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Seminar paper

At the Institute for Information Systems & Society

Smart-TV

Market Trends and Development Trends

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Introduction

Television is and has been one of the most widely used media worldwide. With an average TV usage time of 192 minutes per day, the Austrians (with the age 12 years and over) spent even more time watching television in the past year than in the previous year, which was 186 minutes. Thus, the duration of viewing is six minutes above the previous year's highest level. The use time of the television population watching television on each day was 290 minutes per day in 2018 and this was again a historic record. In 2018, television continued to reach around 4.9 million Austrian people every day, which corresponds to a daily reach of 65.1% (Source: TELETEST-Monitoring/IFES).

With the rapid rising of technology, the traditional television has changed a lot and it is still continuing. Nowadays television can be used for various different uses (which will be explain later in detail). E.g. you can use your television for online shopping, video calls via skype, downloading apps, etc. That is why television has a huge impact on our daily lives.

With this seminar work I want to research about the topic Smart-TV, especially about the market trends and development trends in this area. Furthermore, I want to give an overview about the history of smart-TVs, about the functionalities, providers and the alternatives to watch TV. Most importantly I will describe data privacy in smart-TVs, the new advertising industry, the current and future development of smart-TVs. To sum up all the gathered information, I will list the advantages and disadvantages of smart TVs and see if smart-TVs have a positive or negative impact on our daily lives.

In order to gain all the necessary information, I will do researches by reading a lot of research papers, watching relevant videos, reading relevant news and analysing statistics, which are concerned with this topic. By analysing I will find out, where the stat of development is going.

General Information

Definition Smart TV

Electronic technology continues to develop. Each day new electronic devices that influence human daily life are entering the market.

“A smart TV is a traditional television set with integrated Internet and interactive "Web 2.0" features which allows users to stream music and videos, browse the internet, and view photos. Smart TV is a technological convergence of computers, television sets and set-top boxes. Besides the traditional functions of television sets and set-top boxes provided through traditional broadcasting media, these devices can also provide Internet TV, online interactive media, over-the-top content (OTT), as well as on-demand streaming media, and home networking access” (Wikipedia contributors1, 2019). Smart TVs are available as stand-alone products, but regular televisions can also be made “smart” through set-top boxes that enable advanced functions (Boztas, 2015).

Definition Social TV

Besides Smart TV, there are a huge variety of smart devices. Another growing technology is the so-called “Social TV”.

Social TV is the combination of television (especially Smart TV) and social media. Furthermore, social TV is in the capacity to support social interactions among viewers, which is a new and different way of connecting with people. This is the main difference from social media (Shin, 2013).

Therefore, social TV can be called an advanced platform for social media using the Internet as a medium of communication. In the platform of Social TV sharing, people are communicating with friends in real-time while they comment on the content they’re watching. Eventually there may be a synchronization of sharing with video, which means users will be able to comment specifically on what they are watching when they are watching it, check into content, and invite others to do the same, and thus actually affect the outcome of a show, earn badges, and other social rewards that revolve

around the show, and in fact, build a new social network completely focused around content interests (Luyten, 2006) (Shin, 2013).

History

Smart TVs are not a completely new concept. There have been first attempts for several years by television equipment manufacturers to display Internet content on the TV screen via an integrated browser. But only due to the Internet access, it has become widespread and cheap. Furthermore, there are now a lot of attractive media offers on the Internet and the growth of the Smart TVs technology is still continuing (Marktanalyse Smart-TV: Eine Bestandsaufnahme der Deutschen TV-Plattform).

One of the most important technologies of today's life had its beginning in the early 1980s in Japan, which is the Smart TV. The first attempts for Smart TVs were made, by adding an LSI chip with memory and a character generator to an ordinary television receiver. With this invention, Japanese viewers were able to receive a mix of programming and information transmitted over spare lines of the broadcast television signal. The patent for this invention was published first in 1994 and was extended by the following year. The following patent was including a more intelligent television system. This system was linked with data processing systems through digital or analogue network (Wikipedia contributors1, 2019).

One important point was, its ability to automatically download necessary software routines, according to a user's demand, and process their needs. The growth of the technology for Smart TVs reached a peak through the mass acceptance of digital television in the late 2000s and early 2010s. Smart TVs has become the dominant for of television since mid 2010s (Wikipedia contributors1, 2019).

Alternatives (to watch TV)

Although, the Smart TVs are the most popular way to watch TV, there are a bunch of options to watch TV without a Smart TV. The first option would be watching TV on a regular TV without Internet connection, which is more or less

the old way of watching TV. The next options include extension possibilities for regular TVs. This extension can be a stick or a box. Really popular examples for the stick version are Amazon Fire TV Stick and Google Chromecast. The box version includes popular brands like Apple TV, Amazon Fire TV Box and Set Top Box. It should be noted that, all of these extensions require a HDMI capable screen or a projector. (Smart TV7)

Technical Development

Current State of Development

The current state of Smart TVs includes many useful and creative features, which will be explained in this chapter in detail. This chapter explains how smart TVs work and shows the functionalities. Furthermore, I will give a brief description of all the popular providers on the market and give a comparison between various operating systems for smart TVs on the market. Even though the technology is very well developed, there is still some room for improvement, so the technology is upgrading drastically over a short period of time.

How does Smart TV work?

Smart TVs are characterized by their connectivity and intelligence in terms of computing power. Nowadays Smart TVs are developed so good, that these models can retrieve many other functions via different interfaces. These devices include now a powerful processor, which were usually used on a full-fledged PC. But the most important interface to the outside is the connection to the Internet. The connection to the Internet is that, what makes a Smart TV smart, which means, it allows connecting the television with all the useful applications to execute all the functionalities of a Smart TV (which will be explained later more in detail). The connection to the Internet can be done via integrated network or wireless with WLAN (Schiller, 2018).

Moreover, Smart TVs offer even more useful interfaces, which is e.g. an additional memory card (usually in SD format or various USB 2.0 or USB 3.0

slots), a triple tuner for all three formats and a HDMI interface (to connect the Smart TV with digital media players such as Blu-Ray, DVD, game consoles or set top boxes) (Schiller, 2018).

The most important feature is the Common Interface (CI) format, which is used for paid additional channels. CIs are used to decrypt received data and it is the interface between the encrypted data and the smartcard on which the key is located (Wikipedia contributers2, 2019).

An important difference to conventional TV is the availability of Hybrid broadcast broadband TV (HbbTV) (Schiller, 2018). HbbTV combines Internet and Digital Video Broadcasting (DVB) reception on the TV, which makes it possible to offer customers added value for the current TV program. Therefore, Broadcasters can provide additional content to the current program or to past programs directly on the TV (Ghiglieri, 2013).

Functionalities

The table below gives a brief overview of the features and services of a Smart TV.

<table>
<tr><th>Linear television</th><th colspan="2">Video-on-Demand</th><th colspan="2">Other apps</th></tr>
<tr><td rowspan="3">Program television: films, series, news</td><td>Chargeable offers: iTunes, Watchever, maxdome</td><td>Free offers: MyVideo, Youtube</td><td>Information: News, Weather-Apps</td><td>Communication: Facebook, Twitter, etc.</td></tr>
<tr><td colspan="2">Plattforms and private data</td><td rowspan="2">Games and music: Spotify, Napster, Sudoku, Solitaire</td><td rowspan="2">Internet access: Web surfing, e-mail retrieval, shopping</td></tr>
<tr><td>Photos and other private data: Access to the home network</td><td>HbbTV: Presentation of TV and internet content</td></tr>
</table>

Source: (PricewaterhouseCoopers, 2013)

Illustration 1: Overview Smart TV features and services

The tempting thing about Smart TVs is the infinite number of functionalities that can be performed with a Smart TV. Many of these features are able with Internet connection. Above all, surfing on the Internet is one of these functionalities (Steffens, 2012). While the TV program is running, the special features of smart TVs can be used, which makes it possible to have a weather

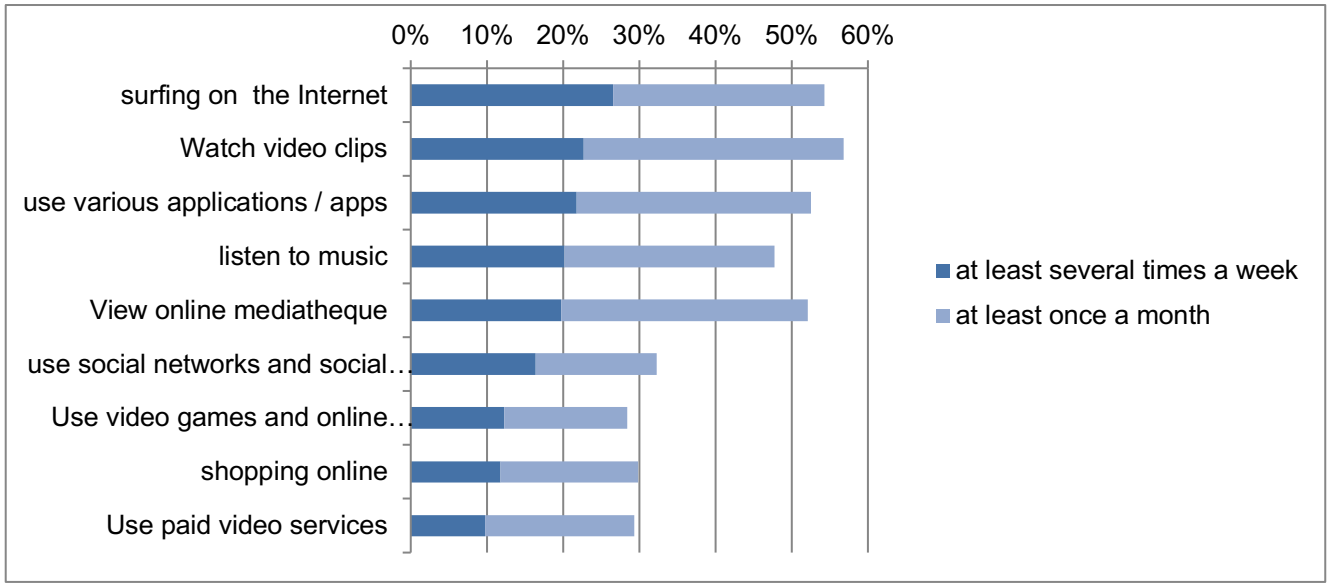
forecast, the latest news or sports broadcasts to show the current results of other parallel games in the current television picture. (Smart TV2, 2013)

One of the main advantages and important functionalities of Smart TVs is the availability of online video library. At this point, a Smart TV clearly scores with easy access to the on-demand assortment of many online video stores. It has never been easier to get the latest Hollywood blockbusters home (Smart TV2, 2013). Another option to use an online video library is video-on-demand service. Online video-on-demand service allows you to watch movies or TV shows from an existing online video store. Typically, VOD services are commercial, paid services. The most famous example of VOD services is Netflix (Smart TV1, 2012).

Another functionality includes the access to PC files. PC files include video, music and image files. To reach this, you have to connect your Smart TV to a computer. Furthermore, you can make video calls with your Smart TV like on your Smartphone by using skype (Wikipedia contributors3, 2018).

Controlling Smart TVs via smartphone, tablet, etc., is also a big advantage. To execute this, it is necessary to download the appropriate application from each manufacturer (Wikipedia contributors3, 2018), which connects the Smart TV with your phone or tablet. By doing this you can use your smartphone or tablet as a remote control.

A survey made by PricewaterhouseCoopers International (pwc) in 2017 in Germany, was made to find out how do consumers use the new features of their TVs. Due to this survey following results were received and it shows that most users who have a web-enabled TV are actively using the online capabilities of their devices, more than half of the respondents use their television to surf the Internet (PricewaterhouseCoopers, 2013).



(Source: PricewaterhouseCoopers, 2013)

Illustration 2: The following services are used most frequently

Providers

There are a lot of Smart TV manufacturers on the market. The most popular of them are Samsung, LG, Philips and Sony.

Samsung

Samsung has a wide range of TVs and was the pioneer in terms of Smart TV. Moreover, the now common name for Internet-enabled TVs comes directly from Samsung, other manufacturers had to tighten up. Therefore, the software is sophisticated, and errors are rare and especially the high-end models can almost be described as full-fledged computers (Fernseher Vergeich1).

LG

When it comes to LG Smart TVs, the operation and the graphical user interface are very different from the Samsung devices. In the TV comparison, the South Korean manufacturer is doing well, the price / performance ratio is right, and the large product range has something for every requirement Fernseher Vergeich1).

Philips

Another popular manufacturer is the Dutch brand Philips. Philips is focusing especially in the TV, innovation and unusual design in the foreground,

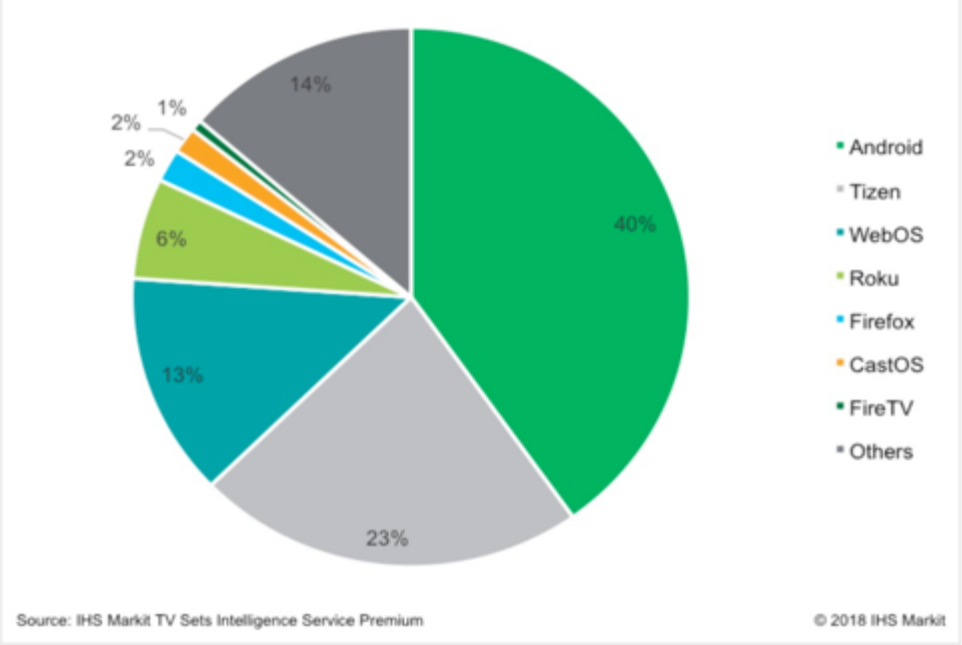
particularly noteworthy are the "floating TV" whose base seamlessly merges into the frame. The product range of the manufacturer ranges from inexpensive entry-level devices to high-end smart TVs but is not as big as that of its competitor LG Electronics. In contrast to other popular Smart TV manufacturers, Philips is programmed in cooperation with other manufacturers (Sharp and Loewe). The advantage of this cooperation is the compatibly of the apps of these manufacturers with each other. On the other hand, the graphical user interface is based on Samsung Smart TV. In the television comparison, the Dutch manufacturer stands for innovation, but new technologies are not always accepted as desired by the customer, so all the consumer electronics will be taken over by the Japanese manufacturer Funai Electronics (Fernseher Vergeich1).

Sony

Sony, another popular TV manufacturer, is keeping the television industry rather small. Despite their big name, the price level of Sony TVs is relatively high. Another difference is, that Sony is the only manufacturer to date that does call its Internet-capable TV sets Internet TV, instead of Smart TV and does the software it uses. In essence, there are not much difference between Sony and other TV manufacturers. Sony is focusing on the quality of the products, rather than quantity. That is why Sony is one of the first to have a TV with HD-4K resolution on offer (Fernseher Vergeich1).

Operating Systems

Smart TVs have come a long way, during the last 10 years it has changed and improved a lot. And so, the operating systems for Smart TVs have evolved enormously. The development has enabled that the operation works much easier and faster, the selection of streaming apps and the variety of functions are comparatively huge. There are some operating systems on the market, the most important and popular smart TV operating systems today include Tizen from Samsung, LG's WebOS, Android TV and the Panasonic software called My Home Screen.



(Source: Smart TV3)

Illustration 3: 2018 Smart TV Operating System Share

Tizen

Tizen is operated by Samsung and is used since 2015. Like WebOS, Tizen is also build on Linux. The main advantage is that Tizen has the thinnest menu. It offers a tidy menu bar at the bottom of the screen that provides quick access to apps and features, such as streaming services last accessed, which is similar to LG. On one hand adaptability of the menu is possible, but on the other hand not all apps automatically land in the start menu and are not uninstalled when deleting them. Another advantage is the wide range of apps in the Samsung store, which is the biggest in the comparison of smart TV operating systems. The app selection includes Social media apps, Youtube, Netflix, Amazon Prime, some media libraries and Sky. The newest operating systems are switched between running apps and the TV program. It is also able to transfer the image from your smartphone or tablet on the TV screen if you wish. The only requirement for this is that both devices are connected in the same WLAN. To sum it up, Samsung's operating system is a bit faster and more intuitive, apps start ticking faster than WebOS. The best thing about it, is the simple and elegant design of the menu bar. On the other hand, the search function does not leave a good impression. (Gotta, 2018) (Schmitz, 2018)

WebOS

WebOS is used by LG and the operating system WebOS is also build on Linux. It impresses the users by its simple structure and user friendliness. Moreover, it offers tightly packed yet clear menu bar, which contains all downloaded apps and it can be arranged as desired and uncomplicated. Furthermore, new applications are easy to install and automatically get to the start menu, removing unwanted items from the menu bar and from the TV itself, the order of the buttons is sorted in no time, which is a big advantage compared to Tizen. The app choices include Netflix, Amazon Prime Video, Sky Ticket and DAZN, but the Google Cast and Apple AirPlay wireless interfaces are not included. Another advantage compared to Tizen is the really good search function. It is the only operating system that includes offers from various online media libraries like Netflix, Amazon Prime Video, etc. In addition, the voide search works good as well. (Schmitz, 2018)

Android TV

Android is most famously known for smartphones and tablets, but it is becoming important for Smart TVs too. The new update (named oreo) makes it possible to bring structure and clarity to the start page. At the top row are the app favourites, these can be adjusted with a few taps of the remote control. Furthermore, it is possible that videos of some apps can be stored for later viewing, but this feature is not supported by Netflix and Amazon Prime Video. Android TV is able to deliver app-specific recommendations, such as Netflix series and movies and YouTube videos based on viewing habits. One of the main advantages of Android TV is the large app selection from the Google Play Store and the high speed of work. The search function is good, but there are struggles with voice search. It is also possible to transfer videos from the laptop to the TV with the built in Chromecast feature. (Schmitz, 2018)

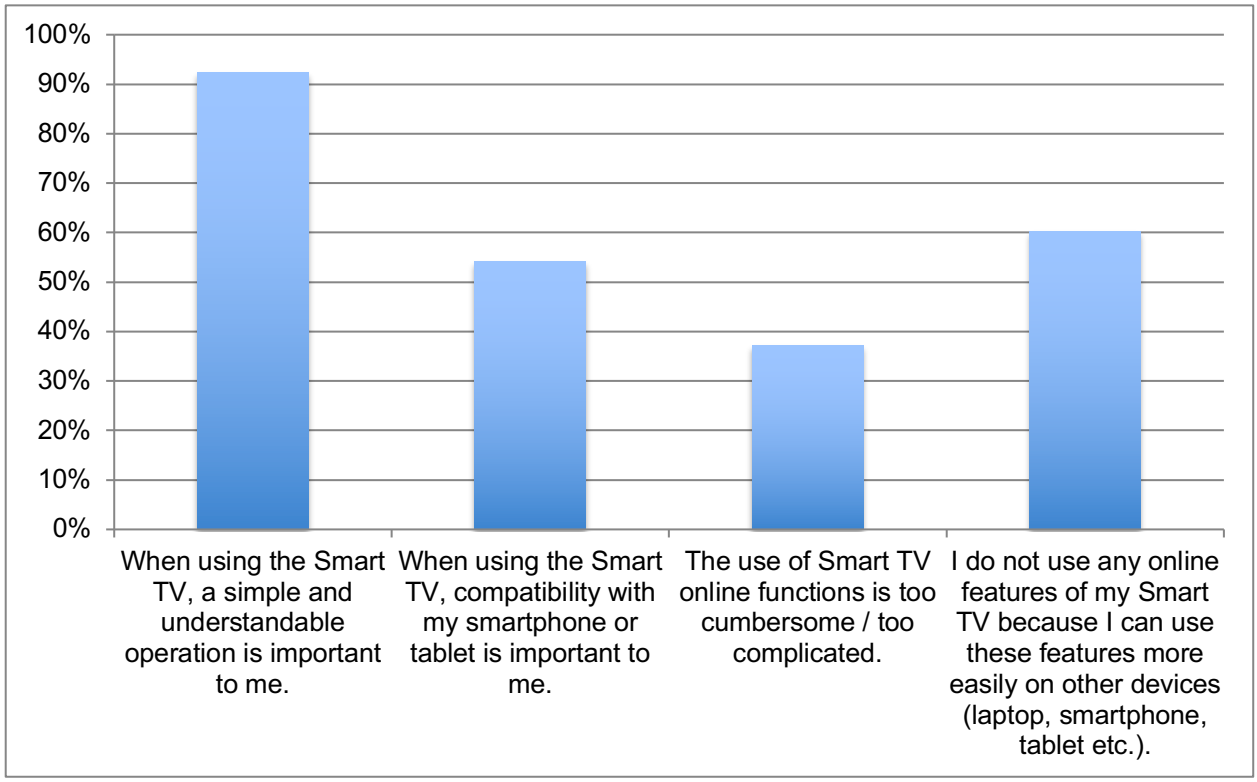
Panasonic My Home Screen

Panasonic was one of the first smart TV providers ever. Before it was called Viera Cast and after Firefox OS. Recently the name has changed to "My Home Screen 3.0", but nothing else has changed. The starting page includes

the favourite apps. The special feature here is the multi-line start menu, which can be adapted to almost any size. You can load apps from the Panasonic App Store and the configuration is simple. Panasonic offers Amazon Prime Video, Netflix, YouTube and DAZN. Furthermore, it is possible to get the IP television from the WLAN. The search function of Panasonic is rather weak, it only looks at current TV programs, your own recordings, YouTube and connected USB data carriers. (Schmitz, 2018)

User Preferences

When it comes to the big assortment of Smart TV features, users have different importance's depending on their preferences. A survey made by PricewaterhouseCoopers International (pwc) in 2017 in Germany, analysed user preferences depending on their Smart TV usage. Following results were achieved.



(Source: PricewaterhouseCoopers, 2013)

Illustration 4: Smart TV usage preferences

92% of Smart TV users said that easy and understandable operation is important in using the Smart TV. For almost 40% of users, the operation of online functions is currently too confusing. 60,2% of smart TV owners do not

use any online features on their TV sets, because these functions are easier to use on a laptop, smartphone or tablet PC. The half of the surveyed peopled mentioned the importance of compatibility and connectivity of TV sets with other Internet-enabled devices. (PricewaterhouseCoopers, 2013)

Future Development

The development of Smart TVs is far from over. Currently, the latest developments are mainly related to even better displays and resolutions, the integration into the smart home and built-in sound systems. All these functions make it possible to use the Smart TV as the central interface for lighting, entertainment and security in the modern smart home. In the future, Smart TVs will be even more conscious of these trends, working together with advertisers to bring you the ultimate TV viewing experience.

Increased Security

Security is an important influence when it comes to technology. By 2020 connectivity of devices, such as smart house, smart phones or smart TVs, are estimated to increase to almost 21 billion objects worldwide. Moreover, it will be able to guarantee complete data protection. That means, in the future, smart TVs will have increased security, extra malware protection, and strengthened infrastructures against hackers (Prajapati, 2018).

Easy to Control

Current smart TV controls can be laborious. Due to the fact that using a remote control to write a text into the search function. Nowadays some operating systems and Set-up-Boxes are offering the availability of voice commands in order to simplify how you access data. In the future there will be even smarter controls for smart TVs, such as smartphone apps. Apps working alongside TVs can replace today’s controls and provide ease of access. Smartphones and tablets may become a universal remote control, allowing for increased usability (Prajapati, 2018).

On-Demand TV

On-demand TV makes it able to skip the content you aren't interested in and allows you to watch movies/series that you actually want to watch. Easier said, they remove the channels that you are not interested to watch and the users have the freedom to personalize their contents based on their preferences (Prajapati, 2018).

Effective Interfaces

In the future personalised recommendations, which are similar to Netflix's system, will be possible for TV watching optimization. To reach this, data collection will be needed. This data is based on viewer preference, ensuring that the TV experience is tailored to what is watched and when it's watched. On one hand, this data collection will allow you to access the content that matters to you, but on the other hand it will also allow to Marketing strategies and advertising experts to improve how they target you with advertisements pertaining to your viewing preferences (Prajapati, 2018).

HDR TV

HDR has its origins from photography and stands for High Dynamic Range. It is the newest image technology, which will also develop the viewing experience. It also allows the user to enjoy the viewer experience with greater range of luminosity and brightness, meaning that bright areas become brighter and dark areas becomes darker (Prajapati, 2018).

Source: (Willcox, 2018)

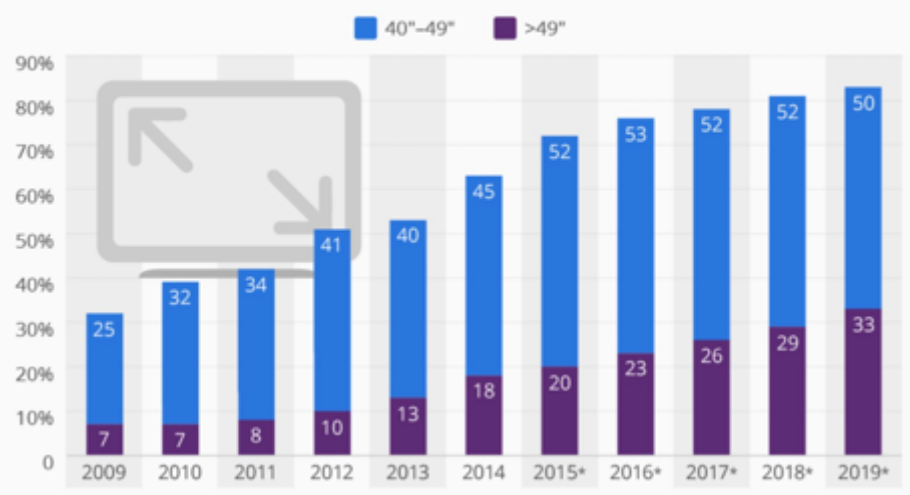
Illustration 5: Example HDR quality

The above image visualises the difference between standard and high dynamic range images. One continuing concern for consumers is that while many 4Ks offer HDR capability, most people will have no idea what level of HDR experience their new TV can deliver until they take it home (Willcox, 2018).

TV Screens

Now, televisions that are 55 inch or even 65-inch screens are common. Experts in the industry predict that the larger televisions will be more in the TV market than any. Currently, the jumbo-sized sets are going down in value these televisions will grow even more. And there are more 70-inch sets being displayed. This all is possible because new facilities can produce very large LCD sheets, called “motherglass”, from which TV display panels are cut. Therefore, bigger TV panels can be produced with less waste, helping to drive down costs and consumer prices (Willcox, 2018).

The picture below shows the growth of TV screen from 2009 to 2019. The results show that in 10 years TV sizes doubled from 25% to 50% (40”-49”).



(Richter, 2015)

Illustration 6: Growth of TV Screen

Voice Integration

Although, some TVs and Set-up devices have already voice interaction, this year experts across the TV industry say more companies will integrate more

expansive digital voice assistants into their smart TV platforms. E.g. Amazon Alexa and Google Assistant. Companies, like LG or Samsung, with their own artificial intelligence platforms are including Alexa and Google Assistant for certain functions and operations to add compatibility (Willcox, 2018).

8K TVs

Even though 4K TVs are really just now becoming mainstream, manufacturers will bring out TVs with four times the resolution. 8K TVs will offer even 33 million pixels. In comparison, 4K TVs 8 million pixels, these sets promise even sharper, more detailed images. A current problem with this technology is that, consumers with an 8K TV won't have any native 8K content to watch. There have been movies, which have been shot in 8K, and the coming Olympics, will be shot in 8K, but right now there's no way for consumers to watch it in 8K. While 4K content is available via streaming services and on 4K Ultra HD Blu-ray discs, broadcasters are still struggling with the amount of bandwidth needed to transmit 4K content. Other new developments include higher frame rates and a new version of HDMI called HDMI 2.1 (Willcox, 2018).

TV with Style

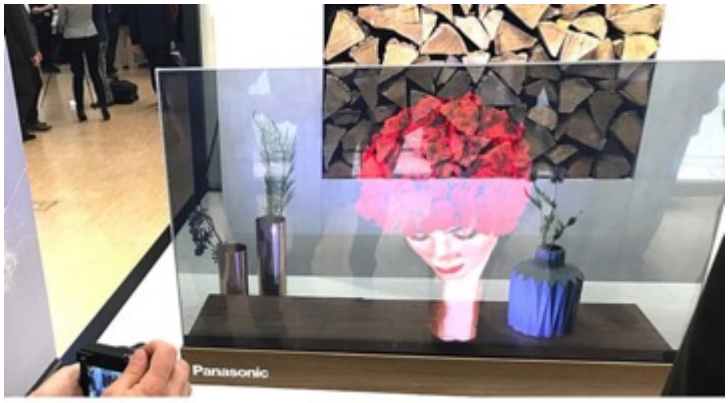
Hitherto Smart TVs and Style were always in conflict with each other, but now a new generation of frames were invented, which includes QLED displays and the complete Smart TV features. The quality and representation of the pictured art in the art mode are able through the better contrast, the higher black value and the 100% color coverage. The picture below is an example or these kind of Smart TVs (Wernicke, 2019).

(Wernicke, 2019)

Illustration 7: The Frame

TV of the Future

One of the futuristic ideas for Smart TVs is invisible television. Already in 2018, the first models were shown, in which the panel is permeable. When the device is off, it is more or less invisible in the room. Similar to a glass, now is to see what is behind the TV. Ready for market, this technique is far from good, but very interesting. The picture below is an example of the end result of this technology (Martin, 2018).



(Martin, 2018)

Illustration 8: Invisible TV

Another innovative idea is a TV with a rollable or foldable display. This means you can roll up the TV when it is not needed and stowed in the closet. The main advantage here is remedy space procurement (Martin, 2018).

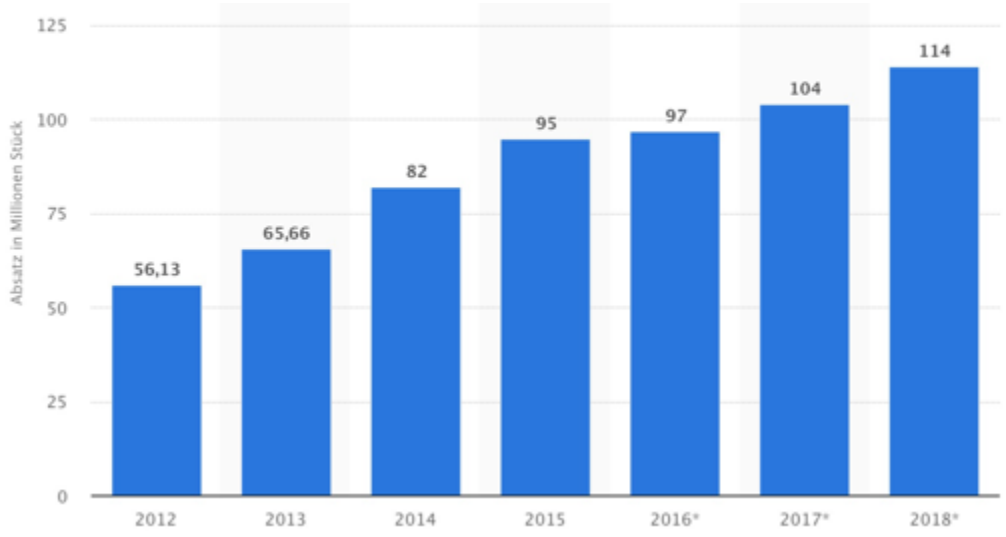
The next imaginable technology would be a holographic television picture. Samsung already patented holographic television for 3D movies. This all is possible with laser beams on a modulator for the spatial representation of light that looks like a television. With the help of other light sources such as LEDs creates a holographic image. It is more or less similar to the "Star Wars" holograms, but the only difference is the 3D images are not really physically in three-dimensional space, but it creates the illusion of a three-dimensional image (Martin, 2018).

Market Development

The increase of the smart TV market has led video streaming services to expand their reach and popularity. This includes a quick growth of online video libraries, mostly fee-based video-on-demand offers such as Apple iTunes and Netflix have quickly gained a foothold worldwide. These are benefits, which

lead the smart TVs to becomemore popularity compared than another TV (regular TV).

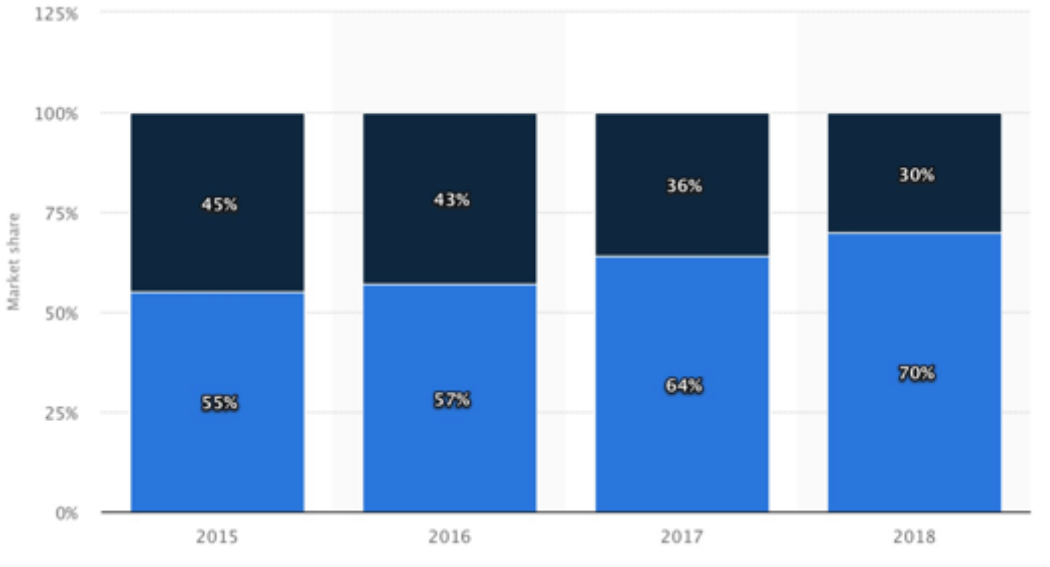
The below diagram represents the sales figures of Smart TVs worldwide from 2012 to 2018 (in millions). Within these six years (2016-2018) sales figures have doubled (Smart TV8).



Source: Smart TV8

Illustration 9: Smart TV sales worldwide (2012-2018)

According to recent research "Global smart TV market share 2015-2018 | Statistic", it has been shown that the market share of smart TVs has grown around 20% in contrast to another TV, which has decline around 15% (Smart TV4).



Source: Smart TV4

Illustration 10: Smart TV market share of overall TV market worldwide from 2015 to 2018

Moreover, there are various apps that allow access to social networks, news, weather services or music portals. Numerous video games are already part of the Smart TV (PricewaterhouseCoopers, 2013).

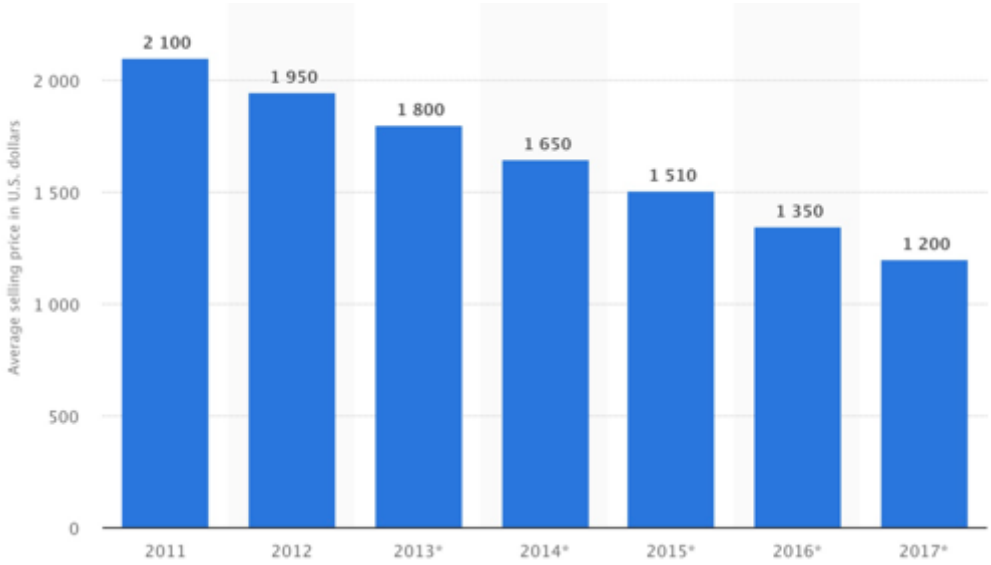
These functions lead to benefits for various groups. Except content providers there are also the advertisers, who have big advantages through this technology. Smart TVs launch interface and additional contents makes it able to offer new advertising channels that can be "recorded" with advertising messages for specific target groups. The advertising industry uses this advantage with convergent content and cross-platform advertising campaigns. This led to new advertising industries have arisen (PricewaterhouseCoopers, 2013).

The advantages for the users are on one hand the higher entertainment factor compared to regular TV, on the other hand smart TV allows individualization of TV usage (PricewaterhouseCoopers, 2013).

Despite the high sales figures of smart TVs in the total number of TVs sold, the smart TV market is still in its infancy. One of the reasons for this is the lack of technological standards, the improved usability of the devices and the expandable content offer (PricewaterhouseCoopers, 2013).

Price Trends

Based on a research "Smart TV average selling price worldwide forecast 2011-2017 | Statistic" results shows that, the average price for a smart TV has fell down massively by almost 50% within six years (2011-2017) (Source: Smart TV5).



(Source: Smart TV5)

Illustration 11: Forecast average selling price smart TVs worldwide from 2011 to 2017 (in U.S. dollars)

It is a fact that the prices for TVs of all classes continue to fall. There are many reasons for this. One reason for this is the quick growth of technology. Smart TV technology improves and extends every few months, so users want of course to get the newest technology. Therefore, to get rid of the “old” versions and make place for the new Smart TVs, consumer electronic businesses making the prices continuously cheaper. This leads to decreasing prices of Smart TVs, which is a big benefit for all costumers.

Another reason is that the production technology of smart TVs has become easier and cheaper over the time. It is possible to get the best quality at really low prices. This leads to more pleasant prices for the retailers and customers.

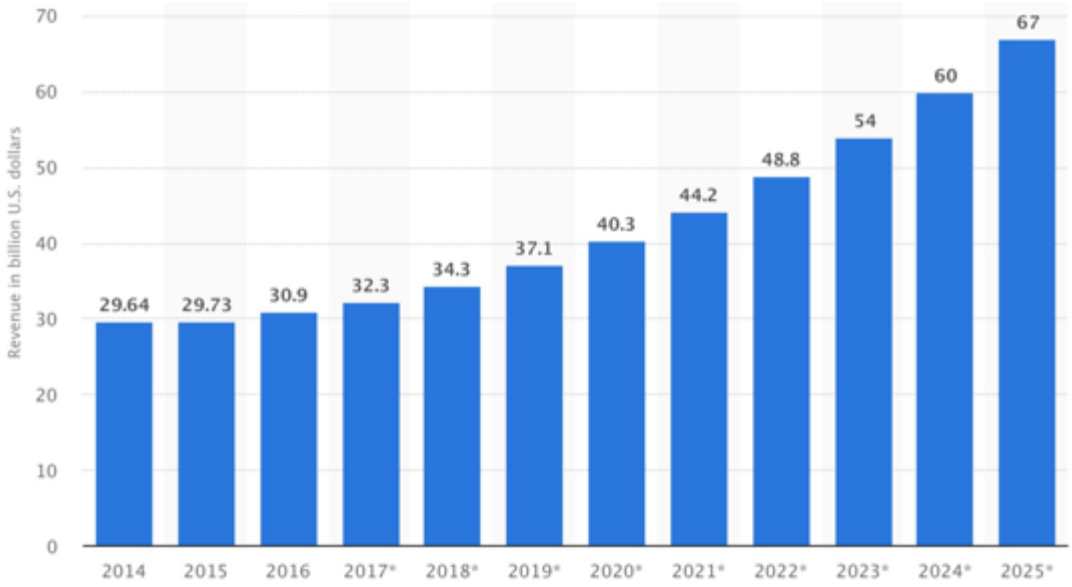
Due to high demand of Smart TVs, the offer has massively risen. Nowadays, Samsung Smart TVs are among the best-known manufacturers of smart TVs. But even LG, Sony or Philips convince with design and high quality. This means that there are a lot of manufacturers in the market offering a wide range of Smart TVs. Therefore, there is a competition among this manufacturers and competitions in the market always leads to falling prices (Plöger, 2018).

Market Development in a Country Comparison

For this section I want to compare the market trends and developments in countries, which are global player in technology contents. These countries are USA, China, Japan, India and Germany.

USA

According to a research in 2016 about the smart TV market revenue in the United States from 2014 to 2025, results shows that in 2016, the smart TV market generated some 30.9 billion U.S. dollars in revenue, which is a big amount of money. This proves the big influence and popularity of smart TVs to USA citizens. In 2020 the revenue is expected to grow by around 10 billion U.S. dollars, which would be reach 40.3 billion U.S. dollars (US smart TV).



(US smart TV)

Illustration 12: Smart TV market revenue in the United States from 2014 to 2025 (in billion U.S. dollars)

While the revenue of smart TVs was growing rapidly, in comparison the average price of a smart TV in the USA was falling continuingly. Due to a research made by Chris Elliott, the average price for an ordinary Smart TV in the market was 1 200 U.S. dollar. In comparison, an ordinary smart TV in 2013 was 1 700 U.S. dollar (Chris Elliott).

China

China is one of the countries with growing penetration rates. There are many Chinese TV manufacturers on the market and some of them gained

international popularity, like TCL. In 2017, globally 245.1 million smart TV shipments were recorded and sales in China were increased by nearly 14% in 2017 from the sales in 2016. Moreover, Goldstein Research analyst forecast that the China smart TV market is set to reach USD 36.1 billion by 2024, expanding at a CAGR of 4.61% over the forecast period (2016-2024) (Goldsteinresearch, 2018).

The average cost for a Chinese smart TV sold online was RMB2983 (roughly US$480) as of September 2015, down more than 40% than 2013, according to All View Cloud, a home appliances research firm. A model launched by LeTV in mid-2014 was priced at only 999 yuan (about $160) (Xiang, 2016). This means that the Smart TV prices are really low compared to the prices in European countries.

Japan

Japan is one of the main manufacturers of Smart TVs. There are globally well-known brands like Samsung and Sony. In 2017, 245.1 million smart TV shipments were recorded worldwide, with Japan being one of the major manufacturers of smart TV. Furthermore, smart TV sales in Japan is continuously increasing and it is expected by 2020 around 70% of the households will have smart TV (Goldsteinresearch1, 2018). According to a research from the IHS TV Sets Intelligence Service, smart TV household penetration in Japan has already reached 50% in 2016 and will rise to 63% in 2019 (Broadband TV News Correspondent, 2016). In 2020, it is expected that the shipment of 4K UHD TV will reach to 7.5 million units. Goldstein Research analyst forecast that the Japan smart TV market is set to reach USD 38.1 billion by 2024, growing at a CAGR of 4.58% over the forecast period (2017-2025) (Goldsteinresearch1, 2018).

India

In 2017, India’s penetration rate was around 15%, which makes India a technology developing country. The rising income of the people of consumer electronics and their shift in preferences towards smart homes and smart

offices environment, led to the quick growth of the market. Currently the 4K TV is a trend in India, but soon the trend will change and upgrade, like the developed technology across the globe. In India the consumer electronic device market is growing, they have been growing at a CAGR of 10.1% under the period of 2017-2025. Even though the growth is expected to have a positive impact in the India smart TV market. Research analyst Goldstein forecast that Indian smart TV market will reach 20.4 USD billion until 2024 this means they will be growing at a CAGR of 4.7% over the forecasting period of 2017-2025 (Goldsteinresearch2).

Germany

In 2018, a total of around 4.6 million TV sets were sold in Germany and 74% (3.4 million) of these TV sets were Smart TVs, which is a sales record compared to 2017. In 2017 (69%), the share of smart TVs in the total market has risen by 5% and since 2015 (60%) by a total of 14% (Krieger, 2018).

Data Protection and Personalized Advertising

Talking about Smart TVs, Data protection and personalized advertising are two important topics. On the one hand, smart TV is offering a wide range of opportunities not only for the entertainment, but also advantages like connection the TV with your personal computer etc. On the other hand, there is evidence that a smart TV is vulnerable to attacks. Moreover, Smart TV has the capability track what you are searching and watching. These information are used to create personalized ads.

Conflicts

Because of their constant use, Smart TVs have access to a lot of personal data. This makes Smart TVs attractive to systematically record and evaluate personal data of its users, especially in the emerging big data era. This is done mostly because of financial or political incentives (Marco Ghiglieri, 2016). But all these have serious consequences for the informational self-determination of the user. There are lots of implications and restrictions for the informational

self-determination. Some may result from the use of smart TV systems for example in following ways:

Intransparency of data processing: in most cases, users are not aware that their television collects data continuously. Many of the Smart TV consumers do not even know that their TV is connected to the Internet. But a Smart TV is capable to collect and process a wide range of sensitive data without the involvement and consent of those affected (Marco Ghiglieri, 2016).

Improper use of data: as before mentioned, Smart TVs are capable to collect sensitive data without the involvement of the victims. Moreover, Smart TV technology makes it possible to link these collected data with other personal data of the viewer and process it further (for example by linking credit card details) (Marco Ghiglieri, 2016).

Mass surveillance and targeted monitoring of viewers: Smart TV sensors, like video, image and voice recordings, can be used to provide information about the users' activities and behaviour without the knowledge and consent of the users. This leads to a big security risk because intruders or intrusive service providers and advertisers can monitor the viewer on-line and off-line. Globally acting bodies such as secret services can gain unauthorized and unnoticed access to the data arising in the smart TV to carry out mass surveillance programs. Furthermore, third parties can spot existing weaknesses in the software and hardware in order to remotely view viewers via installed cameras and microphone in the smart TV sets (Marco Ghiglieri, 2016).

Loss / Limitation of Decision Autonomy: Today’s Smart TVs are capable to manipulate individual decision-making. There are concerns that due to the design of the platform and methods for collecting and processing the data in the smart TV system, users are given no real decision-making options. For example, the consumer has to accept the collection of personal data in order to use a service on the smart TV. Due to the fact of being watched, users can change their usage behaviour to their disadvantage due to the fact that of being watched. Furthermore, a big risk is also that users may change their

personal behaviour and habits as a result of surveillance and even adapt to social expectations (Marco Ghiglieri, 2016).

Tracking and profiling: When a channel is switched on, the device sends a request to a server of the channel. This allows displaying the “red button”, which will be explained later. Many broadcasters send periodic requests with a time interval between one second and several minutes, so the broadcasters know when the user has turned on a station. This leads to the violation of the principle data economy and data avoidance. Some broadcasters track and analyse user behaviour by using tracking scripts, e.g. Google Analytics or eTracker or cookies, which are set via periodic requests to the sender's server. The sender receives the results in anonymous form with Google Analytics. In contrast, cookies allow the sender to get more detailed information about user behaviour. Unfortunately, in many Smart TVs, you cannot view or delete the setting of cookies. The tracking of user behaviour, even if the user does not request the Internet functionalities of a Smart TV, is technically possible. Another important fact is that, in all connections of the Smart TV to the broadcaster, the IP address of the user is also transmitted, which allows a localization of the user. Due to the fact that IP addresses remain the same for many Internet providers for 24 hours or more, the IP address also provides the opportunity to recognize the user during this period. Moreover, it is possible for advertisers to track user behaviour across multiple devices like smartphone or PC, by embedding additional and barely audible signals to the broadcast program (Marco Ghiglieri, 2016).

Other concerns include the risk of disclosure of confidential data, as a result of technical or human error or cyber-attacks. Another problem is the identity theft, which can cause serious repercussions for users, because of material or financial loss of identity (Marco Ghiglieri, 2016).

Personalization

One of the main advantages and disadvantages of Smart TVs are the personalized recommendations or contents. This filtering is done with an automatic recommendation scheme of TV program contents in sequence

using sequential pattern mining (SPM). There are three types of SPM methods, which are offline, online and hybrid SPM (Pyo, 2013).

Similar user grouping: The extracted sequential patterns from the database cannot reflect the characteristics of individual users in personalized manners. Therefore, it is important to find matches between individual users. If a user has similar patterns in their watched TV program contents, this user is put in a user group with users who have similar patterns. The extracted sequential patterns from the watched TV program history of the similar user group can be representatives to the TV watching characteristics of the target user (Pyo, 2013).

Offline SPM method: This method works by extracting frequently watched TV program contents in a sequential order from the whole database with accumulated TV watching history data. Some sequential patterns are based on an existing algorithm, which was developed for item recommendation from transaction database in e-commerce. In this algorithm, only the number of watching times and watching lengths of TV program contents are important to find sequential patterns of frequently watched TV program contents. Moreover, all usage history data is divided by days of the week because of a weekly basis of TV programs (Pyo, 2013).

Online SPM method: The online SPM method works similar like the offline method, but in this method the sequential patterns are extracted by frequently watched TV program contents from the progressive database to reflect the recent characteristics of users. To make the progressive database efficient for extracting sequential patterns online, it is important to consider the processing time and complexity. This method includes an observation window. The observation window calculates the occurrence and net occurrence values of watched TV program contents. In the meanwhile, it is sliding in time without overlapping with the previous observation windows. The occurrence and net occurrence values from the current observation window are calculated by updating to consider the current characteristics and reflect the previously consumed characteristics of watched TV program contents (Pyo, 2013).

Hybrid SPM method: There are advantages when it comes to the previous methods online and offline SPM method. These include, for example, the offline SPM method is able to find out the users watching tendency of a long-term period. On the other hand, the online SPM is focusing on users' recent watching tendency. The hybrid SPM method is combining all the advantages from both methods (Pyo, 2013).

Advertising Market

After a PC, smartphone and tablet, television becomes another highly attractive sales channel for new ad formats and e-commerce or TV commerce.

Smart TV platforms support interactive advertising, addressable advertising with local advertising insertion and targeted advertising and other advanced advertising features, enhanced TV for consumer call-to-action and audience measurement solutions for ad campaign effectiveness. The marketing and trading possibilities offered by Smart TVs are sometimes summarized by the term t-commerce. One of the mains problems is that, the bidirectional data flow can be used for clandestine observation of the owners. Even in sets that are not configured off-the-shelf to do so, default security measures are often weak and will allow hackers to easily break into the TV (Wikipedia contributors1, 2019).

Due to the Internet access on the smart TVs, well-known functions on a computer or smart phone are also available on the TV. This leads to new advertising opportunities in the area of targeting and the growth of a new advertising industry. Commercial through Smart TVs has many advantages like exclusive brand experience for the audience, non-competitive environments, 100% viewability, Well-known advertising formats and targeting criteria from the online world (Smart TV6). A lot of players can earn money because of this, e.g. streaming services, social networks, etc. Moreover, the manufacturers themselves can earn a lot of money too. Since the US market of smart TVs was largely saturated, the manufacturer Samsung came in 2015 to the idea of selling advertising space in the main menu, even more Generate sales. For the time being, this was only possible in the USA, but just one year

later, the EU was on the list. In order to make this feature possible for older models, Samsung has also developed an update. The only way to stop advertising is to turn off the Internet connection (Moser, 2018).

Addressable Advertising

Addressable TV is also called targeted advertising and is a type of advertising where advertisements are placed to reach consumers based on various properties like demographics, psychographics, behavioural variables, etc. Moreover, it can be differentiated between local advertising insertion and targeted advertising (Infogalactic, 2015).

There are some ways to address their products and services via Smart TVs, these concerns above all advertisers and this is Addressable TV. Through the connection between television and digital media for companies makes it possible to offer so-called addressable TV advertising. One of the advantages of addressable TV advertising is the high reach and more accurate targeting by offering targeting options. The condition for addressable TV is, of course, a Smart TV and an active Internet connection. Addressable TV advertisements are not personalized, but they are separated into tailored categories such as regions or weather dependency. ProSiebenSat.1 is expecting high sales in this segment. In 2016, sales were in the single-digit millions and for 2020, at least. This sounds first not like a big deal, but on the other hand it provides more values like, bringing new customers and allowing more individualized offers for the advertisers. In particular, local providers of a national television service should seize the opportunity. (Moser, 2018)

Red Button

A use of addressable TV is the “red button”, which is only available on Samsung Smart TVs. The red button is the red colour button on the remote control. It offers additional features, which is entertainment directly on the TV. Moreover, it offers additional information of the TV program, cutting-edge news, helpful guides, extensive media libraries and exciting themed channels. The only requirement for red button is a standard HbbTV. The red button

works by pressing the button on the remote control with the colour red (redbutton.de, 2018).

An example for Red Button was the commercial for the movie "Baywatch". The interesting thing here is that, the visualization of the content changed depending on the weather (Winterbauer, 2017).

(Winterbauer, 2017)

Illustration 13: Addressable TV

On the left side, you can see the content on rainy and cold days and on the right side, for the warm and sunny days (Winterbauer, 2017).

Interactive Advertising

Another way of advertisement through Smart TVs is interactive advertising. Interactive advertising uses online or offline interactive media to communicate with consumers and to promote and present products, brands, services, and public service announcements, corporate or political groups by an identified sponsor. The advertisers are controlling different aspects of Internet advertising. These include structural elements, like ad types, formats and features. For example, banner Ads, sponsorship, hyperlinks, etc. Moreover, this does not mean that consumers cannot control the structure of interactive ads (Infogalactic2, 2015).

TV Plus

TV Plus is an additional feature on the Samsung Smart TV. It is a channel list, where viewers can also access linear and on-demand content on the big screen over the Internet. With this channel list brands have the opportunity to

launch their own channel or show content in the appropriate genre channel. TV Plus makes it able to present your brand in a variety of ways. There are Brand Channel (Content), Slot in the genre Channel (Content) as well as the classic advertising formats Pre-, Mid- and Post-Roll. Moreover, you can choose between established targeting options like geo targeting, frequency capping and time targeting. To sum it up, the advantages of TV Plus are exclusive brand experience for the audience, non-competitive environments, 100% view ability, Audio-visual (Video with sound) and well-known advertising formats and targeting options from the online world (Smart TV6).

Possible Solutions

So, after we talked about the problems and risks of using Smart TV, I would like to focus on solutions for the above-mentioned issues.

There are some ways to avoid privacy risks. The easiest solution to make sure, if your smart TV isn't spying on you, is to disconnect your Smart TV from your home network. If you want to use some features of your Smart TV also, then you have to try avoiding Smart TVs with built-in webcams. But if you have a Smart TV with a built-in webcam, then putting a sticky note to cover the lens of the camera, is also an effective but the same time cheap and easy solution (Schubert, 2017).

Due to the fact that, it is possible to install malicious software on the Smart TV to access and modify configuration information for a remote control, remotely access and modify files on TV and attached USB drives, access camera and microphone. Therefore, some security software companies are already started working on the solution for this issue. Currently, there is one available antivirus system called "Neptune", a cloud-based antimalware system for Smart TVs, which was made by Ocean Blue and Sophos. Avira is currently trying to set another antivirus software on the market with Labwise. This software is supposed to protect against potential attacks (Infogalactic, 2015).

Another suggestion from experts, if you don't want to connect the smart TV directly to the Internet without renouncing streaming services, is to use

additional devices like the Amazon Fire TV stick or a game console such as the Xbox. These devices can install apps and execute Internet activities. Even by doing this your user behaviour is shared with Amazon, etc., but it minimizes the number of data collectors. Moreover, in this way you have a certain overview of who else is watching (Blaha, 2018).

Conclusion

Smart TVs developed from just being an entertainment medium to a multipurpose medium. After a long investigation with the topic Smart TVs it is easy to say that Smart TVs is a leading daily technology but there are still a lot of risks of using Smart TV. I would like to sum up the importance, risks, advantages and disadvantages with some surveys.

According to a survey from 2013 about experiences with Smart TVs, 23,4% of the interviewed said that since they have a Smart TV, they spend more time watching TV. This proves that Smart TVs changed the game for many viewers when it comes to the usage time of Smart TVs. 25,9% claimed to search for detailed information on the products advertised on the Internet during commercial break. That shows us how important Smart TV commercials are and why the advertising market for Smart TVs has become to a leading advertising material (PricewaterhouseCoopers, 2013).

Data security has become a tense issue even for smart TVs. A survey by University of Amsterdam was dealing with personal data. The results show that 66,5% of the participants' think it is unacceptable that personal data is collected via TV. This leads to a big issue because it is a fact that Smart TVs are collecting personal information. Of course, there are ways, to reduce the risks of Smart TVs, but none of them is promising full security (Kristina Irion, 2017).

So, at the end, everyone makes decision by itself if Smart TVs are beneficial or not.

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