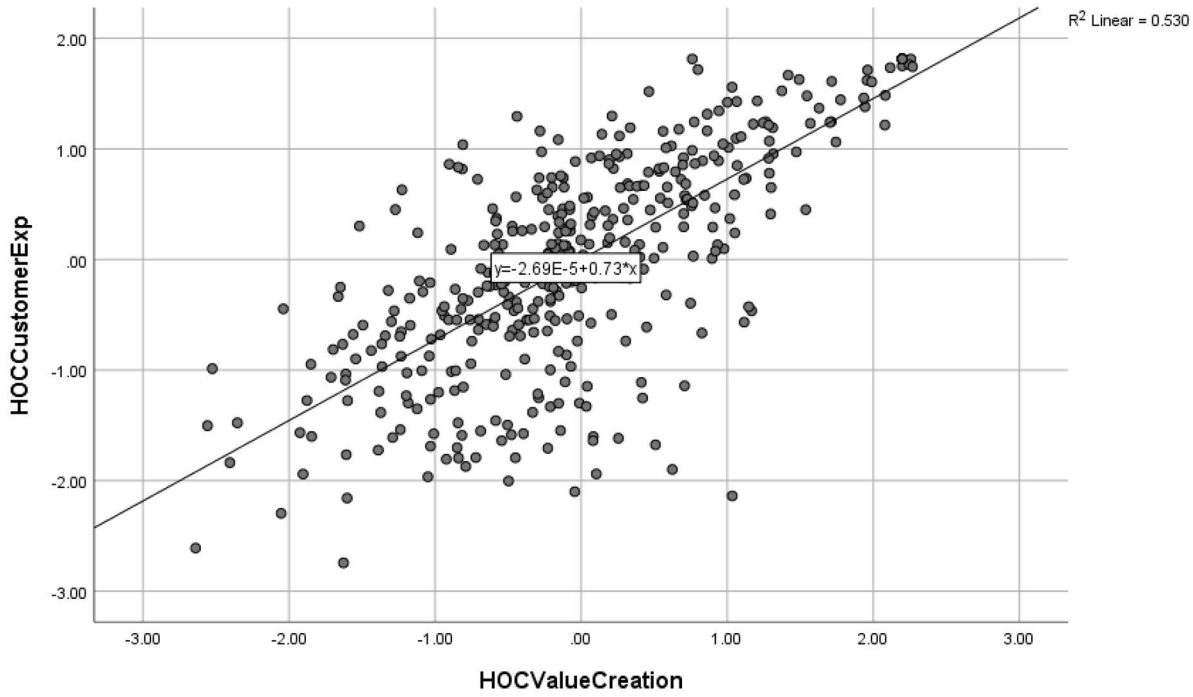
Appendix 48. Scatterplot diagram of social value co-creation scores plotted against value co-creation scores



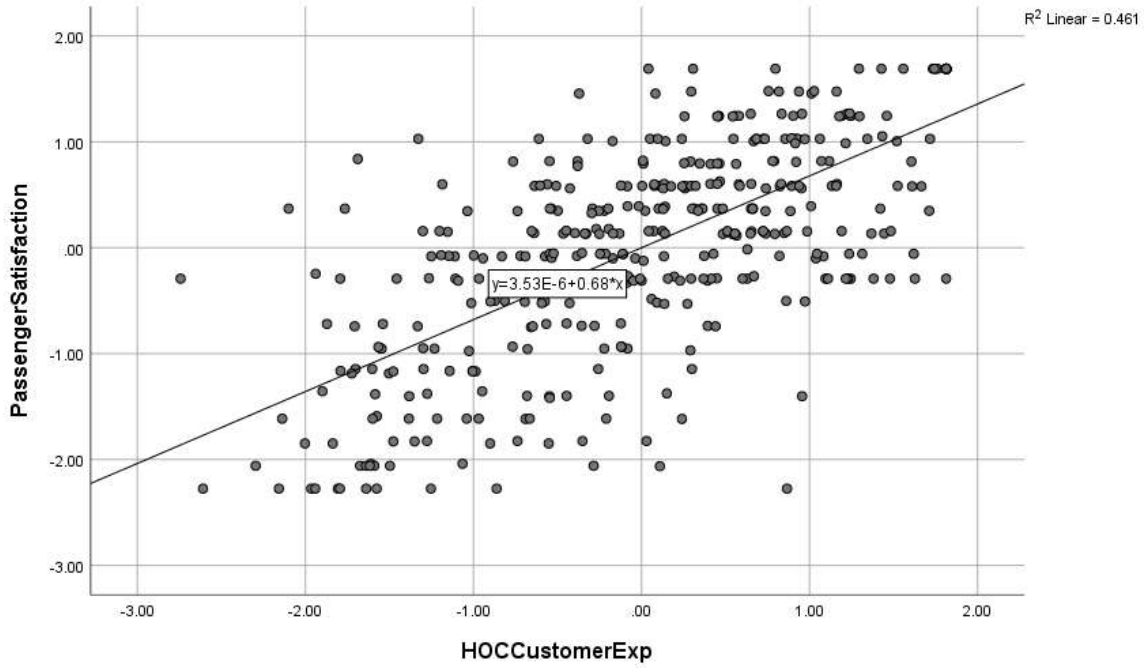
Appendix 49. Scatterplot diagram of negative viu scores plotted against holistic value creation scores



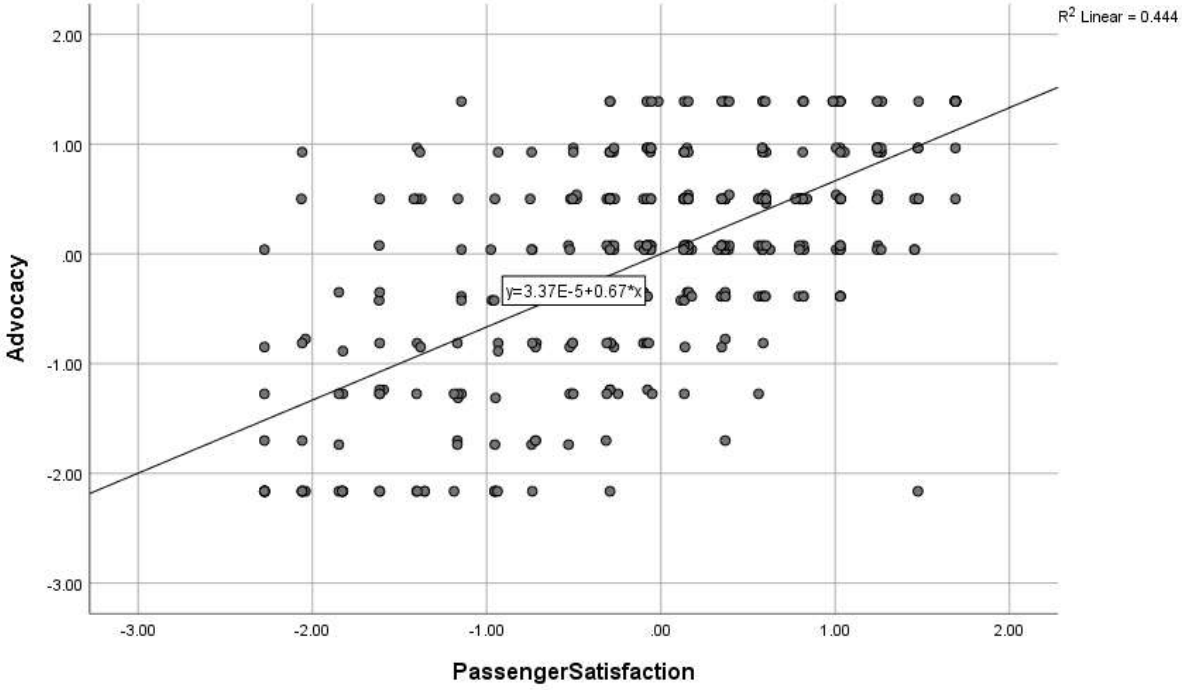
Appendix 50. Scatterplot diagram of holistic value creation scores plotted against customer experience scores



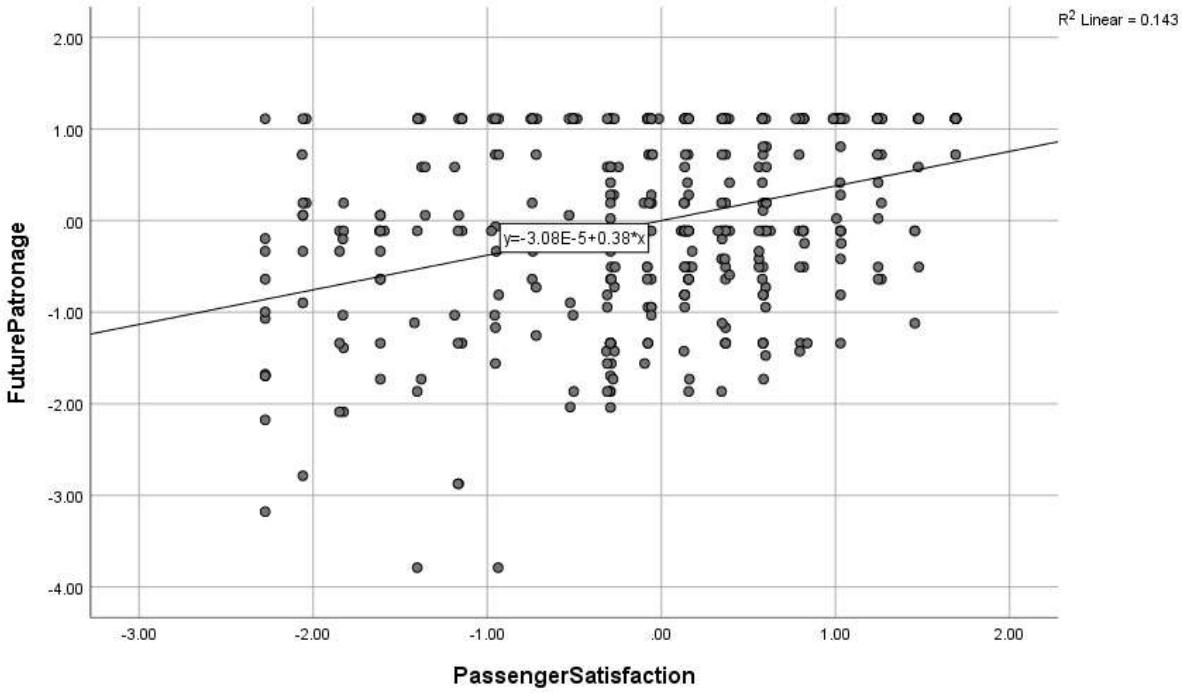
Appendix 51. Scatterplot diagram of customer experience scores plotted against passenger satisfaction scores



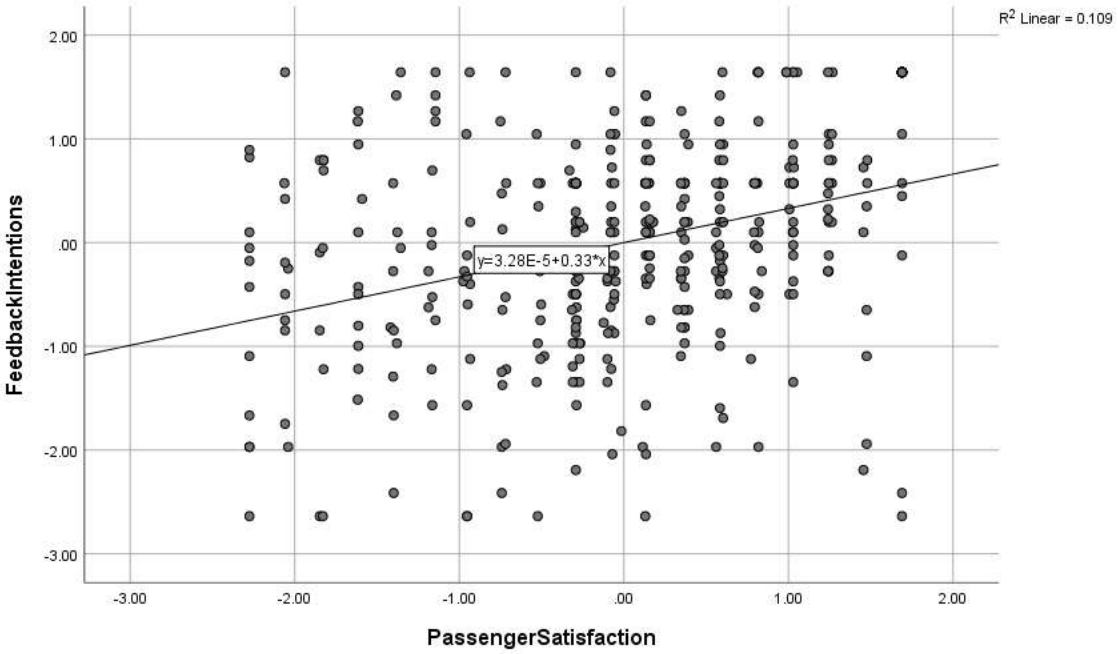
Appendix 52. Scatterplot diagram of passenger satisfaction scores plotted against advocacy scores



Appendix 53. Scatterplot diagram of passenger satisfaction scores plotted against feedback intentions scores



Appendix 54. Scatterplot diagram of passenger satisfaction scores plotted against future patronage scores



Appendix 55. Non-significant MGA-PLS results for model comparison analysis

Commuter Vs Business Indicator loadings	Difference (Commuter Passenger - Business Passenger)	p. value (2-tailed)
Advocacy <- Advocacy	0	0.164
Co-production -> Value co-creation	-0.006	0.536
Feedback intentions <- Feedback intentions	0	0.869
Future patronage <- Future patronage	0	0.145
HOC Customer experience <- Customer experience	0	0.273
Negative viu -> Holistic value creation	0.026	0.915
Passenger satisfaction <- Passenger satisfaction	0	0.619
Positive viu -> Holistic value co-creation	-0.038	0.488
Social value co-creation -> Holistic value creation	-0.016	0.615
Leisure vs Business (path coefficient)	Difference (Leisure Passenger - Business Passenger)	
Passenger satisfaction -> Advocacy	0.062	0.762
Passenger satisfaction -> Feedback intentions	-0.174	0.29
Passenger satisfaction -> Future patronage	0.253	0.133
Leisure vs Business (total indirect effects)	Difference (Leisure Passenger - Business Passenger)	
Value co-creation -> Advocacy	-0.137	0.326
Value co-creation -> Future patronage	0.052	0.572
Holistic value creation -> Advocacy	-0.09	0.521
Holistic value creation -> Feedback intentions	-0.166	0.205
Holistic value creation -> Future patronage	0.088	0.402
Holistic value creation -> Passenger satisfaction	-0.197	0.066
Leisure vs Business (loadings)	Difference (Leisure Passenger - Business Passenger)	
Advocacy <- Advocacy	0	0.713
Co-production -> Value co-creation	-0.028	0.122
Future patronage <- Future patronage	0	0.441
Independent value creation -> Holistic value creation	-0.123	0.042
Negative viu -> Holistic value creation	-0.376	0.045

Passenger satisfaction <- Passenger satisfaction	0	0.72
Positive viu -> Value co-creation	0.005	0.971
CVL vs WBC (weights)	Difference (CVL - WBC)	
Advocacy <- Advocacy	0	0.46
Co-production -> Value co-creation	0.273	0.051
Future patronage <- Future patronage	0	0.427
HOC Customer experience <- customer experience	0	0.245
Passenger satisfaction <- passenger satisfaction	0	0.404
South Wales vs Border Regions (loadings)	Difference (South Wales - Border Regions)	
Advocacy <- Advocacy	0	0.862
Co-production -> Value co-creation	0.001	0.911
Feedback intentions <- Feedback intentions	0	0.37
Future patronage <- Future patronage	0	0.203
HOC Customer experience <- Customer experience	0	0.443
Independent value creation -> Holistic value creation	-0.151	0.064
Negative viu -> Holistic value creation	-0.337	0.074
Passenger satisfaction <- Passenger satisfaction	0	0.817
Positive viu -> Value co-creation	-0.06	0.176
North Wales vs Border regions (loadings)	Difference (North Wales - Border Regions)	
Advocacy <- Advocacy	0	0.294
Co-production -> Value co-creation	-0.02	0.556
Feedback intentions <- Feedback intentions	0	0.713
Future patronage <- Future patronage	0	0.851
Independent value creation -> Holistic value creation	-0.062	0.502
Negative viu -> Holistic value creation	-0.259	0.197
Positive viu -> Value co-creation	-0.018	0.614
Social value co-creation -> Holistic value creation	-0.04	0.643
North Wales vs Mid-Wales (loadings)	Difference (North Wales - Mid Wales)	
Advocacy <- Advocacy	0	0.476
Co-production -> Value co-creation	-0.027	0.374
Future patronage <- Future patronage	0	0.814

Independent value creation -> Holistic value creation	-0.056	0.553
Negative viu -> Holistic value creation	0.04	0.855
Passenger satisfaction <- Passenger satisfaction	0	0.047
Positive viu -> Value co-creation	-0.015	0.678
Social value co-creation -> Holistic value creation	0.014	0.823

Source: this study