15-07-2020

Augmented Reality in retail: A service ecosystem approach

Master Thesis

MSc in Business Administration and E-business

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Abstract

This study conducts a single case study on how a co-owned AR-app impact on the Danish design furniture industry. A service ecosystem perspective is used to understand, how augmented reality comes into use in the context of manufacturers, retailers and consumers. Furthermore, the study expands the work of Henningsson et. al. 2019 in conducting a comparative analysis, with the results found in his article, to detect similarities or differences that can be used to build a theory for explaining how AR affects a retail ecosystem. The focal app for this single case study is Danish Design AR, an external app that act as a brand community gathering prominent Danish design brands and allow them to display visualizations of their furniture in the homes of the consumers who use the app. The main conclusions of the study is that an augmented reality app like Danish Design AR may have an ability to change the power structure between service ecosystem actors, by consisting a new customer touch point and by allowing the actor that controls the augmented reality app to influence the consumers during the inspiration phase and the evaluation phase of their buying process. Another conclusion is that if such new customer touch point as an augmented reality app fail to anticipate its effect on every member of the service ecosystem, it can cause a resistance from neglected ecosystem members and thereby prevent adoption.

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1 Introduction

Virtual reality (VR) and augmented reality (AR) technology, have recently proved useful in solving a wide variety of tasks in different industries, including education, health care, construction, gaming and entertainment. As an example VR is used in education to simulate an immersive virtual learning environment where industrial engineers can gain experience with virtual CNC lathes and cutters, before physically handling the expensive CNC machines in the real world (Trondal T., 2019) and within gaming, AR is used to catch virtual Pokémon's in the real world, in the popular game Pokémon go, which had 486 million users worldwide in 2019 (Statista 2020).

When viewing the literature on VR, AR and Immersive virtual environments (IVE), there are several researches, in which the researcher uses the technology acceptance model (TAM), to investigate the adoption of the technologies, their usefulness and their ease of use (Davis 1989). There are also several articles that investigate the technologies impact on different mercantile areas; like influence on customer satisfaction, shopping experience brand perception and so forth. Several articles have shown that users perceive the technologies as both entertaining, engaging, and immersive and the future potentials of the adoption of such technologies has proved likely (Huang yet al. 2014) (Poushneh et. al. 2016) (Spreer et. al. 2014). This adoption readiness was also confirmed in a 2019 survey that showed that 70% of 25-34-year-old US consumers were ready to use IVE technology in physical stores (Henningsson et. al., 2019).

Also, in the business world, several large and powerful companies have confidence in these technologies and estimates an extensive future potential of the technologies. As an example, Goldman Sachs estimates virtual and augmented reality to constitute a $ 80 billion market by 2025, (Goldman Sachs, 2020) and Gardner estimates that up to 100 million people will choose to shop through AR-touchpoints either in-store or online at the end of 2020 (Gartner 2019).

Due to high expectations of the future potentials of these technologies, the users adoption readiness and due to the disruptive nature of the technologies (Bleu B., 2018), it is interesting to examine how a future world-wide adoption of these technologies, will impact on various sectors. It is also interesting to examine how the technologies will impact on the way we entertain ourselves, educate ourselves, acquire information and

particularly for me as a business student, it is interesting to examine how the technologies will change the way we shop and do business.

An industry that recently has opened its eyes for the potentials of IVE's is retail. Over the last years, several companies have launched AR apps or VR-based IVEs in the hope of attracting customers by enhancing the shopping experience. An example is IKEA Place which is an AR-based smartphone application that allows customers to see how IKEA's furniture look in their private homes (IKEA, 2020). Another example is Alibaba buy+, which is a shopping experience where customers enter a VR environment that simulates a grocery store, from where they can go virtually shopping, after which the goods are paid for and delivered in the real world (Brennan T. 2016).

Common to many of the IVEs available in retail today is, that they are owned by one company to service their own customers, rather than acting as shared environments where several companies join, to co-create AR or VR experiences. However, new AR-technology like AR-clouds is in its development. AR-cloud technology suggests a future in which people, organizations and business join together in shared ecosystems that evolves by the use of social sharing and crowd-sourced activities like shared IT-development, shared environment-mapping and shared content generation. (Vitillo A. 2020) (Inbar O. 2018).

A recent article (Henningsson et. al., 2019) also indicated a need for moving towards shared IVE's by pointing out some issues associated with a solo rather than a shared approach.

The article constitutes a study on the impact of a new AR-app on a retail service ecosystem. The company behind the new app was the Danish design company Louis Poulsen (LP). The purpose of the AR app was to allow customers to see what LP's lamps looked like in their homes. One of the results of the study was that the users expressed an inconvenience about the fact that the app was offered by only one design company, rather than an association of several companies. The reason for this inconvenience was that the users missed the ability to compare products across design companies, without having to download an app from each provider (Henningsson et. al., 2019).

This result was particularly noteworthy as LP's AR-app subsequently shut down, and LP instead, chose to partner with a development team and a number of other Danish design

companies to participate in a shared AR-app, called "Danish Design AR" (Danish Design AR, 2020), that could display AR-animations of a wider range of products to the user.

In the light of this, I find it interesting to examine what impact this change from a "one company to its costumers approach" to a "many-to-many approach" has on a retail service ecosystem, including the way it changes how business is done and how customers shop within the ecosystem. This paper is an extension of the Henningsson et. al. 2019 study, with a specific focus on a shared AR-apps impact on a service ecosystem. The study conducts a comparative analysis of the two cases; LP's solo App, and the shared app Danish Design AR app viewed from a service ecosystem perspective.

This leads to the following research question

1.1 Research Question

"How does a co-owned AR-app affect a retail service ecosystem?"

1.2 Notions used in this paper
The meaning and application of some relevant notions used in this paper is specified below.

Co-owned AR app: This notion refers to an augmented reality app, where a community of ecosystem actors cooperates in developing or operating the AR-app, by contributing with content, labor, money, or other types of resources. The notion of co-owned in this paper does not necessarily require that the ecosystem actors has entered any economical or contractual joint ownership agreements.

Customers and consumers: This paper uses both the notions of customers and consumers about the "end-users" who consumes a product, so B2B customers or retailers will not be referred to as "the customers".

Manufacturer and producer: This paper uses both the notions of producer and manufacturer about a company that controls the manufacturing facilities that generates a product.

Results, findings, and implications: This paper uses both the notions of results, findings and implications about what is found during the analysis of the empirical data, that has relevance in answering the research question.

1.3 Structure of this paper

Figure 1 – Structure of this paper

INTRODUCTION
➤ Introduction
➤ Research question

THEORETICAL BACKGROUND
➤ Literature review on IVE's and AR
➤ Literature review on service ecosystem
➤ Theoretical framework

CASE PRESENTATION

METHODOLOGY
➤ Ontological and epistemological considerations
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CONCLUSION

Source: Made by the author

2 Theoretical Background

In this section relevant topics from previous literature concerning immersive virtual environments, augmented reality and service ecosystems is presented, including researchers' definitions and interpretation of some of the most relevant concepts within these fields. Furthermore, a theoretical framework used for analyzing service ecosystems is presented.

2.1 Virtual worlds/IVE's

The notion of digitally created immersive virtual environment comes in many varieties and is used in different ways in the literature. Cahalane et al. 2012 conducted a literature review that synthesize the vast majority of research on virtual worlds, including researchers different interpretations of definitions, words and phrases that relates to virtual worlds/IVE's. Cahalane et al.'s synthesising of the literature resulted in two main concepts of which IVE's are best interpreted. The two concepts were immersion and emergence. Here Cahalane et al. refer to system immersion as quote: "*related to the physical configuration of the user interface of a virtual reality system; with classifications (full, semi, non-immersive) depending on the degree in which the user perceives the actual world during engagement with the simulation".* Regarding emergence, Cahalane et al. states that the level of emergence in an IVE, is regarded as a strengthening factor for creating immersive response. Here emergence refer to quote; "*the process of coming forth, issuing from concealment, obscurity, or confinement, [and also] of the result of an evolutionary process"* (Cahalane et al. 2012). Where Cahalane et al. especially emphasize the later; "*an evolutionary process*", and states that a characteristic of IVE's is that the interaction between networks of users in the IVE' and the user's interaction with the IVE itself, evolve over time.

Following these states of mind this paper uses the term immersive virtual environment as a term for any digitally created environments, where user and system interactions evolve over time and which provide an experience that engage, and stimulates the user to a degree in which he perceives it as immersive.

2.1.1 What is immersion?

The term immersion is subjective to interpretation and the literature therefore have many explanations to what creates the feeling of immersion. Both technical researchers, as well

as sociological and psycological researchers have their different views on immersion. The following is a sample of some of the elements that the literature points out as creating immersion in virtual environments:

- **Quality of visuel elements and the IVE's technical abilities**
    - (Klinker et al. 2011) states that in order to create a truly immersive experience, scientists and developers need to overcome a number of technical challenges including that virtual objects must look realistic and must be placed correctly into the real world. Furthermore AR-systems should be wearable and mobile, should support collaboration between networks of AR users and should track users' motion correctly and provide real-time rendering according to the users changing perspective. These challenges all strengthen the feeling of immersion according to Klinker et al. 2011. However, they also represent a technical priority dilemma, as technological constraints do not allow for satisfying all challenges at once. These technological constrains relate to limited processing power and data capacity in wearable units e.g. smartphones, as well as limitations related to bandwidth that allow for connecting wearable units with remote processing resources and data storage resources (e.g. from clouds or private servers) to perform real-time responses.
- **The feeling of presence within the IVE**
    - Both (Witmer et al., 1998) and (Steur, 1992) discuss in their articles the close link between the feeling of presence and the feeling of immersion. (Witmer et al., 1998) define presence as *"the subjective experience of being in one place or environment, even when one is physically situated in another"* and states that presence is based on a mix of sensory stimulation and environmental factors that encourage involvement and enable immersion, and internal tendencies to become involved
    (Steur, 1992) define telepresence at *"the experience of presence in an environment by means of a communication medium"* and states that telepresence is achieved through vividness and interactivity, where vividness, is defined as the ability of a technology to produce a sensorially rich mediated environment and interactivity is defined as the degree to which users of a medium can influence the form or content of the mediated environment.

- **Feeling of community belonging and individual distinctiveness within a virtual space**
  - (Boellstorff et al. 2012) indicate that users can become so involved in virtual environments, that they feel so personally attached to virtual goods and avatars, that it affects their feeling of community belonging and individual distinctiveness. These effects are often seen in massively multiplayer online games (MMO's) and is discussed in literature related to gaming-behavior.
- **Interaction between users and the co-creation of shared content whithin the IVE**
  - Artemesia 2009, pp. 133 state that IVE's are community forming and socially interactive, because they represent environments of which shared context for social transaction is created and interaction between several users evolve over time in a co-creative process. The co-creative process is also one of the ideas behind AR clouds which is mentioned in Gardners 2019 list: "Hype Cycle for Emerging Technologies". Here Gartner predicts AR-clouds to have a solid future disruptive potential (Smith et al. 2019) (Bleu B., 2018).

In the light of the view on immersion in these different articles, it is clear that the concept is complex and comprehensive. In my view all above mentioned perspectives, contribute to a broader understanding of the concept and is therefore only empathizing that one view seems inadequate. Instead immersion should be viewed as an entire area of research.

2.2 Augmented reality

According to (Milgram and Kishino 1994)'s definition on augmented reality, it is quote; *any case in which an otherwise real environment is "augmented" by means of virtual (computer graphic).*
Here the ratio between real and virtual objects in the established mixed reality, constitutes a continuum with changeable and moving boundaries. In this continuum, VR is perceived as the 100% digital universe that contrasts with the real physical world, while augmented reality is the digitally modified physical world and augmented virtuality is a virtual world that is modified by incorporating real-world information or replications of real-world elements e.g. captured through photo or video cameras (Milgram and Kishino 1994) (Azuma 1997). But the boundary between what is real and what is virtual is sensory

becoming more fluid as technology evolve and become better at making computer graphics and sounds that appear very close to reality (Naimark, 1991).

2.2.1 Characteristics of augmented reality

Milgram and Kishino 1994 have created a framework for understanding the mixed reality continuum and has established 3 elements that distinguishes the quality and immersion ability of mixed realities including AR.

- Extent of World Knowledge
- Reproduction Fidelity
- Extent of Presence Metaphor

Extent of World Knowledge refers to the degree of knowledge/information about the real world that a computer holds and is able to extract from information sources like smartphones, smart glasses, sensors in the environment etc. This includes information that allow the computer to recognize and label both virtual and real objects and understand the position of the objects in relation to each other. Technically this element relates to the AR-applications rendering method which is described later.

Reproduction Fidelity refers to the quality, by which a display is capable of reproducing the actual intended image of an objects to be displayed. This includes, both real objects and virtual objects. This factor is strongly associated with technologies such as, graphic rendering techniques, image resolution, the strength of the Internet connection and bandwidth, the quality of the hardware, etc. as they all affect the quality.

Extent of Presence Metaphor refers to the extent of which, the user is supposed to feel present in the mixed reality space, including the degree of immersion. This factor is not only related to the software setup but is also closely related to the hardware used (the projection unit). An example is that, head mounted displays typically is designed, to provide the user with a more immersive and present feeling, than PC's or smartphone-screens that only shows "a window of the world".

2.2.2 How does augmented reality work?

Basically, AR consists of the following 3 parts (Henningsson et. al. 2019).

- A rendering method

- o That allow AR-application to understand the real world and overlay virtualities
- A projection unit
  - o The device that you receive AR stimuli from
- A data feed
  - o That allow for retrieving 3D elements, animations, and other data to be placed within the augmented reality

The rendering method is the method used to overlay the real world with virtual elements. It does so, by receiving information about the real world and then trigger the appearance a virtual elements or flows based on that information. Software architecturally there are several different technical methods for this, e.g. the simultaneous localization and mapping method, the marker-based method and the location-based method (Henningsson et. al., 2019).

Simultaneous Localization and Mapping is a programming method used for AR-applications that make a device understand the real physical world, by mapping it through function points. This function point mapping allows the application to recognize 3D objects and their location relative to each other. Simultaneously with the mapping of the physical world, the method makes it possible to overlay virtual objects in the desired locations that suit the environment of the real (Reitmayr G. et al. 2010) (Henningsson et. al., 2019). As an example, this method is the logic behind why a Pokémon creature in the Pokémon go AR-app appears correctly located, in the grass in front of your feats and not hanging upside down from the sky.

The marker-based method tracks certain markers or objects from the real-word, that are captured through e.g. a camera lese. When a marker is detected in the environment, the appearance of a virtual object or flow is triggered. The process of tracking the markers is done by converting images of the physical world into grayscale images, after which an image processing algorithm identifies grayscale pixels and their relative position to each other in order to detect if there is a pixel composition that looks like the predefined markers or 2D objects. If there is a match the virtual overlay is triggered (Levsi Y. 2020) (Henningsson et. al., 2019). The method is known from e.g. QR codes.

The location-based method uses data from e.g. a GPS, an accelerometer, a speedometer, and other location and motion-related technologies, to provide the AR application with location information that the application use to trigger overlays of virtual object (Henningsson et. al., 2019). An example could be a navigation system for AR-

smartglasses that is used when driving a car, where navigation arrows and information on time and speed is triggered on the basis of GPS and speedometer information.

The projection unit is the unit used to showcase the AR experience. That is the unit that visually projects the modified / augmented world. Most AR applications is customized to use smartphones as the projection unit. But also head mounted displays (HMD), smart glasses, televisions and computer screens can be used as AR projection units. The advantage of using smartphones as projection unit for AR application is, that many people already holds one and that the distribution therefore is much easier and more accessible. The downside with smartphones is that the small screen, limits the experience and attenuates the sense of immersion. This is contrary to head mounted displays and smart glasses, which covers a person's field of view completely, which gives a more immersed experience and support the feeling of presence within the augmented universe. The disadvantage of HDM and smart glasses on the other hand, is that few people already owns one and that most HDM's are expensive to acquire (Henningsson et. al., 2019).

The data feed processes and provides the application with the data used to transfer virtual objects to the environment. Some data is static, which means that it is loaded from databases. This could be a database where 3D objects are uploaded in advance. Other data are so-called real-time dynamic data and extract the information from, for example, sensors in the environment or social medias in real-time. (Henningsson et. al., 2019)

2.3 Augmented reality in retail

An industry that is increasingly opening its eyes for the potential of AR is retail as AR is expected to disrupt the industry and change the way consumers buy (Bleu B., 2018).

In the literature the technology acceptance model TAM is widely used. These studies have had different focus areas, including the examination of both AR or VR hardware and software, used in different contexts and to solve different task. The TAM model is used to investigate users' readiness to adopt new technologies such as AR. This is by studying the perceived ease of use and usefulness of a technology, which according to the model is precursors for the users' attitude towards AR, their intentions to use AR and finally their actual use of the technology (Davis 1989). There are also several articles confirming the TAM model, as an applicable framework for investigating AR in a retail setting, e.g. (Rese et al. 2016) and (Spreer and Kallweit 2014). In the literature, TAM models are used widely and is used to investigate the adoption of both new AR hardware, such as smartglasses

and new software. The outcome of the TAM research varies according to the specific context and field of topic of the research; however, some similarities can be found. Several articles conclude to the paradox, that AR applications for smartphones typically is perceived as easy to use but having low usefulness, while applications with high usefulness, typically have low ease of use, due to lacking AR-technology maturity (Henningsson et. al., 2019).

Besides the numerous TAM research', other articles focus on examining specific mercantile opportunities and effects of using AR and examines topics like AR's impact on customer satisfaction, user experience (UX), brand perception, costumer buying behavior, costumer information search at the point of sale etc.

Regarding UX, the studies indicate that AR has a positive impact on user experience, by allowing virtual product interaction and by creating a more personalized experience, that encourage to social network sharing, and enhances playfulness (Huang and Hsu-Liu, 2014). Furthermore, AR forms an entertaining virtual playground, where different products can be experienced in 3D and costumers have the chance to view different colors and styles, which enhance the user experience and users' perception of reality (Poushneh et al.) (Huang and Hsu-Liu, 2014).

In a point of sale situation, AR has the potential to enrich information about products, which positively influence the process of letting costumers through the consideration-fase, the intent-fase and the evaluation-fase of the sales funnel. AR also let costumers interact with products, e.g. by allowing them to stipulate a product's features. The enriched product information and the interaction with product features, colors and styles, stimulates customers to feel closer to the real product despite the physical distance, when shopping online, and stimulates the feeling of telepresence (Fiore et al. 2005) (Poushneh et al.) (spreer et al.) and (Schwartz 2011).

Interestingly, studies like (Poushneh et al.) (Haenlein et al. 2009), (Chen et al. 2010) and (Schwatz 2011) also indicate that AR has the ability to improve the hedonic value and the user's satisfaction, and thereby improve customers willingness to buy. Furthermore (Haenlein et al. 2009) and (Gabisch and Gwebu 2011) conclude in their studies that AR have the ability to strengthen the costumers brand perception as firms that uses AR is associated with being innovative.

2.4 Service ecosystems

As mentioned in the introduction, this paper investigates AR technologies impact on service ecosystems, why understanding these systems and defining this papers interpretation of concepts related to service ecosystem is essential.

In the concept of a traditional supply chain, the idea was that several subcontractors contributed with the supply of components used within the final product, thus all subcontractors in that way took part in the value creation and processing of that product. Since the beginning of the information technology era the value creation has taken a shift from being product-centered to becoming more service-centered, as what is being offered in many cases is a mix of services and physical products and sometimes only services. This means that simply having subcontractors to take care of the supply of components to a product, does not cover the whole value creation as the value package consist of both tangible components as well as intangible service elements. In the information technology era people therefore started to realize the importance of operant resources like knowledge and skills as key to value creation. From this era the service dominant logic was created as a new way to view and analyze the integrated networks of business and consumers and their mutual value creation (Vargo S. et al. 2004). Service ecosystems is a concept that originate from the literature on service dominant logic.

Service ecosystems have many similarities to traditional supply chains, but here the concept of value-adding subcontractors and what constitute the final offer (final value package), is viewed from a broader perspective. The final offer can be viewed as a package of different services, ranging from services that consist the core offering, as well as services associated with all the jobs a customer need to get done along his journey, from the phase of information search to the termination/disposal of the offering. The traditional notion of "subcontractors" is broadened to comprise both strategic business partners that provide elements to the core offering, as well as second party companies that e.g. provide services for e-commerce activities or customer financing. Furthermore, the partners of a company's partners, can also be viewed as "subcontractors" to the service ecosystem, as they indirectly contribute to the value creation and are indispensable actors in the service ecosystem as well (Akaka et al. 2015). The traditional notion of added value is also interpreted differently than the traditional economic conception, where a firm's added value is the portion of the monetary sales value of the final offer that a firm creates in its stage of production (McDowell et al. 2009). In service

dominant logic, value is a concept of interpretation, as it is based on an evaluation made by the beneficiary of the value. As stated in Akaka et al 2015, quote; *"What might be considered valuable to a particular actor, in a specific context, may not be considered valuable to a different actor or to the same actor in a different context. In this way, it is the positive or negative evaluation of an experience, situated within a particular socio-historic context, that determines whether value is created or not.*

Many different types of service ecosystems exist today, and the actors in the systems can both be individuals, organizations, and businesses. Examples of service ecosystems are software ecosystems (e.g. Apache and Salesforce), Electronic business networks (e.g. virtual networks and ecommerce platforms), cloud computing platforms (e.g. those provided by Azure and Amazon Web Services) and social networking platforms (e.g. Facebook and LinkedIn). Common to service ecosystems is that the actors share the value creation and that the interaction and exchange between the customers and the customer touchpoints of the service ecosystem have a mutual nature. This means that all actors in the ecosystem have the opportunity to influence these exchanges, just as they also are affected by them. This also implies that a change in one part of the ecosystem will affect the whole ecosystem (Ruokolainen et al. 2011), (Zhang et al. 2017)

In Vargo et al. 2016 a service ecosystem is defined as quote *"a relatively self-contained, self-adjusting system of resource-integrating actors connected by shared institutional arrangements and mutual value creation through service exchange"*

Regarding the notion of *"a relatively self-contained, self-adjusting system"*, several articles support that statement. E.g. in Akaka et al., 2013 it is explained how service ecosystems are based on repetitive interactions between ecosystem parties and how interest in these interactions is driven by a mutual dependency relationship between actors, also referred to as a service-by-service exchange.

Regarding the second notion in the definition *"a system of resource-integrating actors connected by shared institutional arrangements and mutual value creation through service exchange"*. Vargo and Lusch stress in their 2011 article the importance of a service ecosystems ability to raise dynamic and influential resources, as the exchange of these resources is the basis for creating value. These resources both include operant resources, such as the actors' various competencies, as well as static resources, for example. goods and money (Vargo et al. 2011).

2.4.1 A theoretical framework on service ecosystems

The article (Henningsson et. al., 2019) presents a framework that can be used to analyze service ecosystems. The framework divides a service ecosystem into three different types of relationships. First, *dyadic relationship* which is the direct connection between a customer and a firm's costumer touchpoint. Second, *Triadic relationships* which is indirect connections between 3rd party actors and the costumer. This is actors who is linked to a dyadic actor, but who only contribute indirectly to the value creation towards the costumer, through their interaction and exchange with that dyadic actor. These actors do not have direct control over any customer touchpoints and therefore rely on the dyadic actor on this matter. Finally, there is *relationships between different triadic constellations.* These ties occur when costumer touchpoints along the costumer journey derive from each separate triadic constellation. This could be the tie between a manufacture that controls a customer touch points and a retailer that also controls a touchpoint to the same group of customers. See the framework in figure 2

Figure 2 - Service ecosystem framework
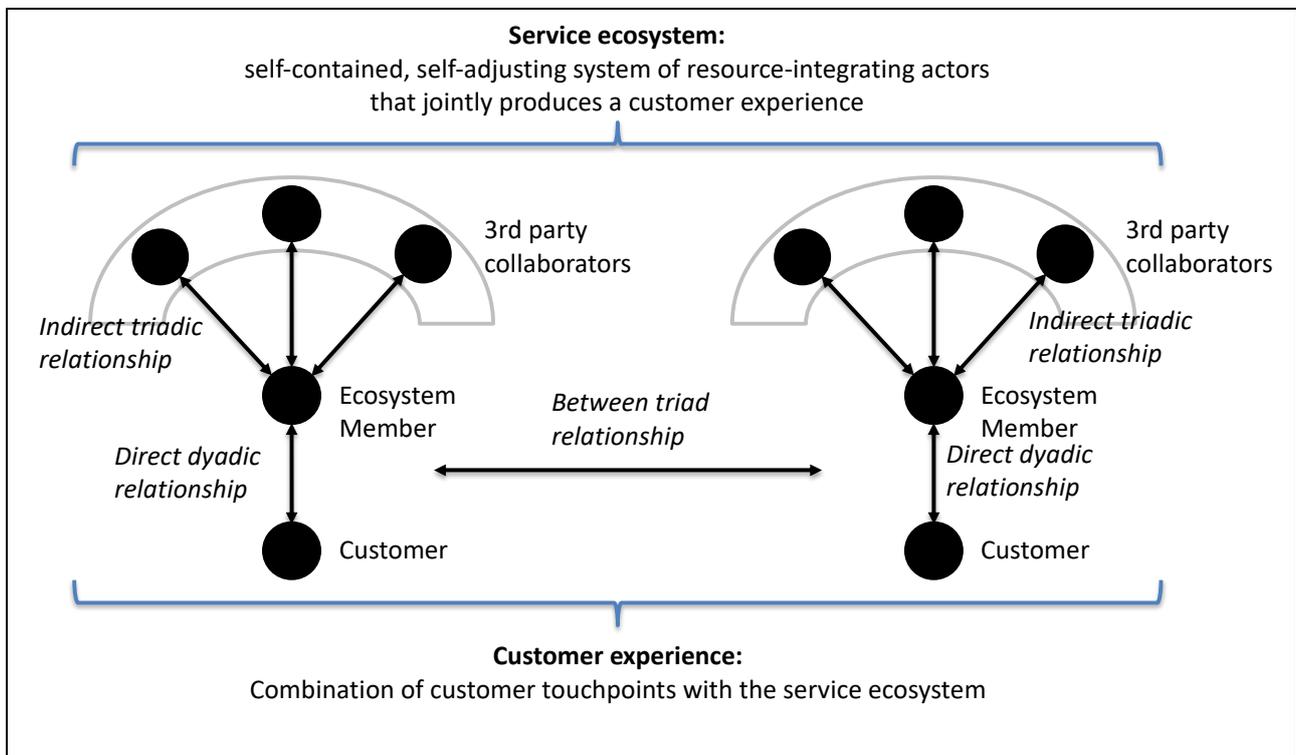
The framework from (Henningsson et. al., 2019) is based on theory from previous literature on the subject of service ecosystems, written by prominent ecosystem scientist such as Melissa Akaka, Stephen Vargo and Robert Lusch, mainly articles such as (Akaka et

al 2015) and (Vargo et al. 2016). However, the framework has a more relationship oriented and retail oriented analytical focus, compared with the theories presented in the underlying literature, as it is only used to divide actors in a retail service ecosystem into 3 levels on behalf of their roles in relation to the value creation towards a costumer and the relationship and relative distance to that customer. On the other hand, the underlying literature, just as much emphasizes a focus on the social and cultural stimulations viewed from a micro meso and macro perspective, that impact on the actors state of mind, which again impact on interactions and transactions among the actors in an ecosystem as well as impact on the actors perception of added value (Akaka et al. 2015) (Vargo et al. 2016). In that way the framework from the Henningsson et. al. 2019 article is clearly just an extract of the underlying literature, selected and interpreted to suite better for a retail context. Despite my awareness of this simplified or extracted analytical focuses, I still find the framework suitable for analyzing this papers research question, as the focus of this paper exactly lies on retail and how AR technology impact on a retail service ecosystem. The underlying literatures more sociological focus and their division into micro meso and macro stimulation, instead served better in the case of this paper, as background knowledge when understanding the context of stimulations that affect the interviewees during data collection.

When the theoretical framework is used to analyze a specific service ecosystem, it is a matter of interpretation, who is considered triadic and dyadic actors. That depends on the point of view and the purpose of the analysis. For example, if the service ecosystem of the B2B sales platform of Alibaba.com were to be analyzed, both the users of the site looking for a supplier and the advertisers, i.e. the individual suppliers of goods, could be regarded as Alibaba's customers, just as the suppliers act as content creators and thus could be regarded as triadic 3th party collaborators. Therefore, in an individual analysis, it must first be defined who is regarded as having what role? The definition of this papers dyads and triads can be found under the headline "Interview and selection of respondent's" in the methodology section of this paper.

3 Case presentation

This section first gives a presentation of the AR-app at stake in this research, its origin and how the app works and add value to the user. Secondly a presentation of the service ecosystem of the Danish design furniture industry is presented.

3.1 About Danish Design AR

Danish Design AR originated as a startup project by the company Utopian City Scape ApS. At the time, Utopian City Scape ApS was a small company and consisted of 6 people who designed 3D visualizations (not AR) of construction projects for their clients. In connection to one of their projects, they were asked to develop a series of 3D visualizations of Danish furniture design classics, which were to be used to visualize the interior of the Danish Architecture Center's new headquarter, in central Copenhagen. During the same period of time, Apple released their first version of their augmented reality kit for the iOS operating system, and therefore the team behind Utopian City Scape chose to test how their 3D furniture would look in augmented reality. Because they already had developed the portfolio of 3D furniture in advance, the process of applying it in augmented reality went fast and soon they had a catalog of the Danish design classics within an AR app. They were pleasantly surprised by the experience of viewing the furniture through AR and thought that this AR application could also show valuable to people in the furniture industry. This was how the project of Danish Design AR started. (Developer interview line 6-33)

Danish Design AR allow users to view AR visualizations of selected furniture's from the brands that participate in the app, in the context of their own home. This is done by capturing the room through the lenses of their smartphone cameras while simultaneously overlaying the room with preloading 3D visualizations of design furnitures. The app thus gives the user the feeling of the furniture being present within the room and visually manipulate the rooms interior and looks. The resolution of the 3D visualizations is high which allow the user to take a look at the 3D furniture in close range to view details as well as allow users to move away and view the 3D furniture from a distance. The brands participating in the app consist of 11 reputable, high-end furniture companies and include names such as Fritz Hansen, Louis Poulsen, Royal Copenhagen, Montana and House of Finn Juhl. The app thus acts as a catalog of a selection of these manufacturer's products.

With some of the furniture visualizations, the app allows the user to swap between different colors, materials and styles in order to see different modifications of the same product. However, this is only the case with selected number of the furniture, and the range of product modifications that can be switched between, in most cases is significantly smaller than the number of modifications, that the brands actually offers to its customers.

The app is designed to allow users to be led from the app, directly into a landing page on the manufacturers website and the plan was that it later should be developed to include a possibility for the users to place orders and make payment for furniture directly through the app, however this upgrade never happened. Today, Danish Design AR does not experience a particularly large userbase, although the app is still operated, and data storage and other cloud services continue to be paid to keep the app running.

3.1 The service ecosystem of the Danish design industry

Figure 3 shows the service ecosystem of the Danish design furniture industry. As this paper focuses on the relationship between the community of manufacturers included in the Danish Design AR app and their relational ties with retailers and customers, it is not relevant to investigate what the relationship is, between the various rivaling manufacturers in the industry. For that reason, the network of furniture brands in this paper is treated as a single triadic constellation, although each brand could have been seen as each separate triadic constellation if this paper's analytical focus had been different.

Figure 3 - Service ecosystem of the Danish design furniture industry
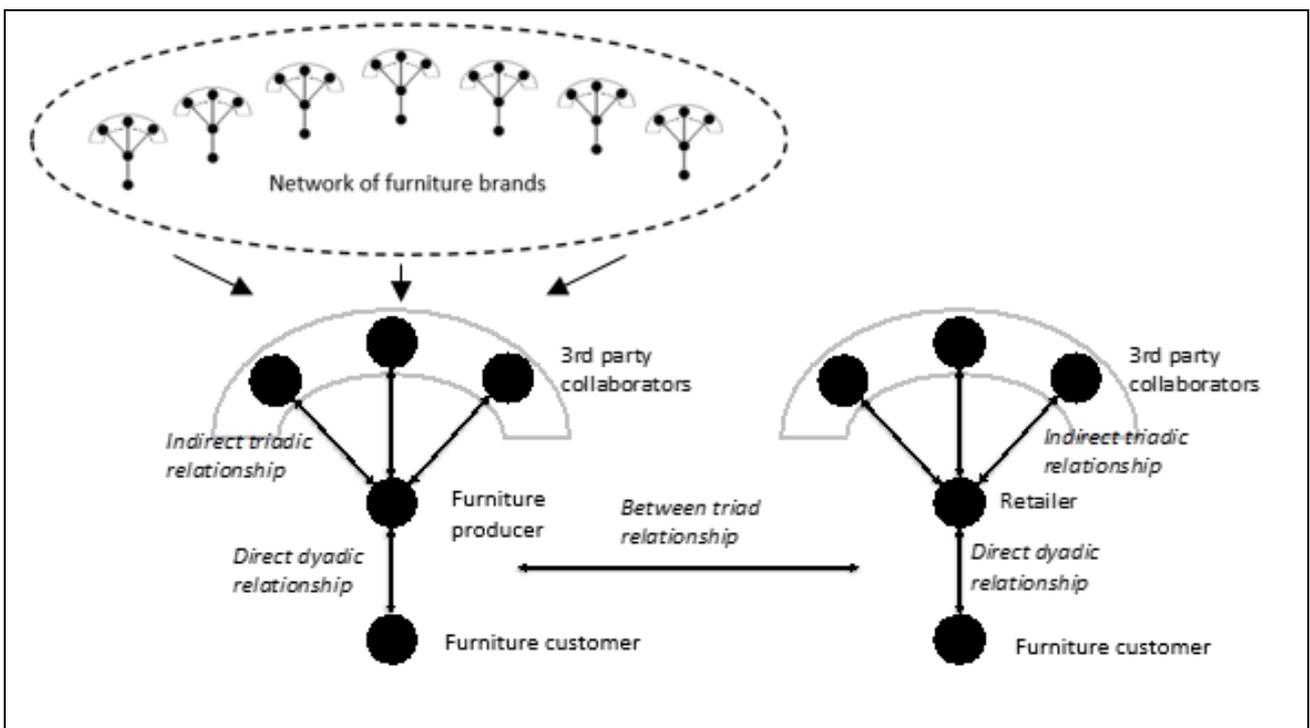
Source: (Henningsson et. al., 2019) with my own modifications

The manufacturers In the Danish design furniture industry are characterized by having a long history and the designers behind many of the furniture have been central personalities in the Danish design history. The products are relatively expensive and can be described as high-end products. The segment that the manufacturers aim to target can be described as wealthy people with long educations and high job positions. They are quality and design conscious and probably knows about the Danish cultural heritage in terms of design.

The manufacturers produce the furniture and sell it to consumers through a retailer network, as some of the manufacturers do also perform direct sales to the customers through webshop or brand stores. The manufacturers typically have a number of design classics that they hold the rights to produce. Some manufacturers live well through these old design classics, but rarely innovate, while other manufacturers have prominent designers working for them to design new furniture alongside selling the classics. In addition, the industry is characterized by the fact that most manufacturers have their existence on both the Danish market as well as on different export markets worldwide.

The retailers in the furniture industry is a mix between small one room stores large apartment stores and webshops. Typically, the retailers specialize in mid to high end products and try to target the designs and quality conscious consumers, from the higher middle class or upper social classes. The retailers typically provide a large range of products to the customers and the manufacturers included in Danish Design AR are typically a few among several hundred suppliers. However, many of the manufacturers still have an important role for retailers, due to their long history and customers high demand for their products.

4 Methodology

This section contains the considerations and choices in relation to the production of knowledge in this paper. The section also contains considerations in relation to scientific philosophy and approach, as well as methodological considerations, case and respondent selection and research design.

4.1 Ontological and epistemological considerations

The governing scientific paradigm which this paper is based upon is the interpretivist paradigm (Cohen D et. al., 2006). The reason for this choice of philosophical view is that, this paper deals with the introduction of AR technology, which is emergent but, still not widely used.

This calls for an approach where the purpose is to explore and get thorough understanding of some of the few cases that is available, learn from them and use them to build theories for explaining (Gregor 2006). With that in mind, I as a researcher must be aware of the fact, that such in depth investigations of a few cases, implies the use of qualitative non-statistic data, where my interpretation of the data and the dynamics between me and the interviewees, may affect the results.

The epistemological assumption behind the interpretivist paradigm is that the way we understand the world builds on our past experiences and who we are. In that way the subject that is researched, cannot be separated from me as a researcher. Subject and researcher are dynamically linked together (Cohen D et. al., 2006).

The ontological assumption behind the interpretivist paradigm derives from the social constructivist school of philosophy. That is, reality is constructed, through the meanings and understandings, which is developed between humans in social interactions or experientially (Cohen D et. al., 2006).

4.2 Methodological considerations

This paper is a comparative research, which aims to establish scientific evidence that can support the development of a theory that seek to explain, how AR-technology affect a retail ecosystem. To perform a comparative analysis, there first must be 2 sets of results to compare. For that reason, this paper is split in two parts.

First part consists of an interpretive single case study (Ridder et. al., 2014) (Saunders, et. al. 2016 pp. 185), about the Danish Design AR-app that LP joined in 2019, in order to get the first set of results. The data from the case study of the Danish Design AR-app, is analyzed and interpreted with respect to the service ecosystem framework figure 3.

The second part is a comparative analysis, where the synthetizations of the data that was retrieved from the case study, is compared with the results from the the Henningsson et. al., 2019 article. This to detect similarities, differences and to establish scientific evidence that can support the development of a theory for explaining how AR-technology affect a retail ecosystem.

The interpretive case study was chosen for several reasons. One reason is that when examining an emerging technology like AR, which is still not widely used, research with large sample sizes that justify generalization to a large population, is impossible to perform, why explorative and interpretive approaches can be used instead. Here the method of interpretive case study is ideal. The advantage of interpretive case study is that it provides the researcher with in-depth knowledge of the dynamics between a case and its context (Dubois et al. 2002). In this situation the case is the introduction of a co-owned AR app and the context is the Danish design furniture retail industry. Another advantage of using the interpretive case study in this paper, is that the same approach was used in the Henningsson et. al. 2019 article, which makes the results easier and more comparable when performing the comparative analysis.

However, disadvantages with choosing the interpretive case study must also be acknowledged. The main disadvantage is that when using interpretive case study for building theory, the theory developed, only apply in the specific case and cannot necessarily be generalized to the population, in this case the retail industry as a whole. Therefore, the theory is only a theory for explaining, following the definition from Gregor 2006. Gregor 2006 states that when theory is used for explaining, the theory itself, can be seen as end product itself, but cannot be expected, to be a predictive, deterministic theory. Correspondingly, in this paper, the presented theory, merely is an indication of how AR affects a retail service ecosystem, based on the case and its specific context and not a deterministic generalizable theory. The results found in this paper, however, may be included in future literature review studies, where multiple similar case studies about AR's impact on retail ecosystems, is gathered and coded, which would provide more generalizable theories applying for the retail industry as a whole.

4.2.1 Case selection

In qualitative research, including case studies, cases are typically selected purposefully (Neergaard, p. 11). Typically, this involves that the researcher set up a number of requirements, to ensure that the case is relevant for answering the research question. Since this paper is a comparative study, the main reason for selecting the Danish Design AR-app case, was due to its relation and similarities with the old Louis Poulsen AR-app case. The case selection was thus based on the same considerations that exist in the the Henningsson et. al., 2019 article, supplemented by one additional requirement.

The selection criteria of the Henningsson et. al., 2019 article was as follows: First, the case should include the introduction of AR technology in a retail setting, consisting of a service ecosystem that together creates a customer experience. Second, the AR app should be mature enough to be introduced as a commercial app. Third, the case should include at least two triadic actors in the ecosystem that contribute to the customer experience.

In addition to these requirements which correspond to the requirements of the Henningsson et. al. 2019 article, the case should also include a retail service ecosystem, where at least two triadic actors participated in the AR app that is focal for the costumer experience. This additional requirement is set up, as it helps addressing this papers research questions notion of a co-owned AR app which differs from the Henningsson et. al., 2019 article.

The Danish Design AR case embraces both the requirements from the Henningsson et. al., 2019 article as well as the additional requirement about co-ownership. At the same time the Danish Design AR case is especially interesting to investigate as it is naturally linked to the Henningsson et. al., 2019 article due to the fact that Louis Poulsen switched from their own app to participate in Danish Design AR instead.

4.3 Research design

4.3.1 Interview as a method

I chose the semi-structured personal interviews as the method for conducting the empirical research. The method is inspired by Kvale and Brinkmann's 7 stages in an interview; thematize, interview, transcribe, analyze, verify, report and publish (Kvale et al. 2015)

The personal interview form was chosen because it allows for an in-depth understanding of the interviewee's insights, attitudes and state of mind, which matches the purpose of a single case study, where the approach is explorative and the goal is to gain in-depth knowledge and insights on a single case of interest and its context. The interview was prepared in accordance with a semi-structured approach, to allow the possibility of asking follow-up questions to gain additional insights into subjects of particular interest, while at the same time maintaining a certain amount of structure, to ensure that all relevant topics was covered. As a preparation for the interviews, 4 interview guides were created to maintain the desired structure. See interview guides in appendix 1.

4.3.2 Research sub-questions

To be able to respond adequately to the research question; "How does a co-owned IVE affect a retail service ecosystem?" the question was broken down into smaller parts consisting of 6 sub-questions. To make sure all relevant aspects of the ecosystem was covered within these sub-questions, they were designed to cover the various dyadic and triad relationships of the retail ecosystem presented in figure 3; the manufacturer/retailer relationship, the consumer/retailer relationship and the consumer/manufacturer relationship.

Sub-question to the manufacturer/retailer relationship

1. What characterize the relationship and collaboration between the manufacturers of design furniture and the retailers?
2. How did the introduction of the co-owned AR app impact on the relationship and collaboration between the manufacturers of design furniture and the retailers?

Sub-question to the consumer/retailer relationship

3. What characterize the relationship between the retailers and the consumers?

4. How did the introduction of the co-owned AR-app impact on the dyadic relationship between the retailers and the consumers?

Sub-question to the consumer/manufacturer relationship

5. What characterize the relationship between the manufacturers of design furniture and the consumers?
6. How did the introduction of the co-owned AR-app impact on the relationship between the manufacturers of design furniture and the consumers?

These sub-questions constituted the guiding premises for the design of the 4 interview-guides that was used during the interviews.

4.3.3 Interview and selection of respondents

In order to answer the research sub-questions, a number of different interviews were required. This to examine actors in the service ecosystem and their relationships with each other, as well as to gather enough data material to gain an in-depth understanding of the case and its context.

The study is based on 6 different individual interviews.

2 interviews with consumers, 1 interviews with a retailer, 2 interviews with manufacturers of design furniture and 1 interview with the developer of the AR app Danish Design AR. In relation to the interview with the manufacturers, their relationship with the consumer is considered a dyadic relationship due to the fact that the manufacturers owns some of the costumer touch points and that several functions in the manufacturers value chain interacted directly with the consumers. During the interview with the retailer, the retailers relationship with the consumer was also considered a dyadic relationship and here the manufacturers were instead considered triadic 3rd party contributors.

The selection of the manufacturers was based on an exhaustible approach, where all 11 participating brands within Danish Design AR were contacted first by mail and later by phone. The people contacted was typically marketing responsible or CEO's. This resulted in 2 manufacturer interviews. The developer interview derived from trying to contact the innovator behind Danish Design AR. As he did not reply, one of the other 5 people in the team was contacted, and I managed to get an interview with the person who had been responsible for sale at Utopian City Scape ApS. The retailer was selected by contacting 8 different furniture retailers that specialized in mid to high end design furnitures, and who

had several of the participating manufacturers from Danish Design AR as their suppliers. I also strived to contact those retailers that owned both online and offline stores and who owned relatively large stores. This resulted in one retailer interview. I would have preferred to talk with more than one retailers, but as the industry was influenced by the corona pandemic, several of both the retailers and manufacturers, rejected participating in the project, as they couldn't justify firing staff and subsequently spend time and resources on this project. However, the retailer who volunteered, was a retailer with a large apartment store, a well-attended webshop and a history dating back to the early 1900s, who was selling products from 9 out of 11 of the brands from Danish Design AR. The customers selected were people that recently had purchased a design classics and who had several design furniture's as a part of their home interior.

Table 1 below provides an overview of the respondents interviewed, their role in the service ecosystem, the duration of the interview, and a record of which appendix readers of this paper can find the transcriptions of the interviews

Tabel 1 – Overview of the interviews

Respondent	Role	Duration	Appendix
Developer	Entrepreneur and responsible for sales and app	39 m. 48 s.	4
Customer 1	Owner of a large seafood farm	29 m. 36 s.	5
Customer 2	Cabinetmaker	31 m. 28 s.	6
Retailer	Owner and CEO of a large apartment furniture store	32 m. 13 s.	7
Manufacturer 1	PR and marketing manager	33 m. 46 s.	8
Manufacturer 2	Digital marketing coordinator	32 m. 25 s.	9

4.3.4 Analysis of emperical data

To analyze the vast amount of empirical data from the 6 interviews, I chose to categorize the material by breaking it down into manageable units. I did that by defining 11 themes, based on the purpose of this study and based on different patterns in the text identified after a general perusal of the interview transcriptions. See the defined themes below:

- Customer segment
- Customer & retailer relationship
- Customer & manufacturer relationship
- Manufacturer & retailer relationship
- Manufacturer & retailer hope and expectations
- App developer & manufacturer relationship
- Manufacturers & retailers benefits and incentives for Danish Design AR
- Manufacturers/retailers disadvantage with Danish Design AR
- Customers benefit with Danish Design AR
- Customers disadvantage with Danish Design AR
- Danish Design AR's application and role in customers buying process

Based on an abductive approach, I chose within each of the themes to condense the material, in order to examine the content of the individual themes. Subsequently I reviewed the material again, to see if new interesting themes appeared from the empirical data.

My analytical approach for processing the data was inspired by Maltherud's systematic text condensation (Maltherud, K. 2012). Therefore, the method of analysis followed the following steps:

- Identify and sort meaningful entities - from theme to codes
- Synthesize - from condensation to descriptions and conceptualizing (to build theory for explaining)

Maltherud presents a method where the intention is to first gain a comprehensive understanding of the empirical material. To perform the analysis, I therefore read through the material several times, to identify the main themes stated above and break the extensive material down into smaller units. After that, I analyzed the individual interview statements step by step to identify meaning-bearing units from the accumulated body of interview statements. When finding statements of particular interest, I highlighted them

to keep a record of them. The record of relevant interview statements was then sorted corresponding to the defined themes.

I then summarized each of these themes and tried to condense the units and add meaning to them (in appendix 3 an example of this process is shown). After that, I assembled the condenses into larger themes corresponding to the different relationship-types stated in figure 3; the manufacturer/retailer relationship, the consumer/retailer relationship and the consumer/manufacturer relationship. This, to make the themes less chaotic more manageable and more suitable to the service ecosystem framework. After that I synthetized these new themes in relation to the formulated sub-research question so that they could be used in the analytical paragraph of this paper and to see if this synthesis could contribute to the production of new knowledge or form theories for explaining.

The condensations of the themes are given in Appendix 2.

5 Analysis

The analytical section presents the synthetizations of the vast amount of empirical data from the 6 interviews. The section is divided in 3 parts, according to the relationships between the actors in the service ecosystem; the manufacturer/retailer relationship, the consumer/retailer relationship and the consumer/manufacturer relationship (see Figure 3). In each of these subsections, the related sub-research question addressing that specific relationship is answered (se sub-question in the metholodical approach section). Finally, this section ends up by comparing the results with the results from the Henningsson et. al. 2019 article and summarize the comparison in an overview listing.

5.1 Dyadic relationship - Customer & Retailer

This section presents a synthetization of the key findings from the empirical data, especially drawing on the following theme condensations: Costumer/retailer relationship, customers benefit with Danish Design AR, customers disadvantage with Danish Design AR and Danish Design AR's application and role in customers buying process (se theme condensations in appendix 2)

5.1.1 A characteristic of the dynamics and relationship between the retailer and the consumers

Both of the interviewed customers expresses that it is important for them, to be able to physically see and feel a design product before purchasing the products and thus expresses a need to visit either a retailer or one of the manufacturers' showrooms. It is particularly important for them to see the product physically, if the furniture at stake is a furniture that you can sit in, because the comfort element in such furniture's is vital to the buying decision. In addition, the customers express a need to physically look into the details and craftsmanship of the product. (Customer 1, line 64-72 & 85-87) (Costumer 2, line 79-88)

Before the customers enter a retail store, they are already quite far in their purchase decision, and the store visit merely act as a way for the costumer to confirm a decision already made, and to see if the product lives up to the customres expectations, and corresponds to the descriptions and pictures that the customer gathered during his prior search for information. (Customer 1, line 122-132) (Customer 2, line 100-106)

When buying a product of interest, both customers expresses a need to get questions answered regarding the history of the product, the product designer or the company, as well as get questions answered in relation to choice of colors and materials of the furniture at stake. The customers will typically ask these questions to a salesperson if the customers are located within the store, but both customers state, that they prefer talking with the manufacturers of the furniture, as they are convinced that they can answer their questions more adequately. (Customer 1, line 49-54) (Customer 2, line 93-97)

Conversely, both customers are reluctant to talk to the retailers. Here they express a skepticism towards interacting with the retailer's sales staff. Customer 1 expresses that he suspects the salespeople of trying to sell him the more expensive furnitures, or just try and validate or invalidate a decision customer 1 already made (Customer 1, line 56-59), and customer 2 expresses that he feel annoyed when talking to salespeople, because he feel that the sellers often will try to sell him the products too expensively, so that he subsequently feels that he have been cheated(Customer 2, 159-164). This stands in contrast to the fact that the retailer expresses, that he tries to attract his customers and create value by engaging in dialogue with customers and provide polite and competent assistance when they are out shopping for furniture's (Retailer, line 176-178). In this regard, the retailer mentions that it is important to him that his sales staff have been given sufficient training by the manufacturers, so that they are prepared to answer customers questions satisfactorily (Retailer, line 197-200).

After the customers have been visiting the retailers store and confirmed that they want to buy a product, it does not necessarily mean that they also plan to make the purchase in the same store where they have seen the product. The customers express, that this is because they want to see whether they can save money by getting a discount at another retailer, or by looking for the same product in the market of secondhand furniture. (Customer 1, line 64-67 & 182-187) (Customer 2, line 44-56) . Customer 1 also expresses that he likes to be able to talk with sales staff to bargain for a lower price (Customer 1, line 189-191). Although both customers have purchased design furniture several times, both customers expresses that they perceive design furniture's as overpriced and that it therefore should be possible to obtain cost savings (Customer 1, line 189-19) (Customer 2, line 48-50). In that way the empirical data appoint price as an important factor in the customers buying decision. Furthermore both customer states that they don't care whether they make the purchase online, offline or through an AR app, as long as they can obtain a cost saving (Customer1, line 64-67) (Customer2, line

81-88). Because of this, the retailer is aware, that he easily may lose customers to other retailers. He expresses, that he is focused on trying to retain the customer within the touch points of his own business. For the same reason, he would never refer one of his customers to Danish Design AR, as he does not have control of this external touch point and believes that it benefits the manufacturers more than him (Retailer, line 11-23). By contrast, the retailer would be willing to use an AR app if he controlled the app himself, or if he knew that it would benefit his business. The retailer also expressed his enthusiasm for being part of an AR App that worked in his favor and expressed a willingness to spend both time and money on such an app. (Retailer, line 320-323) The retailer also stated that he looked upon Augmented Reality as a race between the retailers and the manufacturers to first attract customers' attention (Retailer, line 68-69).

Besides the customers desire to achieve a price reduction where they make their purchase, the customers also express that they would rather shop directly with the manufacturers than make their purchase at a retailer. This is because of the following 3 reasons: First they would rather support the designer or manufacturer of the furniture. Secondly they believe that they will be presented with a larger range of fabrics and materials from the manufacturer. Thirdly they believe that the manufacturers are better at answering their questions (Customer 1, line 44-60) (Customer2, line 91-97).

The retailer is aware of this trend and, for the same reason, he looks upon manufacturers with own sales channels as his most threatening competitors and for that reason he find it devastating that he have experienced that more and more manufacturers establish their own direct sales channels (Retailer, 143-145). However, the retailer still has a number of areas where he offers the customer something, that the manufacturers don't. Among other things, the retailer can offer more discounts, can offer better delivery terms. can offer the customer to get product on stock right away and can offer the custormers to buy products from different brands the same place. e.g. an Arne Jacobsen dining table with Hay dining chairs around (Manufacturer 2, line 200-201) (retailer, line 177-181 &168-172 & 232-234). On the other hand, the manufacturers only sell their own brand and often have a longer delivery time. For this reason, the retailer also view his large product range as a parameter of differentiation, that separate their value offer from the manufacturers.

Quote: "*That is really one of our landmarks, There is no furniture that we don't have. For the same reason, we sometimes have 6-7 people driving all the way from Sealand to visit*

our store and buy that table, that lamp, that chair... - they can get that, that and that, all at the same place." (Retailer, line 168-172)

5.1.2 Danish Design AR's impact on the retailer/consumers relationship?

The empirical data of this study has provided no indications of, that Danish Design AR has created a radical change in the Danish furniture industry or has changed the way in which consumers trade furniture. Just as it has not yet drastically changed the customer / retailer relationship. There is a consensus among respondents that AR, for a large number of products cannot stand alone in the buying process and cannot replace customers' need to see the products in a physical store. The empirical data suggest that the products that will be particularly difficult to sell through AR are products that are characterized by being large, expensive, and complex or furnitures you can sit in such at sofas or chairs, where comfort is essential to the purchase. On the other hand, the respondents believe that examples of furniture that could be traded directly through AR are tables, lamps, shelves, vases, floor buckets, sculptures and the like. In this way, the empirical data indicates that customers continue to have a need for visiting the retailers to be able to see the products physically, despite the presence of an AR-app. (customer 1, line 192-215) (customer 2, line241-248) (Manufacturer 1, line 216-237) (Manufacturer 2, line 232-269).

AR's impact on costumers buying process

According to both manufacturers and the developer, the part of the purchasing process where AR has its relevance is in the inspiration phase and in the evaluation phase. (Developer, line 68-81) (Manufacturer 1, line 227-245) (Manufacturer 2, line 173- 187)

In relation to the inspiration phase, customer 2 confirms this by mentioning that he find Danish Design AR useful when finding a product through the app and then be able to show a picture to his girlfriend with the words quote; *"Honey, try to see.. we should buy The Bull shouldn't we? Look, I will just put it right there at the corner – now you can see it just fits perfectly doesn't it!"* "(customer 2 line 243), this apparently to inspire himself and his girlfriend in relation to interior decoration. In relation to using the app during the evaluation phase, both customers also confirms this fact by pointing out that they see it as an advantage to be able to see a product they are considering buying in their home before making the purchase, in order to see if the furniture's appearance or size fits into the style of the customers home (Customer 1, line 76-87) (Customer 2, line 172-179).

The fact that the customers would like to use the app during their inspiration and evaluation phase means that AR has the potential to attract customers at different stage in the buying process. For this reason, the ecosystem actor who controls the AR app will also be in a good position for influencing the customer during these stages. Therefore, it indicates a potential for AR to cause a power shift in the service ecosystem. This potential is apparently reinforced by the fact that customers mention that they already are at a later stage in the buying decision when they go to visit a physical store (Customer 1, line 122-132) (Customer 2, line 199-111). Thus, if the app is used after a store visit to make a final evaluation of whether the furniture fits well into the customer's home, they are on the final step before choosing the shop to allocate the final purchase. And if a marketeer interferes with the customer in this stage where the customer is more receptive and try to attract him into his business it could be quite valuable to the marketeer.

AR's impact on product returns
The fact that customers use the app to check if a product fits into their home before the final purchase, may also influence positively on the retailer's business, by reducing the amount of returned goods. Customer 1 believes that Danish Design AR is able to reduce his chances of buying a furniture that misfits the style of his home, by letting him see the product virtually in his home before making the purchase decision (Customer 1, line 171-179), just as manufacturer 2 and the developer point out that through Danish Design AR, the customer can easily view a product in different material and textile combinations, so that it is easier for them to find the right match in relation to color, fabrics and styles (Developer, line 50-67). The retailer also believes that AR will be able to reduce the amount of returned goods, which he states is a financial burden for a company like his as well as an environmental burden for the world (Retailer, line 28-42).

AR as a common catalog for the brands and product configurations of an industry
However the positive effects of the customers being able to view different product modifications through AR, it also comes with a downsite for the retailer, due to the fact that the retailers typically only has a limited number of product modifications in stock compared to the manufacturers, who typically offer a larger range of colors, fabrics and styles (Retailer, line 283-289). In that way, a customer who falls in love with a particular product modification will not necessarily be able to buy that exact model from the retailers, and for that reason the Manufacturers may end up taking the final order instead and let the customer do their purchase directly through one of their customer

touchpoints. This is also one of the problems that the interviewed retailer expressed as a problem that would need to get solved in order for him to benefit from an AR app.

Quote: The app community is on the manufacturers site. They participate together in the same app. Here you would also experience some troubles, as it is not all retailers, who sell all the products that you can find in the app. So, there would be an issue there, - it would be very annoying for a customer. It would be like if I redirected you to an app, and you were thinking "wow what a cool table"... What you don't sell it?..."
In that way I don't want to show people something that I am not able to sell them.
(Retailer, line 286-290)

Another thing is that Danish Design AR is a fine catalog to help customers experiment with different styles and looks by allowing them to combine products from different brands. This could potentially threaten the advantage that the retailer holds in offering the customer to see several different brands at one place at the same time, which the interviewed retailer pointed out, as something of great value to the customers and something that differentiates him from the manufacturers (Retailer, line 156-172). However, the customer may experience problems if he were to place an order consisting of different products of different brands through an AR application as that would probably result in long delivery times compared to buying from a local retailer who got the product package in stock. Here, the retailer continues to have an advantage in holding a larger inventory of products from different brands than the manufacturers can offer. However, there is no guarantee that the particular product package the customer has seen through the app is in stock at a local retailer. This thus indicates a potential inconvenience for consumers, caused by the fact that the app does not take inventory levels into account and only covers the manufacturer side of the service ecosystem, leaving out the retailers.

5.2 Dyadic relationship - Manufacturer & Retailer

This section presents a synthetization of the key findings from the empirical data, especially drawing on the following theme condensations; manufacturer/retailer relationship, manufacturer/retailer hope & expectations, manufacturers/retailers benefits and incentives for Danish Design AR and manufacturers/retailers disadvantage with Danish Design AR, manufacturer/retailer/developer relationship (se theme condensations in appendix 2)

5.2.1 A characteristic of the dynamics and relationship between the manufacturer and the retailers

If you look at the retailer network as a single unit, they constitute one of the manufacturers' largest channels to showcase and sell their products. As manufacture 2 says qoute; *"It is clear then that if you did not have the retailers, then we did not have a very large sales channel."* (manufacturer 2 lines 61-62), but since the individual retailers do not cooperate with each other and thus do not have a collective power when negotiating with the manufacturers, they are individually vulnerable. If a retailer or two ended their corporation with a manufacturer it would not make a big financial difference to a major manufacturer who have e.g. 2000 retailers affiliated, which is the case for manufacturer 2 (manufacturer 2 line 58). Conversely, manufacturers are dependent on their products being presented in the way they want to appear at the retailer's shops in terms of branding, and thus have a dependence on the retailers fulfilling this. Therefore, they also allocate resources to train their retailers in their products and make sure they have marketing material available, that they can use towards consumers. As manufacturer 1 says:

Quote: *"It is the retailers that represent our brand towards the consumers, it is them who talk with the customers, so every content, picture and story we provide, will be conveyed to the end user by them."* (Manufacturer 1, line 97-100)

The manufacturers live well from their rights to produce and sell traditional design classics and find that these products are almost selling themselves without notable effort (manufacturer ,1 line 59-61). Several statements suggest that this is due to the well-known design history of the products, their high status value and the monetary stability of these products, which gives consumers confidence because of the easy access of reselling these products without suffering significant financial losses (Retailer, line 237-257) (Manufacturer 1, line 89-94) (Manufacturer 2, line 33-44) (Customer 2, line 4-25).

The tendency of the design classics to almost sell themselves does not please the retailer, as he expresses that it causes some of the manufacturers to be too laissez faire in relation to renewing and improve their products, improve their service level and improve their efforts in training the retailer's staff (Retailer, line 203-206). Furthermore, the retailer claim that the consumer's tendency to buy design classics, prevent new talented business people from entering the market and make startups, as designers and manufacturers of furniture, which as a result impedes competition on the manufacturer side of the Danish furniture industry (Retailer, line 206-216).

There is a tendency of customers to prefer trading directly with the manufacturers instead of the retailers (Customer 1, line 44-54) (Customer 2, line 63-77). The retailers therefore lose revenue every time a manufacturer choose to open a channel for direct sales. An AR app with the possibility for manufacturers to sell directly to the customers, is therefore a threat to the retailers, just as manufacturers with their own brand stores or their own webshops also represent a threat and take revenue from the retail sector (Retailer, line 61-70). Some manufacturers protect the retailers from lost revenue by making decisions about not to open up for direct sales and by choosing to only sell their products through the retailer's, which is the case for manufacturer 1. In addition Manufacturer 1 also have a policy, of only selling to retailers with physical store, to show solidarity with retailers paying for salesstaff and squaremeters (Manufacturer 1, line 75-86). However, there are many manufacturers who do not protect the retailers and choose to open their own sales channels and thus enter direct competition with the retailers. This is e.g. the case for manufacturer 2 (Manufacturer 2, line 46-54). According to the retailer, the number of manufacturers choosing the latter has increased to the retailer's great concern (Retailer, line 130-145).

The retailer believes that manufacturers that perform direct sales pose a greater competitive threat than rival retailers. The retailer's argument for this is that manufacturers pull revenue out of the retail market and make the "economic pie" smaller, while the retailer points out that rival retailers simply share the same "pie" as they have always done. At the same time, the retailer expresses his concern, that if revenue are pulled out of the retail chain and the retailers still have the same expenses for staff and square meter, it could inevitably cause retailers to go out of business (Retailer, line 61-70). Thus, the retailer sees Augmented Reality and Virtual Reality as a race between retailers and manufacturers to first attract the customers, who in the future want to use AR technology for shopping. The retailer points out that it is a major problem that they

are fighting directly against the manufacturers with whom they also share a mutual dependency relationship (Retailer, line 69-70). In some ways, the manufacturers agree that there exits a mutual dependency relationship as they agree on the importance of using retailers to showcase and sell their products through a network of retailers that reach a large audience (Manufacturer 2 lines 61-62), yet each retailer is only a small part of a large network of dealers and for that reason the power structure seems unbalanced. This might be one of the reasons for many manufacturers to feel free to do direct sales.

The unbalanced power structure is further enhanced by the fact that the design classics that the manufacturers sell, are products with a long history and high demand. In addition, the products are often subject to high customer loyalty in relation to the manufacturer's brand or the name of the designer behind their products (Manufacturer 1, line 4-30) (Manufacturer 2, line 4-20). This high demand and loyalty, of course, gives the manufacturers a greater bargaining power against the retailers, as it means that their design classics account for a significant part of the retail revenue (Retailer, line 130-140).

The interviewed developer also stated that one of the reasons for their failure to become a leading AR app with the Danish design industry, was because they did not solve the problem that selling directly through Danish Design AR, would be a kind of cannibalization of the manufacturers own large sales channel, - the retailers. Some manufacturers allow it while others do not. (Developer, line 88-97 & 104-106).

5.2.2 Danish Design AR's impact on the manufacturer/retailer relationship?

According to the app developer and the manufacturers, Danish Design AR has not yet achieved a large enough user base to be able to change the way Danes buy furniture, nor have Danish Design AR caused a significant change in the service ecosystem and in the producer / retailer relationship.

An AR-app as a maketing -and sales opportunity

Despite the fact that Danish Design AR has not yet caused such a radical change, the empirical material still shows a number of correlations that point in the direction of the app being able to influence the relationship between manufacturer and retailer, if Danish Design AR eventually became a significant app with a larger user base.

As previously mentioned in the section about the customer / retailer relationship, there is a consensus among the respondents that the AR app finds its particular use in the inspiration phase and evaluation phase of the customers' purchasing process. Therefore,

anyone who controls all or part of the app will be able to influence customers during these stages. In this way, if the app had achieved sufficient user connectivity, it would have represented a large marketing potential and if the app had been developed to allow selling products through it, it would also represent a large sales potential. Who to benefit from this potential by controlling such an app and how the resulting revenue would be distributed, could potentially affect the power structure in the service ecosystem including the power structure between manufacturers and retailers. Therefore, it makes sense when the retailer expresses that he sees Augmented Reality as a race with the manufacturers.

When looking at the current dependency between the manufacturers and the retailers, another reason for the retailer's desire to win the race may be derived. Namely to achieve a greater bargaining power towards the manufacturers. According to the retailer, there are some of the manufacturers that he is particularly dependent on, typically those who account for a large part of his revenue or those who holds a large number of design classics (Retailer, line130-140).

This unbalanced dependency might be reduced if the retailer himself controlled a customer touch point like an AR app, which acted as a hub between a large number of customers and the manufacturers, as such a touch point could have a decisive impact on the manufacturers' ability to market their products if the user base was large enough. In that way, the retailer would be able to achieve the desired bargaining power towards the manufacturers that he expresses to be missing. As the retailer expresses:

"If Fritz Hansen did not have their 7'er chair, their Peit Hein tables, their Eggs and their Swans, then everything else they do wouldn't matter. Then they would not even have a name. Some of the manufacturers I am deeply dependent on. Take e.g. Louis Poulsen, maybe they stand for at large portion of my revenue. If I get lousy service there, I cannot just tell them that I don't want to sell their products, if they don't make their service better. Then they would just say; Well that's fine... se you..." (Retailer, line 131-137)

This desire for the retailer to gain greater bargaining power towards the manufacturers, may also be the reason why the commitment and willingness to participate in an AR app like Danish Design AR is so different between the manufacturers and the retailer. Both of the interviewed manufacturers express their cooperation with Danish Design AR, as something that has been a low priority and that merely was something they wanted to try out because it was free, rather than something they wanted to incorporate in their daily

operations or devote resources to (Manufacturer 1, line 195-210) (Manufacturer 2, line 98-109).

By contrast, the retailer stated that if he was given the opportunity to participate in an AR app that attracted users to his business, he would be willing to devote both labor and money to such project (Retailer, line 320-323). For this reason, it may have been possible for the developers behind Danish Design AR to achieved more success with acquiring users to the AR-app if they had also chosen to approach the perhaps more engaged retailers, rather than only approaching the manufacturers (Retailer, line 291-304). In context of this, the developer also stated, that it would have helped them to achieve greater awareness of the app if they had a larger marketing budget or if the manufacturers had contributed financially to this (Developer, line 165-179). If the developers instead had approached the engaged retailers, they might have acquired more funding to market the app which might have resulted in attracting more users.

Contractual restrictions affecting the retailer possibilities to enter an external AR app

The retailer expresses that there is a number of challenges in terms of becoming the winner of the AR race with the manufacturers. For example the retailer is contractually bound by a restriction that prevent him from selling the manufacturer's products to third parties, which means that he is not allowed to enter into agreements on B2B sales of the manufacturers' furniture (Retailer, line 29-33).

In practice, this means that the retailer cannot enter into a AR community like Danish Design AR without breaking the contract, if the app was developed to act as a sales channel, except if he engaged in full or partial ownership of the app. This means that the retailer would not be able to accept the same offer about joining a common AR app, as the manufacturers was able to, when the team behind Danish Design AR proposed their offer to them. Therefore, the retailer is required to engage as an owner or investor in such an app with the risks and costs associated therewith. By contrast, the collaboration with Danish Design AR for the manufacturers was an opportunity to test AR without any notable costs.

AR as customers direct way to the manufacturers

In addition to this requirement of the retailer's investor commitment, if to enter an external AR-app, there is also another challenge for the retailers. That is the earlier mentioned fact that customers express that they would rather buy directly through the

manufacturer than through the retailers (Customer 1, line 44-54) (Customer 2, line 63-77). But besides the fact that the customers express that they want to buy directly from the manufacturers, they also would rater appoint their questions to the manufacturers. Both of the interviewed customers express that it is important for them to get questions answered during their buying process, namely questions regarding the history of the products, the product designer and the company, as well as questions about the furniture's different color and material combinations. They expresses that they would rather avoid talking with the retailers sales staff and states that they believe that the manufacturers are better at providing a comprehensive answer to their questions (Customer 1, line 49-54) (Customer 2, line 93-97). Danish Design AR as it is now, provides only limited information and offers only limited possibilities for customers to get their questions answered by contacting the manufacturers directly through the app. However, this could very easily be changed by the developers and such change could potentially affect the power structure and relationship between manufacturer and retailer, as it would allow customers to appoint all interaction to the manufacturers and completely leave out all interaction with the retailers.

5.3 Dyadic relationship – Customer & Manufacturer

This section presents a synthetization of the key findings from the empirical data, especially drawing on the following theme condensations; manufacturer/customer relationship, manufacturers/retailers benefits and incentives for Danish Design AR, manufacturers/retailers disadvantage with Danish Design AR, customers benefit with Danish Design AR, customers disadvantage with Danish Design AR and Danish Design AR's application and role in customers buying process (se theme condensations in appendix 2)

5.3.1 A characteristic of the dynamics and relationship between the manufacturer and the customer

As mentioned earlier, the customers express a clear desire to address all trade and inquiries directly to the manufacturers and generally expresses a greater trust and loyalty to the manufacturers. In this context, customer 1 show a particular loyalty to Danish manufacturers and Danish designers (Customer 1, line 95-100). Customer 2 expresses that he believe that the manufacturers' range of products, colors and product modifications is greater than the retailers (Customer 2, line 72-76). This notion from

customer 1, is also confirmed by the manufacturers as they see it as value-adding for customers to offer the customers an opportunity to visit showrooms so that they can see a larger range of products and product modifications, than customers would have been able to, if visiting the retailers (Manufacturer 1, line 135-141).

Manufacturer 2, who also has their own sales channels, is aware of customers' desire to buy directly from them. Manufacturer 2 does not have any direct sales channels and therefore mostly uses his contact with the customer to promote the branding and help customers get questions answered, after which they refer them to a local retailer, if the customer wants to buy something (Manufacturer 1, line 76-86). Both manufacturer 1 and 2 have phone contact and email contact with interested customers as well as influence customers with marketing, through ads and website and through interaction with customers on various social medias. Thus, both manufacturers have several touch points where they can influence the customers and where the customers can satisfy their desire to get questions answered. Just as manufacturers use these touch points to promote their branding. (Manufacturer 1, 126-131) (Manufacturer 2, line 86.97)

The customers express their confidence in buying design classics from the manufacturers, as these classics are easy to resell without significant losses if they want to change the style of their home interior at some point (Customer 2, line 4-25). Customer 2 also points out that, if visitors sees a high-end design classic in his home they would probably be impressed, which highlights that customer 2 view design classics as status symbols (Customer 2, line 19-25). In relation to this both manufacturers also consider status to be one of the buying motives behind their products (Manufacturer 1, line 4-23) (Manufacturer 2, line 6-14). This also means, that manufacturers sometimes have the feeling that the design classics almost sell themselves, without notable effort. As manufacture 1 says.

Quote: *"You can say that the products still is the value itself. I use to say that in my previous job it was hard to do PR. Now it is very easy to do PR, as there is nothing new that you need to invent or anything you need to hide."* (manufacturer ,1 line 59-61)

The retailer also points out this phenomenon with a certain vexation, when commenting on the manufacturers behavior:

Quote *"They are to laissez faire, you know, they are in possession of the drawings of some of the furniture that 80% of the design conscious consumers would like. Now they can just sit back and produce, then someone will always go buy it"* (retailer, line 204-206).

Both manufacturer 1 and 2 believe that customers want to see the products physically either in one of their showrooms or at the retailer (Manufacturer 1, line 211-217) (Manufacturer 2, line 239-260). In this connection, manufacturer 2 points out that an advantage that the customer have when making the purchase at the retailers, is that the retailers have the opportunity to offer better conditions in a number of areas, including delivery conditions and price reductions compared to the manufacturers. In addition, manufacturer 2 points out that only physical stores can offer customers traditional payment terms by use of credit card and terminal, as opposed to e.g. manufacturers webshops. (Manufacturer 2, line 195-206)

5.3.2 Danish Design AR's impact on the customer/manufacturer relationship

Despite several of the large design furniture manufacturers' affiliation with Danish Design AR, there is no empirical evidence that support that Danish Design AR has caused a radical change in the service ecosystem's consumer / manufacturer relationship. This may be due to the manufacturers' low commitment in relation to the app and that the app never experienced any large userbase, and in the way the AR-app never became a valuable customer touch point. However, parts of the empirical data indicate a potential of using an AR app as a manufacturer community, which could potentially strengthen the customer / manufacturer relationship if such an app in the future gained a large user base.

AR shorten the feeling of spatial distance between consumer and manufacturer
The potential for changing the customer / producer relationship lies in the possibility for an AR-app to decrease the feeling of spatial distance between the customer and the manufacturer. This by giving the customer a visual opportunity to assemble different furniture from the manufacturers' different brands and see different color and fabric combinations of the individual products in the context of the customer's own home. As manufacturer 1 expresses it.

Quote: *"You leave your home to go visit a retail store and to go looking at the products, but there is no connection between the home you left and the shop. There is a lot of examples on retail stores that rent out a furniture, so that the customer can try it at*

home. Maybe we could skip that step, by letting people look at it in their home through an AR- app instead" (Manufacturer 1, line 176-180)

The fact that the customer has all the manufacturers gathered together in one place, it also makes it easier for the customers to fulfill their desire to interact directly with the manufacturers.

AR unify relevant customers from the same segment and increase the customer prospect base

Both Manufacturers 1 and 2 mention, that when manufacturers who address the same customer segment stand side by side, it has a tendency to attract a large number of customers from the same segment. This is the same attraction that is the reason why manufacturer 1 choose to participate in trade fairs (Manufacturer 1, line 252-261). Manufacturer 1 states, that the manufacturer community within Danish Design AR, follows the same principles as a trade fair. Manufacturer 1 also states that the fact that Danish Design AR was a community between other furniture brands that manufacturer 1 identifies with, was one of the reasons why manufacturer 1 chose to join the app in the first place. Manufacturer 2 mentions in this context that a community like Danish Design AR could possibly have the same advantage as known from the Momondo app, where different airline companies join in a community, that together attracts a large number of potential customers (Manufacturer 2, line 211-216). However, both manufacturers 1 and 2 points out, that such manufacturer communities also come with the disadvantage that they risk that customer using the app, will chose to buy a furniture from a competitor instead of them (Manufacturer 1, line 262-266) (Manufacturer 2, line 112-117).

AR allow for incorporating consumers in an exclusive design universe

Both manufacturers 1 and 2 states, that they find that there furniture being status symbols are one of the main buying motives for their customers, which is also confirmed by customer 2 (Customer 2, line 19-25) (Manufacturer 1, line 4-23) (Manufacturer 2, line 6-14). When such high-end products are sold, some companies does not only try to create an atmosphere of exclusivity through the product, but they also try to build in the feeling of exclusivity within the customers buying experience. For example. Manufacturer 2 mentions that their products, especially in Asia, are considered major status symbols and therefore manufacturer 2 tries to create the same experience, as known from prominent brands like Louis Vetton from the clothing industry, or Nespresso from the coffee industry, where customers get incorporated in an exclusive universe, when shopping

(Manufacturer 2, line 262-282). Although manufacturer 2 believes that such a buying experience is easiest to create through physical business, AR could possibly also be a tool to complement such a universe. The empirical data indicates that customers expect such feeling of exclusivity when shopping for Danish design furniture. An example is that customer 2 expresses that the user interface in Danish Design AR did not match the atmosphere that he associated with Danish design, consequently criticizing the app for its design (Customer 2, line 206-212).

AR as a tool for the manufacturers branding at social medias
In relation to the manufacturers' branding on social media, the empirical data also indicates that this could be strengthened through an AR app like Danish Design AR and thereby possibly influence the customer / manufacturer relationship positively.

Producer 1 expresses that they generally view interaction with the customer through social media as something that adds value to their brand.

Quote: *"In relation to social media, it makes sense that people can see that we interact with the customers, e.g. customers commenting a picture of cause that adds value. This also demonstrate that others show an interest in our brand."* (Manufacturer 1, line 137-141) ....
.... It is a butterfly-effect, when someone shows their interest for the brand, by tagging us in a picture. I am sure that strengthen our brand" (Manufacturer 1, line 148-150).

If you hold these statements up to the fact that customer 1 expresses that he intends to take advantage of the opportunity to share screenshots when using Danish Design AR on Instagram, then it indicates an opportunity for an AR-app to act as a facilitator for creating a closer brand/customer interaction, which might strengthen the manufacturer customer relationship (Customer 1, line 146-150).

5.4 Comparative analysis between this papers results and the results from the Henningsson et. al. 2019 article

The comparative comparison between the results from this paper and the results of the (Henningsson et. al., 2019) article shows that there are several results that are similar across the two studies, which together give the results a greater explanatory value. Likewise, the comparative analysis also revealed a number of differences between the results of the two studies, caused by that one study concerns an app that is offered by a

single manufacturer, while the other study concerns a co-owned app that acts as a manufacturer community.

5.4.1 Similarities between this papers results and the results from the Henningsson et. al. 2019 article

Both studies show that an AR app can constitute a new costumer touch point, that allows manufacturers to influence customers with marketing, during the customer journey. Both studies indicate that such a new customer touch point has the potential to reduce the spatial distance between customers and manufacturers, which in the traditional offline world has been large, as retailers have been the only link between manufacturers and customer. AR, in this context, thus weakens the relationship between customer and retailer, by incorporating customers into an online space, where they get easier access to interact and trade directly with the manufacturer, leaving out the retailer. This also affects the power structure between the manufacturers and the retailers. The Henningsson et. al., 2019 article states that the manufacturer previously only provided pre-and after-sales service, but now also acquires control over the customers in the sales process as well. (Henningsson et. al., 2019, pp. 10-11).

The article also mentions that an increasing number of customers are buying PH lamps online and that AR may serve as a tool for manufacturers to acquire some of these new online customers and let them buy directly from the manufacturers (Henningsson et. al., 2019, pp. 11). This paper's empirical evidence backs up the statement of increasing online sales, as the retailer mentions that they have experienced a large increase in online sales in 2020 (Retailer, line156-159). As in the Henningsson et. al. 2019 article this paper's results also suggest that AR serve as a new online sales and marketing potential for customers (Henningsson et. al., 2019, pp. 11), but there is also empirical evidence, suggesting that several manufacturers already had direct sales before the introduction to Danish Design AR, but just through their own web shops or brand stores (Manufacturer 2, line 49-54) (Retailer, line 143-145). For this reason, it can be difficult to say exactly how much influence AR alone affects this tendency for manufacturers to trade directly with customers and how much that can be explained by the generally large access to various information technologies that allow direct interaction between customers and companies, thus making it easier for manufacturers to follow a forward vertical integration strategy.

In addition to the problem that AR allows customers to leave out the retailers when shopping, both studies' results point to another problem associated with leaving out the

retailers. That it that customers who wants to buy a piece of furniture through an AR app does not have the opportunity to see where the item can be collected in the local area, including an overview of retailers located near the customer or furniture inventory level at the local retailers (Henningsson et. al., 2019, pp 11). It thus impairs the customers chance to shop at a store where he can actually get the goods right away and the customer is left only with the delivery conditions that the manufacturer can offer. Since manufacturers often have central warehouses and a retail network in their nature is decentralized, the manufacturers will typically not be able to offer the furniture to the customer at the same day the customer choose to buy it.

Another thing that was similar between the two studies was that AR is considered a good tool for customers to see if a piece of furniture fits in size or style within the customer's home. This makes customers more confident in their purchasing decision and thus prevents mis-purchases. In that way, the amount of returned goods is reduced, which is considered expensive to handle for both retailers and manufacturers (Henningsson et. al., 2019, pp. 10).

Finally both studies suggest the paradox, that the distribution of the 2 AR apps the studies deals with, is best handled by the help of the retailers, as they are closest to the customers, but in both studies the retailers expressed, that they had no intention to direct customers to the app. This is because retailers would like to have control over their customers themselves, and do not want to encourage them to use an app that manufacturers control or benefits from, leaving them out (Henningsson et. al., 2015, pp. 11).

5.4.2 Differences between this papers results and the results from the Henningsson et. al. 2019 article

As mentioned in the previous section, both studies revealed many of the same conclusions, even though this paper's study concerns a co-owned app that act as a manufacturer cummunity and the Henningsson et. al. 2019 study, concerns an app offered by a single manufacturer. However, a difference may be indicated. This paper's empirical data indicate that Danish Design AR, finds its application in both in the inspiration phase and in the evaluation phase of the purchasing process. On the other hand, the Henningsson et. al. 2019 article suggest that LP's app finds its application during only the evaluation phase. As stated in the article:

Quote: "*Because the app only displays LP products, a prospective customer would need to download a specific app for every possible product under consideration. This means that in practice the AR app is only used by customers in the very last stages of the purchase process, to confirm a decision already made.*" (Henningsson et. al., 2019, p. 11-12)

The reason why Danish Design AR's also apply in the inspiration phase, opposite to the LP app, can be explained by Danish Design AR, being a manufacturer community, as the nature in a purchase process in most cases implies a phase where the customer get inspired not only by looking at one brands products, but by comparing several products from different brands. Danish Design AR allow for this comparison while LP's solo app did not.

5.5 Overview of results

On the next page in table 2 the comparative analysis between the two cases is presented in an overview listing. The table shows:

Column 1.	An overview of AR's possible impacts on the service ecosystem, which was identified through the analysis of this paper.
Column 2.	An assessment of the strength of the empirical evidence backing up this paper's results.
Column 3.	A comparison with the Henningsson et. al. 2019 article

In the assessment of the empirical strength, the individual results are categorized as; strong, medium, or low. Where strong is results that is thoroughly backed up by the empirical data and low is results that have less empirical evidence, and which may require further research to be fully confirmed.

The rating is based on an assessment of the following 3 things

1. Number of respondents that expresses statements backing up the result
2. The importance of the statements to the respondent, in terms of emotional engagement, use of positive or negative adjectives in the statements etc.
3. The plausibility of the results based on common knowledge

In appendix 10, I have commented on each of the results, to make my assessment of the strength of the empirical evidence more transparent.

Tabel 2 – Overview of this papers results in comparison with the results from Henningsson et. al. 2019

Type of relation-ship	AR's possible implications	Assessment of the strength of the empirical evidence	Similar result found in Henningsson et. al. 2019
Consumer / Retailer	AR is a valuable tool in the information phase and the evaluation phase of the buying process	Strong	(Yes) apply for the evaluation-phase
	AR can prevent wrong purchases and reduce product returns	Medium	Yes
	AR can act as a catalog, showing a larger product range of manufacturers products to the customers, but lack including retailer's, location, product prices, inventory levels and delivery time	Strong	Yes
Manufacturer / Retailer	AR provide marketing and sales opportunities, benefitting the ecosystem actor controlling the AR-app	Strong	Yes
	Contractual restrictions comprising the retailers cause unequal access to join an external AR app	Strong	Not mentioned
	A manufacturer platform within an AR app creates a new customer touch point and a way for customers to interact and shop directly with manufacturers excluding the retailer	Strong	Yes
Consumer / Manufacturer	AR shorten the otherwise long distance between customers and manufacturers	Medium	Yes
	AR unify and attract relevant customers from the same segment and increase the customer prospect base for the manufacturer	Strong	Not mentioned
	AR can act as a tool to integrate customers in the manufacturers attempts to represent an exclusive design universe	Medium	Not mentioned
	Screenshots from an AR-app constitute a tool for manufacturers to brand themselves on social medias	Low	Not mentioned

6 Discussion

In this section a discussion on 4 different areas will be completed.

Firstly this papers result is discussed in relation to the literature on AR and service ecosystems, presented in the literature review section of this paper. Then a discussion on the validity and reliability is conducted, followed by a discussion of this paper's results implications to practice. Finally, a discussion on this paper's relation to the e-business study program is carried out.

6.1 Discussion on the results in relation to the theory

When looking at the results of this paper and the relevant literature regarding AR and service ecosystems, there are several points of comparison and areas where the theory can enrich the understanding of the results found.

6.1.1 Theory on AR in relation to the results

Several places in the empirical data, the respondents expressed the importance of an AR app to be realistic in relation to whether they would give the AR app their negative or positive evaluation. This is similar to when Klinker et al. 2011 states, that AR developers need to overcome a number of technical issues to create a true immersive feeling, including that virtual objects must look realistic and must be placed correctly in the real world. This is due to realistic looking visualizations ability to make the user feel immersed and present in the situation, which was also referred to as telepresence by Steur in 1992 and referred to by the notion of "the extent of presence metaphor" by Milgram and Kishino in 1994.

In practice, there was a split between the perception of whether the visualized furniture in Danish Design AR created a sense of presence and immersion. Manufacturer 1 expressed satisfaction with the visualizations in Danish Design AR, just as customer 1 described the experience with the AR app as realistic and expressed that he would not have been able to see the difference between real elements and visualizations, if he did not know it beforehand.

Quote: "*Actually I think that the furnitures that I have tried to see through the app looks quite good. It really looks realistic. So, when you've become familiar with the app and place the furnitures correctly, it looks quite one to one. You could actually take a screen shot and post on Instagram, and then people would think that you actually got one of those furniture's in your home.*" (customer 1, line 146-150)

Despite this positive announcement from manufacture 1 and customer 1, manufacturer 2 and customer 2, in turn, described the visualizations as unsatisfactory and buggy. For example, customer 2 had found a Dinesen wooden floor, that did not position properly on the surface of the floor of the IVE but hovered in the air like a tabletop. During the interviews it was clear to see how the two different experiences affected the two respondents' emotions and feeling about the IVE. Customer 1 expressed surprise and enthusiasm and customer 2 expressed a lack of esteem for the team behind the app.

6.1.2 Theory on service ecosystems in relation to the results

According to Akaka et. al. 2015, value is based on an individual negative or positive evaluation made by the beneficiary at the given time, in the given situation and context. As it is a retail service ecosystem being investigated, it makes sense to consider the consumer as the value beneficiary, rather than the other ecosystem players. In this context, the empirical data provided an insight into what was perceived as valuable to the consumers and what was not. The empirical data also provided an insight into the role in this value creation that the retailer and manufacturer carry, and in this context the empirical data also indicated a number of values that the manufacturers and retailers spend time on handling, but which was not necessarily perceived as values by the consumers. For example the empirical data showed, that the retailer tried to create value through dialogue with the customer, while the customers expressed that they found it annoying to talk with the retailers sales staff and expressed that the store visit merely was motivated by a desire to see the products physically. Conversely, the empirical evidence showed that the conversation with the manufacturer was perceived as value adding to the consumers.

As stated in Ruokolainen et al. 2011 and Zhang et al. 2017, it is common to service ecosystems that changes in the interaction and exchanges between the customer and the service ecosystem's customer touchpoints ultimately will result in a change in the whole ecosystem. In this context, the empirical data also pointed out Danish Design AR, as a

new customer touchpoint, that has the potential to change the customer's interactions and exchange with the manufacturer by allowing them to trade and interact directly with the manufacturer, leaving out the retailer. Ultimately this results in a change in the whole service ecosystem by changing the power structure between the retailer and the manufacturer.

in Akaka et al., 2013 it is explained how service ecosystems are based on repetitive interactions between ecosystem parties and how interest in these interactions is driven by a mutual dependency relationship between actors. So a change in the power relationship between the retailer and the manufacturer also creates a change in this mutual dependency as the manufacturers takes control of these new direct customer touchpoints, and in that way release themselves more from the retailers and weaken the dependency towards the retailers. This independence will only grow as more customers choose to use these new manufacturer-owned touchpoints.

6.2 Discussion and reflections on validity and reliability

This section explains some of the concepts and criteria related to quality assurance within qualitative research and evaluates this papers validity and reliability in relation to its production of knowledge.

6.2.1 Validity

Validity is a term that tells you something about whether what you want to investigate actually is what you get answer to during the empirical data collection.

As this paper follows the interpretivist paradigm, with the social constructivist reality view, validity is not grounded in an objective reality, as truth is negotiated socially (Cohen D. et. al., 2006)

With that in mind validity judgements must follow different guidelines, than those of the positivists. (Angen, 2000) provide a set of guidelines for evaluating validity in an interpretivist setting. This section of the paper will follow these guidelines to evaluate validity.

In table 3 Angen's validity requirement is lined up in column 1. In column 2 the degree of which these requirements are met in this paper, is argued.

Tabel 3 - Evaluation of validity according to Angen's creteria

	Angen 2000	Evaluation
1	Careful consideration and articulation of the research question	What I sought to investigate was a co-owned AR apps impact on a retail ecosystem. The research ended up showing many results on AR's impact in general, but yet it did also reveal some insights related to the fact that Danish Design AR is a co-owned manufacturer community.
2	Carrying out inquiry in a respectful manner	Researcher showed kindness, flexibility and respect of time and duration during the interviews. The respondents could choose both Danish and English as the interview language, to make them feel more comfortable, not having to answer in a non-native language.
3	Awareness and articulation of the choices and interpretations the researcher makes during the inquiry and analysis process and evidence of taking responsibility for those choices	All interviews were transcribed and line numbered, every statement used in the paper either is a direct quote from an interview or have a reference to a statement from an interview transcription. Efforts was made not to twist respondents' statements too much. In table 2 an assessment of the strength of empirical evidence backing up the results found, was carried out too. All interpretations and themes and their corresponding source by line number in the data material can all be seen in appendix 3.
4	A written account that develops persuasive arguments	The condensations in appendix 2 act as a written account that develops persuasive arguments directly linked meaning bearing units, derived from the interview transcriptions
5	Researchers need to ask if research is helpful to the target population	Argued in the section implications for further research
6	Seek out alternative explanations than those the researcher constructs	Argued in the section implications for further research under possible bias
7	Ask if we've really learned something from our work	Argued in the section implications for further research
8	An assessment of the biases inherent in the work over the lifespan of a research project	Argued in the section implications for further research under possible bias

6.2.2 Reliability

Reliability tells us about how reliable the production of knowledge is. A study is said to be reliable if there is consistency of measures and results. Reliability imply that if a research were carried out several timed by different researchers, the results would continue staying the same. In qualitative studies results is often affected by the researchers, the respondents state of mind and the dynamics between interviewers and interviewees. Therefore, acquiring exactly the same results twice, is hard to achieve, thus affecting reliability. However, actions can still be done to address this challenge and improve reliability.

To improve reliability the interview-guide must contain non-leading questions, which leaves little or no room for interpretation by the respondents. The interview guides can be found in appending 1 and does not contain any leading questions.

To improve reliability there must also be an alignment between the research questions and the interview-guide, so that respondents actually provide the researcher with the answers that address the research questions. To ensure that the researcher might start an interview by supporting the interviewees with information about the purpose and scope of the research to improve common understanding. In this paper every interview was started by introduction the scope of the research. To make sure the interview guides was designed to fit the research question. Research sub-questions was formulated to break the main question down into more manageable units. The sub-questions, then formed the basis for how the interview guides was made. One can say that the sub-questions is a breakdown of the research question and the interview guides is a breakdown of the sub-questions. After formulating the interview-guides they were then reviewed and commented by 3 different people to anticipate misunderstandings and ambiguous formulations.

6.3 Implications for further research

This section, is a reflection on the studies applicability in relation to research, both what knowledge the study provides as it is now and how it can be used within future research to do further investigate how AR come into use in a retail context.

6.3.1 This studies applicability in relation to academia

This research is a single case, case study to help build theory for explaining. For that reason the results from this research give indebt insights into how Danish Design AR affect the retail service ecosystem of the Danish design furniture industry, but cannot be seen as a deterministic predictive theory, which can be generalized to tell something about retail as a whole (Gregor, 2006). However, if other researchers chose to conduct a study on AR's impact on a retail ecosystem, this study may be suitable to use for comparison, as it might be used to add more strength to the findings in such studies, if similarities were found. It would require that the study dealt with a case that had similarities with the Danish design industry e.g. in terms of dealing with high end products where design and appearance is essential, and where the buying motive is to obtain status or to use the product as an asset or investment or where the buying process is characterized by being non-impulsive and requiring high involvement.

Also if this study was compiled with a larger number of other studies concerning AR's impact on different retail service ecosystems, it might be used as a part of a meta study that could hold enough empirical evidence, to justify generalizations, that tells something about retail in general, across different industries.

The findings in this case study apply in the context of the Danish design furniture industry and is generally backed thoroughly up by the empirical data. Furthermore, to rate the empirical strength of the findings, I did an assessment on every individual result's explanatory strength, in table 2, and did also compare the results with the Henningsson et. al. 2019 case, to find similarities that could add even more strength to the results.

6.3.2 Possible bias or alternative explanations than those the research provides

Possible biases

As the empirical data of this study has systematically been processed, using Maltheruds systematic text condensations (see appendix 3), it is unlikely that the study suffers from biases related to the analysis of the empirical data. In relation to this I also tried to avoid confirmation biases by doing my utmost not to bend, add or remove meaning baring statements, when I did the condensations. On the other hand, a few participant biases or researcher biases may be found in relation to the interview process. For example, a habituation bias was found, when manufacturer 1 was asked, what value their customer touch points provided them, after we had talked about the consumer. Hereafter manufacture 1 answered the question in relation to their value acquisition as a business instead of answering what value the touch point provided to the consumers. Also, in the interview with customer 2 I did one leading question bias, as I failed to refrain completely to do a leading question and said. Quote: *"I can imagine, now perhaps I put my words into your mouth, but I can imagine that maybe another thing that adds value to you, is this thing we talked about, about seeing the product physically"* (Customer 2, line 169-170). Of course these two bias have a negative effect on the production of knowledge, but overall I cannot come up with other examples, than the mentioned, that might have caused biases and since the biases does not blurry large parts of the empirical material, I still assess the study of generally being valid.

Alternative explanations than those the research provides

When choosing an approach as the ecosystem approach, it also comes with the consequence that it narrows the focus into trying to find that AR actually affect an ecosystem, even though it might not create a radical change. In this study I started all headlines in the result section by admitting that AR yet, hadn't created a radical change, and instead I focused on what in the empirical evidence that indicated that AR just had some kind of impact. Statements about AR's impact often came with a set of prerequisites like "if Danish Design AR had a larger userbase" and "if products was sold through the app" or "if people who controlled the AR app used it for marketing or included it more in the daily business operations". But I as a researcher must also ask myself if the service ecosystem perspective really is suitable for investigating ARs impact and nature of adoption. I have learned that the service ecosystem approach has lead me

to consider AR technology more as a channel or a customer touchpoint, than just as a media or a tool for improving user experience or provide entertainment and maybe that way of looking at AR suites better for the technology at its current maturity level.

In my own subjective opinion, I think that AR will become more of a channel or customer touch point, as more and more people use AR and as new technologies like AR clouds provided by global influential companies like Microsoft, Apple or Amazon gets integrated as a part of smartphone devices worldwide and when those large companies have designed the underlying cloud base infrastructure as a service (IaaS) and platform as a service (PaaS) that allow for a global co-cration of a common AR universe.

6.4 Discussion of the findings in the overall perspective of the MSc e-business study program

During the E-business study program, especially in the field of strategic tools in e-business, we have been presented for various e-business business models, which in different ways use technology in their business. This can either be to use technology for streamlining business processes, provide access to more customers or to otherwise provide competitive advantage in relation to competitors. Similarly, during the course strategic tools in e-business, we have had lessons in various emerging technologies that have either disrupted industries or have great future potential to disrupt, by completely changing the way customers shop, changing the dynamics between industry players or by radically changing the underlying business processes that creates value towards the customers. Augmented reality which this paper concerns, is just one example of a technology that is perceived by businesses and by researchers, as having a potential to disrupt various industries. This is mainly due to AR's hedonic and immersive values that transform customers' shopping experience and the way in which customers perform the activity of shopping. Likewise, the ecosystem view, that I have chosen for this paper, have a connection to the e-business study program, as an ecosystem approach fits just perfect for examining the impact of technologies on industry actors' dynamics, coherence and value creation, which has a direct connection to the concept of disruption.

Technically, this paper's section on how AR works, especially AR's rendering method, also has direct correlation with subjects from the e-business study program, such as programming and software architecture. They have provided me with an overall insight into the design and structures of programs and have thus made it easier to understand

how AR is structured. Finally, the subject of cloud computing has given me an insight into how software as a service (SaaS) is operated and built through cloud services such as Apple Cloud, Microsoft Azure, and Amazon Web Services. Danish Design AR is just an example of a cloud-based SaaS app and, the cloud computing course have therefore made it easier for me to understand how the architectural design behind Danish Design AR link to Apple Cloud. All in all, both businesswise and technically, I find the investigation of AR as a new technology enabled channel for reaching a market, very closely linked to the e-business study program.

7 Conclusion

In this study a service ecosystem perspective was used to understand, how augmented reality can impact on and comes into use in the context of manufacturers, retailers, and consumers. To explore this problem area, an interpretative single case study was conducted, with the case being the app Danish Design AR and the context being the retail service ecosystem of the Danish design furniture industry. Besides the empirical research, the study also expanded the work of Henningsson et. al. 2019 in conducting a comparative analysis to detect similarities or differences to build theory for explaining how AR affects a service ecosystem. The results from the empirical research showed several of the same results as Henningsson et. al. 2019 concluded. Which promotes the explanatory value of these results.

In summary the conclusion of this study is that a co-owned augmented reality app such as Danish Design AR, can constitute a new customer touch point. This new touch point allows the companies that controls it, to influence on the customers and to market their products to them, especially during the inspiration phase and the evaluation phase of the customers buying process.

In relation to the customer, a manufacturer co-owned AR app, can act as a catalog, showing a large range of the manufacturer's products to the customers. As the app act as a manufacturer community it can also unify and attract relevant customers from the same customer segment and thereby increase the total customer prospect base for the manufacturers. On the other hand, as the AR-app act as a manufacture community it also fails to include the retailers. This imply lacking to provide information about where to find a local retailer, local retailers product prices, inventory levels, delivery time and the like. In this way an AR-app as a new customer touch point interfere with the traditional idea of the retailer being the intermediary between customer and manufacture and thereby, and AR-app may cause a change in the power structure of the service ecosystem. Due to this potential power shift and that the control over customers, change to the hands of the manufacturers, the retailers will feel disinclined to adopt the AR-app or to motivate their customers to adopt it. In that way an augmented reality app that fails to anticipate its effect on every member of the service ecosystem, can cause a resistance from neglected ecosystem members and prevent overall adoption.

Besides this conclusion, the study also indicated some more positive impacts that a co-owned AR-app has on a service ecosystem. The study indicated that the AR-app can be used as a tool for customers to visualize remote products in the context of their own home, which in that way close the spatial distance between home and shop. The AR-app serves as a useful tool for the customers to view different products, colors, and fabrics in conjunction with the interior design and style of their homes. The product visualizations provided by the AR app, also showed as a tool for customers to view if a product would fit into their homes in the terms of size. Because product, color, fabric, and size can be seen by the customer prior to an actual purchase, another conclusion is that AR can inhibit wrong purchases and thereby also reduce product returns to the benefit of all members in the service ecosystem.

8 Future Perspectives

Both this study as well as Henningsson et. al. 2019 has pointed out the following paradox. On the one hand that the retailers are in the best position to accelerate customer adoption of the AR apps. On the other hand, the retailers are also the least inclined members of the service ecosystem to use the apps themselves or to encourage the customers to do it. This situation is unsustainable if you want to ensure future adoption of AR within a retail ecosystem. In the future we therefore might experience a scenario in which no significant change will happen in terms of adoption, because the retail industry has no confidence in AR's effect on the retailers. However, if the retail ecosystem finds a solution for allocating some of the benefits to the retailers, they might become ambassadors of the AR app and thereby acts a catalyst for future AR adoption.

Another scenario for the future could be that manufacturers continues to evade the retailers and succeed in using AR to attract customers to their direct touchpoints. In this scenario the entire service ecosystem would undergo a change as the power structure and the revenue allocation would shift. In this scenario those traditional retailers who fail to find their position in the new ecosystem structure would become losers. The beneficiaries of the change would be manufacturers and perhaps also the 3. party collaborators that provide the indispensable services that allows the new structure to work. This could be external app holders like Utopian City Scape (the development team behind Danish Design AR).

In the light of this scenario it is interesting to ask if companies like Utopian City Scape are really the retailers of tomorrow, as they act as a new intermediary just like the retailers, just with another revenue model. It is also interesting to ask what the service ecosystem would look like if a visionary retailer and a company like Utopian City Scape entered into a strategic partnership and together controlled both the AR related touchpoints as well as traditional brick and mortar touchpoints. Maybe this would give them a larger bargaining power towards the manufacturers and thereby bring the power structure of the service ecosystem to a new equilibrium?

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Interview transcriptions

Respondent	Role	Duration	Appendix
Developer	Entrepreneur and responsible for sales and app	39 m. 48 s.	4
Customer 1	Owner of a large seafood farm	29 m. 36 s.	5
Customer 2	Cabinetmaker	31 m. 28 s.	6
Retailer	Owner and CEO of a large apartment furniture store	32 m. 13 s.	7
Manufacturer 1	PR and marketing manager	33 m. 46 s.	8
Manufacturer 2	Digital marketing coordinator	32 m. 25 s.	9