



ÜSKÜDAR ÜNİVERSİTESİ  
İLETİŞİM FAKÜLTESİ  
**6. Uluslararası  
İletişim Günleri  
Dijital Dönüşüm  
Sempozyumu**

ÜSKÜDAR UNIVERSITY  
FACULTY of COMMUNICATION  
6<sup>th</sup> International  
Communication Days  
**Digital Transformation  
Symposium**



**Tam Metin  
Bildiri Kitabı  
Full Text  
Book**

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# DIGITAL CONVERGENCE OF RADIO: EFFECTS OF DIGITALIZATION ON RADIO MEDIA

Mihalıs KUYUCU \*

## Abstract

The change in new communication technologies deeply affects the traditional media. As a result of this interaction, fields of the traditional media have entered into a transformation. The most tangible indication of this transformation can be seen in the convergence of traditional media and digital media. In this study, digital transformation of the radio, as one of the oldest medias of traditional media with a history dating back to a century, will be examined in terms of convergence. In this context, the study will describe experiences of the radio media in its transition from traditional to digital, relationship between the radio and whole digital media today, and its implications to the media. In the communiqué prepared by the screening method, milestones in digitalization of radio ranging from the emergence of Internet radios to mobile radio and to DAB (Digital Audio Broadcasting) technologies will be examined. Although the traditional radio station continues to exist today, in the research, it will be emphasized that radio is a part of the digital media within digital development through the convergence theory, and the question of "does the digital transformation of radio threaten the existence of traditional radio station?" will be discussed.

**Keywords:** radio, digital media, new media, convergence, digital radio, internet radio, web radio, DAB

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## Introduction

Technological advancements are rapidly transforming the nature, usage and shape of everything be it about professional aspects of life or associated with personal aspects of individuals; be it socialization or entertainment, the technological encroachments since the end of 21<sup>st</sup> century have mesmerized people at individual as well as organizational level. Media is considered to be a tool of entertainment and relaxation for people which is rapidly changing. The introduction of mass media in the society can be reported back to 1920 when the first ever KDKA commercial radio station by Westinghouse Electric Corporation have been launched and aired the continuous updates about the elections of November 2, 1920. That radio station is considered to be a steppingstone in the field of media, mass communication and entertainment as, it has given immediate results without making people wait for the next-day newspaper about the results (Zanger, 2016: 1920).



*Figure 1: The First Years of Radio Broadcasting*

The company soon after the WWI, have tried to use the station for the sake of commercial purposes in order to gain enhanced publicity, goodwill and financial returns. For this, the company have appointed F. Conrad as engineer who was aware of the usage of the radio equipment. The company have then launched a first ever commercial of a real estate company from NYC during the start of 1922, which have founded the way of advertising (History of Innovation, n.d.) This study provides

information on transformation of the traditional radio to the digital radio, which reveal history and development of the radio with the steps or milestones of digitization of radio. The internet invention and the beginning of the first internet radio broadcasting/ digital audio broadcasting (DAB) radio will be examined as well as advantages and disadvantages of the digitization to radio will be developed in this study.

<b>Traditional Radio</b>	<b>Radios Broadcasting Online</b>
Terrestrial Broadcast Receivers	Internet Connection / PC
Automobile Receivers	Telephone (Android and Iphone Apps)
	Smart TV & Digital TV Platforms
	MP3 / Ipod Player
	Car Radios

*Figure 2: The Forms of Radio Distribution*

### **Transformation of Traditional Radio to Digital Radio**

According to Tan et.al (2019: 492), the traditional radio has an antenna that usually covers particular area. Main stations set up in areas outside of the coverage set up with smaller rebroadcast stations. On the other hand, small local stations are quite confined around transmitter to the limited area, for instance Studio FM105.4. Digital radio has been transformed from the traditional radio to the new level with increasing usage of the internet where individuals has a tendency to spend a lot of time being online on internet. Several radio directory portals like Tune In, My Community Radio, I Heart and many other features have thousands of digital radio stations across the world. Tan et al. (2019) explained that there is a difference that traditional ratio is over air independent from the digital connections as it is receivable during power outages without bandwidth limit. Tan, Guo & Wang, (2019) determined that it can be content-wise relevant to listeners due to which it seems to be local too for instance, advertising, traffic reports and news.

Considerably, Tan, Guo, & Wang, (2019) determined that traditional radios cannot be used anywhere because of the long wavelength of radio stations. This is the issue

that the person cannot get into every channel as well as it totally depends on location they are using. Now, as traditional radio is transformed into the digital radio with regard to the utility, reach and user-experience. The digital radio has an international reach whereas before transformation into the digital radio, traditional radio broadcasts the channel confined to the specific and local area. For accessing digital radio, individuals just need to have online access and stream their own choice to listen to their favorite artist or genre. However, Tan, Guo, & Wang, (2019:490), have posited that FM (frequency modulation) radio channels have quite low coverage. Additionally, according to Tan et al. (2019), as compare to the traditional radio, the digital radio can afford to be more specialized as well as eclectic. Since, it is not limited in a geographically manner, therefore, it can clearly appeal to the audience internationally with more specialized interest and not have to try to please all individual all the time like traditional radio stations do usually.

According to Nielsen and Kreutzfeldt (2016: 170), there are eight measures that generate essential framework for the radio broadcasting transformation in digital age. The regulation of the smart radio is one of the mandatory equipment of the radio receivers with one digital interface. The regulation creation that makes sure that analogue transformation capacity released by the public radio broadcasters and is not accessible for different or new analogue radio offerings. Nielsen and Kreutzfeldt (2016) explained that the transformation of the traditional radio to the digital radio support high speed broadband networks with the provision of the essential transmission capacity with the setup of a second nationwide DAB plus multiplex by network agency. Furthermore, the development of measuring methods for the use of radio in liaison with agma includes digital terrestrial broadcasting usage. Jianjie et al. (2016:27) described that programs were broadcast on medium wave in the early days of 1920s. The transmission using FM began in Germany after the Second World War. Bavarian Radio started operating the very first transmitter in the year 1949 on 28<sup>th</sup> February in Europe.



*Figure 3: The Old Radio*

Therefore, it was believed that traditional radio broadcast is a linear medium and time-based where people have to be tuned in to the certain channels at certain times. They need to follow the schedule so they can be able to get the content they want, and that schedule needs to be designed by the broadcaster. The characteristics of the emerging digital platforms for the radio were assumed to be user sovereignty and higher listener. As an outcome, both are the increasing channels (terrestrial and satellite digital radio including the Internet) and the nonlinear content delivery including consumption (podcasting, downloading and listening to the recorded audio files) (Nielsen and Kreutzfeldt, 2016:170). In the view of Jianjie et al. (2016), beside schedules, when on the move listening to the recorded or downloaded programs will help overcome poor signal reception specifically. The medium wave is still considered as a transmission mode for radio specifically where programs aren't broadcast by means of long or medium wave. In Germany, the last medium wave transmitter operated and was switched off in the year 2015 by the publicly owned broadcaster.

The strongest critiques of the digital radio are not newsy, but its traditional public radio is mission-drive that seeks to inform the critical problems in public. Podcasts seek to amuse the audience while selling ads and are basically known as commercially driven. No matter how much demand is there for newsier podcasts, there are some of the economic challenges working against the podcasts. This is due to which central facets related to the business models construct up the content in the library that

can be indefinitely recessed. When a person explores new podcast, they usually listen to the old ones while going back to their old list. The ads on the new podcasts can be refreshed because new listening to the old episodes counts the number of audience while selling to the advertisers. A huge part of the profit presented the back catalog and provides the importance that enhances as podcasts catalog and where podcasts would get older. Hence, the digital transformation of the radio brings major challenges for the traditional radio broadcasting which also opens up new chances. The usage of media is now becoming more convergent and non-linear popularity audio offerings are continuously growing which is why individual voices foresee a future for linear programme.

### **How Did Radio Convergence with Digital?**

The radio convergence is the buzzword in media. Jianjie et al. (2016) find out what does it mean in the radio industry because biggest challenge has come from disruption as an outcome of technology. UK is one of the digitized countries all over the world with complete digital television and has 78% of the ownership of Smartphones with complete digital broadband nearly. Jianjie et al. (2016: 27) determined that significant amount of people use digital radio where population claims to listen almost 50 minutes of radio all the time. According to Jianjie et al. (2016), radio is transforming with rapid advance of digital technology into a newer form of media by including the visual materials and convergence applications. This does not mean that listeners are no longer capable to have aural experience, it means that there is layer of content that permits users to increase that experience in online space and through diverse devices that are accessible within the market.

Jianjie et al. (2016: 22) determined that radio stations are leading media convergence phenomena, due to the radio user's tendency to search for what they actually want to consume. It is also permitting its user to listen to any of the channel or station no matter where they are as long as they are connected to the internet. However, to have access to digital radio, an individual always need to be connected to use that specific service associated to the internet. Significant, radio stations are compelled to make audiovisual contents where users need to browse visually instead of the text. This encourages stations to generate websites with large graphics and icons. Broadcasters have to think attentively and invest in some of the ways of storytelling. The programs

on the radio do not flourish on their own; they make the best out of the platforms relevantly. Mobile phones, television, radio, web and social media can no longer be treated as the entities separately. They are interconnected through diverse pathways that might also lead to the pool of information. In the recent digital radio convergence and development, metadata storage is the key achievement where technology links to the content with another like any catalogue collection within the library.

In the view of Nielsen and Kreutzfeldt (2016: 164), the technology or radio convergence clears that smartphones are emerging as the new radio and not only as the new laptop computer. We are not sure that we are actually 'front and centre' on devices but we are extending the connection with our clients and listeners through virtual lives importantly.

### **History and Development of Web Radio**

The early history of the radio is the technology history that makes and employs the instruments related to radio that use radio waves. The development of the radio started as wireless telegraphy. Later, the history of radio involves broadcasting matter increasingly. According to Jianjie et al. (2016), the very first internet was launched in the year 1993. The existence of the electromagnetic radiation was proved by the Heinrich Hertz in a successful manner known as radio waves. Hertz who was an Italian inventor and set out to prove that waves could be employed without wires for telegraphy between a receiver and a sender. Eventually, wireless experiments proved to be successful and to this very day when this was remained one of the turning points in the radio invention.



*Figure 4: Web Radio Receivers*

Delaere and Ballon (2017: 322) determined that Alexandar Popov of Russia was attempted to detect the thunderstorm by employing the waves related to atmospheric electromagnetic. He constructed the machine in the year 1894 with the intention to recognize electrical storms which also included coherer and worked in a good manner. He also forecasted that it could be employed to receive man-made radio waves. The apparatus to the Russian Physical and Chemical Society presented and demonstrated by him in the year 1895 where Karl Braun who was the German scientist developed the tool to manipulate radio waves. These waves produced by the light that can be visible when hit with a stream of electrons.



*Figure 5: Karl Braun*

It is also examined that telegraph and signal company was founded by the Marconi in the year 1897. In his recent years, the development of the organization proceeding, where he had traveled all around the world with the intention to illustrate the power of his wireless telegraph practically. He was spotted at sports venues and demonstrates how his machine could be employed to report the athletic events outcomes like horse racing and yacht. During the US travel in the year 1899, he also set up the branch of Marconi Wireless Telegraph Company in America. On the other hand, Delaere and Ballon (2017: 323) determined that the very first human voice transmission was made by the American Reginald Fessenden across the radio waves. He achieved this feature amazingly by using the wave theory continuously where a sound wave is transmitted to the receiver and combined with a radio where the wave in the radio is removed so that listener can be able to hear the original sound clearly.

Surprisingly, this explains how radios of today operate. The radio development or advancement hit the speed bump in the year 1901 in the month of October. In New

York, Macroni with his two radio businessmen attempted to broadcast the races at an internal yacht racing competition. Conversely, all of these individuals explored that interfering the transmission of two businessmen had made their own kind of broadcast incoherent where some of them were not able to comprehend. All individual have learnt that there is a great deal from simultaneous radio attempt (Uimonen, 2017: 182).

### **Radio's Digital Transformation – Milestones of Digitization of Radio**

The radio reached significant milestone on 17<sup>th</sup> May 2018 whereas for the very first time, over 51% of the radio listening was by means of a digital platform such as online or through digital TV and DAB (Digital Audio Broadcasting). In other words, radio listening is done through the digital means rather than through analogue on FM. Esteban et al. (2016: 580) explained that some of the milestones for the radio digitization from the year 2010 till the year 2019.

- 2011: The culture ministry decides the prolongation of commercial radio licenses possible in the FM network until the year 2017.
- 2013: The culture ministry determines whether obligation for the NRK radio services shall attached to DAB multiplex alone or whether it can be fulfilled by using other technologies such as DAB. On the other hand, what exactly needs to be understood by the criterion technically and affordable solutions for the in car reception needs to be comprehend too.
- 2015: The Ministry of Culture decides the following situations that need to be met such as digital coverage of radio corresponds to that of the NRK P1 in FM. The coverage population of commercial and national multiplex which can be less than 90%. The radio offers digitally and represents the value added to the public. The affordable and technical availability could be satisfactory in the car solutions where the digital platforms usage can be less than 50% of daily radio-listeners.
- 2017: There was a switch-off possibly
- 2019: There will be a prospective postponed final switch-off of the FM.



*Figure 6: DAB Radio*

Although, the Ministry of Culture is committed to the policy of leaving technology choices to industry currently which demonstrate that authorities take favorable position towards the prospective migration to DAB+. It is more effective radio standard as compare to the DAB standard originally. The study proposes that local radio stations must have right to continue transmitting in FM beyond the year 2017. According to Xu et.al (2018: 2134), it isn't possible to digitalize radio, but this is what people can call digital broadcasting. The procedure is analog encapsulated in a carrier from the studio and that is of digital format and routed to transmitter where it broadcasted with radio waves. It is examined that the electromagnetic radiation or waves travel through space and air with the powerful transmitter. There is no way that signals on the audio can do that. The audible sounds a human ear which can perceive but cannot reach far distances. People have got employed to say that radio for broadcasting programs is only by means of the Internet (Yang et al., 2018: 3-4).



*Figure 7: DRM Receivers*

Majority radio services are driving new listeners towards the non-analogue radio services and internet. Digital TV services like cable, satellite and terrestrial perform additional radio services. Moreover, there are some of the digital radio broadcast services like DRM, DAB and DMB (not to confuse with encryption). The streaming services of the internet radio are rapidly rising as a new profit stream with streaming to both mobile and computer devices (O'Neill: 2009: 85). The internet streaming is increasing with the audio devices like dedicated audio/radio streamers and Sonos. Sending signal over the internet instead of the radio waves or sending the data packets by means of the radio waves needs to be unzipped upon reception. Notwithstanding, iHeartRADIO is developed by the digital radio platform for which performance royalty payment is required. The broadcast radio does not pay a sound recording performance royalty to the right owners and artists. Economists have concluded that innovation has stalled out due to which business remains focused on driving EBITDA through the result of government price suppression and reduced content cost by the current public policy (Shmeld et al., 2017: 455-456).

### **The Invention of Internet**

After the change in economy, the internet should advance even about services and objects. Children born after the popularization of the computer network and touch screens over the past decade have dealt with technology like the push of a button to turn on the light when it is dark. A reality very differently examined from that of the English physicist Tim Berners-Lee in 1989. Until then, the first computer network, Arpanet, created by the American army in 1957, meant a communication made by complicated codes, impenetrable to those without training in exact sciences. Berners-Lee has been exploring ways to improve the exchange of information between machines at the European Organization for Nuclear Research (CERN). Two years later, he combined his experience with hypertexts - expressions or words that, when clicked, the computer transfers the user to another area. He built the first browser and the first server that aired on August 6, 1991. CERN's information site, the first in history, was born and is still active.

The internet was not the invention of a single person, at least not the internet we know and use nowadays. Different personalities have worked and worked on the idea, development, and improvements of a complex global system. At this precise moment, a lot of information is displayed and transported to computer over the internet. It consists of two essential parts: software and hardware. One allows the physical connections that

facilitate the contact (hardware), ex: cables, servers, etc. The other allows the encoding and decoding of information (software), eg. programs, browsers, etc. This entire work in such a way that it constitutes an immense joint and decentralized system of interconnected communication networks over the internet. Through TCP / IP protocols, it enables its operation as a logical network that spans the entire world, connecting millions of computers globally (Hirschmeier et.al, 2019: 76).

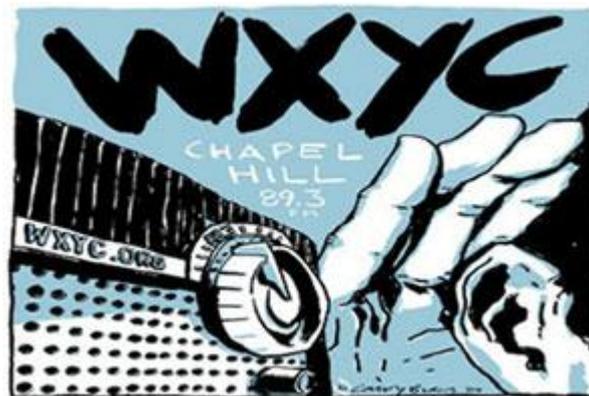
In the beginning, the internet was an idea generally attributed to the American Leonar Kleinrock, engineer, computer scientist and professor of computer science at UCLA, who mentions it in the article Flow of Information in Large Networks of Communication in May 1961 A year later. In 1962, JCR Licklider, a North American technologist, along with the contribution of another technologist from his country, named Robert W. Taylor, gave his vision about a possible galactic network. These three names that have been mentioned above formulated the first idea of what the network would be, which later became ARPANET. The impact of the internet on people's lives has been compared to that of the steam engine in the industrial revolution. But there are those who bet that the changes were even greater. "We live the age of David against Goliath," says Caetano, who has been named one of the 10 most innovative minds in the country by MIT, the Massachusetts Institute of Technology. Any small, innovative company has the same odds as giants in the business world, depending on disruptive potential of its invention. Caetano quotes, for example, Waze was developed by a small Israeli startup that Skype was born in Latvia and that the Brazilian Nubank card is already competing with the big banks.

Thus, in 1968, the study of the parameters of the computer network design was published and, together with the contributions of Paul Baran, Thomas Marill and his colleagues; Lawrence Roberts and Barry Wessler created the final version of the Message Interface Processor (IMP) that was immediately designed and built by BBN Technologies. With the necessary tools, the ideas of Kleinrock, Licklider, Robert W. Taylor and their colleagues materialized quickly. With the work of numerous researchers from the United States Department of Defense, the ARPANET (Advanced Research Projects Agency Network) was developed, the basis of the Internet until 1990. The network has been developing and improving steadily for decades. The most important names in these terms are those of Leonar Kleinrock, who invented the so-called packet-switching (basic technology of the internet), Robert Kahn and Vinton Cerf who invented the TCP / IP

protocol in the 1970s; Lawrence G. Roberts; Ray Tomlinson, who introduced the electronic messages by network and Tim Berners-Lee who in 1990 developed the HTML language and the WWW system.

### **The First Internet Radio Broadcasting**

WXYC became the very first radio station to announce its broadcasting on internet. WXYC employed an FM radio associated to the system later known as Ibiblio at Sunsite in the year 1994 in North Carolina USA. The very first internet radio broadcasting is a digital audio service transmitted by means of the internet. The broadcasting is referred to as webcasting since it is not even transmitted through wireless means (Madni et al., 2016: 476). It can be used as a stand-alone device through the internet or as software running through the computer. The internet radio includes streaming media which present listeners with continuous stream of the audio that cannot be replayed or paused typically much like traditional broadcast media. The services of the internet radio offer news, talk, sports and several genres of music where each and every format is accessible on traditional broadcast radio stations (Losler, Eschelbach & Haas, 2017:31-32).



*Figure 8: The Radio Station WXYC*

According to Tomanna et al. (2018: 37), digital radio will have to adapt to shift listening habit as the listeners replace with the older ones. It can be said that AM radio has remained unchanged from the broadcasting days and their main music medium is relegated to talk about the news and sports formats due to which voice sounds good on AM. The digital broadcasting approved by the US Federal Communications Commission for the US radio stations from a company using a system named as iBiquity. FM and AM radio stations will start broadcasting the digital signal with their analog signals across the country on the same frequency (Al-Fossi, 2016:266-267). Hence, there was a period of time when consumption and disruption of mediums like movies, TV and

radio were subject and well established to little change relatively. However, the period we are living in now is in perpetual change with the help of the internet.

Internet radio would play its part as it would eventually rise the streaming music services such as Google Music, Spotify, Music and Pandora. New media platforms were based on the diverse paradigm radically and choice for the listeners specifically being the 'on-demand' service. The early new media file formats such as mp3, mpeg and mpeg2 offered trade-offs between sound quality, compression and portability which initially championed by the internet pirates but has become mainstream rapidly (Ala-Fossi, 2016:266). It is actually about how portability in the first internet radio broadcasting would marry with the ubiquitous tablets and smartphones in future which also allow listeners to take unthinkable music quantities formerly with them anywhere they want (Church et al., 2010: 264).

Also, on the other hand, the internet radio stations simulcast programs by employing the compatible audio formats that radio uses such as AAC, MP3, WMA, OGG and others. Majority software media players can play streaming audio by employing these kinds of popular formats. The radio stations are quite limited to the power of transmitter and broadcast options (Madni et al., 2016: 478). Hence, the first internet radio broadcasting has changed media in a traditional way and has been challenged with consumption models so that all media can now accessed from anywhere by any of the individual in the world instantly. The changes in society are quite powerful that even media empires would be forced to meet as well as adapt new ways in which consumers wanted to access their choices associated with entertainment.

### **The First DAB Radio**

DAB digital radios pick up the broadcast digitally while giving great sound and lots of choices of the channels. Internet radios connect to the web-based stations over the home broadband connection as well as offer channels in thousands. RAJAR's latest quarterly figures/statistics demonstrated that 1 in 2 listeners are now using DAB or online streaming (Finger et al., 2017). Therefore, radio analysts will be looking to see if government twitches on dormant debate over switching off AM and FM. The process has happened for so long since in many countries where AM and FM were taken off, the agenda in the UK have also taken until majority had organically switched to DAB (Maniou and Seitanidis, 2018: 111-112). With majority youngsters are persuaded and like

to listen music thru phones and majority radio players offer Alexa service as a cherry on top of the radio apps (such as RadioPlayer and iTunes) therefore, it does not seem more likely that digital radio will continue to rise any further (El-Moghazi, Whalley & Irvine 2017:165). There is a large increase in smart speaker usage where the rise is seen in the smart speaker that has been considered as tangible. It has always been noticed that DAB is a great way for the individual that need to be discovered. Smart speakers are now considered as an essential part of radio landscape, undoubtedly.



*Figure 9: The Great Discovery of DAB Radio Capital FM*

In accordance of Jauert et al. (2017: 11-13), internet only stations prove that there is a great springboard for new and unique formats because digital radio formats such as voice assistants, DVB, DAB and apps are major opportunities. When a person is fond of using internet, people seem to be most likely to stumble across themselves. On digital radio, the Classical FM and Capital FM is great for discovery and with DAB being in new car for over 90%, the fans of the country keep finding them. Despite the huge online presence, the radio one continues dropping the audience. Therefore, DAB radio was billed as a transformative technology that would also revolutionize the industry when first services went on air in the mid-1990s. BBC has exposed the cracks as the controversial U-turn in policy in the argument for DAB. Cracks are widening as live streaming technology improved and as the popularity of the podcasts arose. There were many objections to a forced adoption of the DAB. The system major critics were the media analyst Grant Goddard. He objected to the general development and specifics of the implementation within UK where specifically he pinpointed on the transmission

costs of the commercial stations. Conversely, majority listeners will be happy about the execution stay for FM. They also complained that accessing DAB meant them having to purchase new sets that signal was unreliable and non-existent (Jauert et al., 2017: 16).

### **The Features of Digital Radio Broadcasting**

DAB brings along many advantages over other radio broadcasting systems.

- The modulation technique used is virtually unaffected by contamination caused by multi-path echoes. On mobile or stationary receivers, it allows for excellent receptions in the most crowded areas of cities or where traffic is intense.
- The transmission of digital signals requires less power than analog systems, and it provides same clean sound as long as the signal is received.
- It has ability to transport multiple services (stations) on a single transmitter. This allows for a very good cost effectiveness or shared cost emissions.
- In addition to sound for a variety of value-added applications, it has features allowing for data transmission.
- Radio programs with CD/Stereo, FM/Mono, FM/Stereo, AM quality can be broadcast as preferred by the publisher.
- It is possible to make data transmission independent of program-related data or schedule.
- Interactive radio broadcasting (Interactive Radio Broadcasting)
- It is possible to receive broadcast without interruption and interference in constant, portable and mobile type receivers.
- Depending on the broadcast quality preference, it has the ability to publish 5-8 stereo radio program from a single transmitter.
- It provides lower power coverage compared to Analog FM broadcasts.
- It can work with other technologies such as GSM and GPS.
- Competition between publishers will improve based on program contents rather than technical obstacles making competition difficult.
- DAB's wide data capacity opens a way for multimedia/radio services.

### **Features of Traditional Radio Broadcasting**

Compared to DAB, the transmission of analog signals has some open disadvantages.

- In the world of analogue radio, the sound quality suffers due to transmission deteriorations such as effects caused by weakening of signal as distances increase or due to multi-path echoes.
- Analog signals require higher power levels to provide a useful emission coverage.
- Each transmitter can only carry one service in a way to eliminate the possibility of cost sharing (One broadcast from a transmitter).
- FM radio stations require a minimum of 200 kHz. To prevent geographically adjacent channel interference, channel gap is provided.
- It requires allocation of other frequencies to broadcast signals taken from a transmitter again in another field, namely, to repeat.

### **The Advantages and Disadvantages of Digitization to Radio**

Some of the advantages of the digitization to radio are discussed in this section to know more about the radio one by one (Jiang et al., 2015: 2049). According to Ferguson and Greer (2011), Johnson (2012), Baltzis and Barboutis (2013), Rooke and Odame, (2013) the advantages and disadvantages of radio digitization can be compelled like this.

Audio clarity is advantage of digitization of radio and is proportional to the signal to distortion and noise of the demodulated audio and is also proportional to bit error rate (BER). The reconstructed audio waveform with analog communications at the receiver is derived from the frequency or instantaneous amplitude of the received signal. Another benefit includes that digitization to the radio have more options and flexibility with regard to review and record the media and can be able to manipulate what is recorded. The digitization advantage to the radio is that it has effective use of spectrum space, improved the clarity in audio at low receiver signal levels approaching sensitivity and increased the amount of information can be passed down on a single channel.

The biggest benefit is that they can function day and night in any kind of weather. Since, Earth communications depend on the radio waves from TV to the cellphones and to the radio channels. The arrays in the radio satellite should be constructed from towns and cities. The arrays should be made up of various to dozens of the precise and large antenna with the intention to pick up the wavelengths due to which they seem to be very low in energy (Patzold et al., 2018: 6-7). Some of the advantages related to radio also revealed that they are less expensive as compare to the television advertising or other forms such as direct mail, billboards or some forms of the online advertising. The advertising ability

nationally and regionally increases the reach for companies with wider geographic offerings. The genre of the format and music influence the kind of people that only listen to the stations (Birsen et al., 2018: 40-41).

The wavelengths of the radio are immune to dust unlike the visible waves. This means that they can go straight through the dust without being reflected or being absorbed (Jiang et al., 2015). According to Ito et al. (2016), some stations talk about the sports and are successful at gaining the listeners attention specifically. As compared to the other media employed by the advertisers, the digitization to the radio offers wide reach, affordability, selectivity of the target audience and deliver message timely. Conversely, the poor fragmentation and attentiveness and a complex national purchasing procedure with a lack of visual appeal are some of the common challenges (Pang et al., 2019: 1094).

Additionally, the disadvantage to the digitization of the radio include that it is quite more complex so there more to go wrong. It is also unforgiving if the information is damaged and tends to spoil the media packet (Ito et al., 2016: 143). It is quite hard and expensive to fix when it has any kind of issue. The privacy is more open to monitor and easier to be recorded without the consent or knowledge (for both government and criminals). Another disadvantage for the digitization to radio is that it has less support in developing countries for this technology. The digitization to the radio becomes ineffective for the local advertisement. It reaches out internationally to the local audience and does not address to the local community specifically. The radio digitization permits stations in similar amount of the bandwidth which allow the commercial operators to broadcast more stations.

### **Advantages of Digital Radio (DAB)**

The possibilities of digital radio can be listed as follows (Balabanlar, 2011: 108):

#### ***Sound quality level***

\* High quality stereo sound (two-channel) with the same quality as CD/R-DAT standards for almost all program materials.

\* To be able to benefit from audio channels at an optimum level, the ability to send sound signals at low-level

### ***Voice control markers***

Transmission of voice control data (intensity of sound, dynamic field pressure, matting, etc.)

### ***Types of services***

- \* High quality stereophonic sound
- \* High quality monophonic sound
- \* For special applications, ability to add additional audio channels of the appropriate type in host system (for example, for surround sound layout)
- \* Additional services with different data capacity and uptime (e.g. traffic news channel, commercial data, pagination, photo/graphics, 1.5 Mbit/s video/audio layers, future digital broadcast integrated services)

### ***Publication distribution***

- \* Domestic, regional and national surface VHF/UHF networks
- \* Combined use of national/global UHF satellite services with terrestrial networks
- \* For cable transmissions, the use of common signals on receivers

### ***Broadcast data***

- \* Radio Program Data related to each program signal (Program Classification, Program Distribution Control, Copyright Control, Conditional Input, Live Program Connection, Hearing Impaired Services)
- \* Versatile data transmission system (easy determination of program or broadcast, selection and connection feature)

### ***Intermediate connections***

- \* (Reduced to byte service) ability to record audio signals and related data. Thus, ability to record all program signals containing self-program data, and to accept small data errors consisting of encrypted signals.

### ***Service facilities***

- \* Detection with mobile, portable and fixed systems
- \* High efficiency in terms of time and space
- \* The ability of losses to be in acceptable levels
- \* High resistance to Doppler effect observed in mobile receivers and to long- and short-term versatility

### ***Universality in use***

- \* Availability for fixed, portable and mobile receivers
- \* Common signal system uses in receivers for distribution of different types of services that enable common receiver model

### ***Spectrum efficiency***

- \* Wide spectrum use (more convenient than FM band, minimizing frequency and single-frequency network)
- \* Possibility to transmit multiple programs in adjacent frequency bands.

### ***Operation conditions***

- \* Graded audio CODEC array option (at least two codecs)
- \* Minimum signal latency and preferential fixed volume

## **The Effects of Digitalization on Radio Media**

Digitalization has four main major effects to traditional radio. These are:

1. Emergence of new publication formats
2. Changing the interaction of radio channels with listening
3. Economic impacts on radio
4. Disappearance of the FM band

Digitalization has influenced the radio station in four different ways. The first of these is the emergence of the new forms of publication mentioned above, the latter has

changed the interaction of radio stations with their listeners. The third important effect is that the radio station alone is unable to get the share of traditional broadcast forms from the advertising pie and try to receive a share of advertising cake by offering itself through digital platforms. This effect can also be called as the radio influence of digitalization.

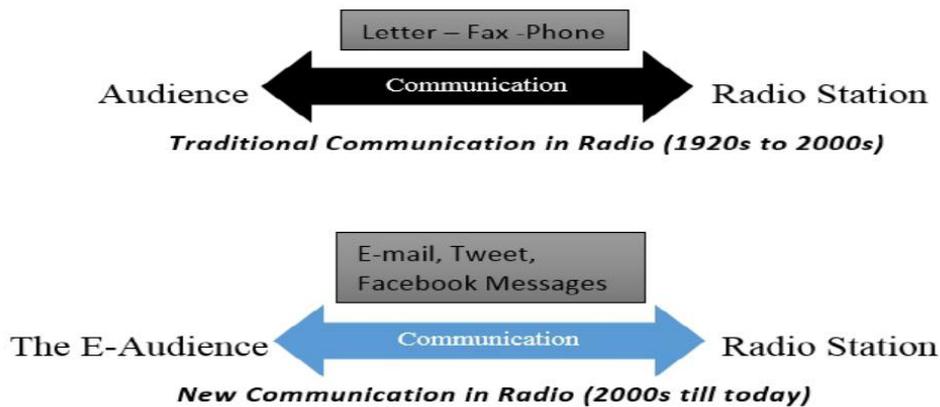
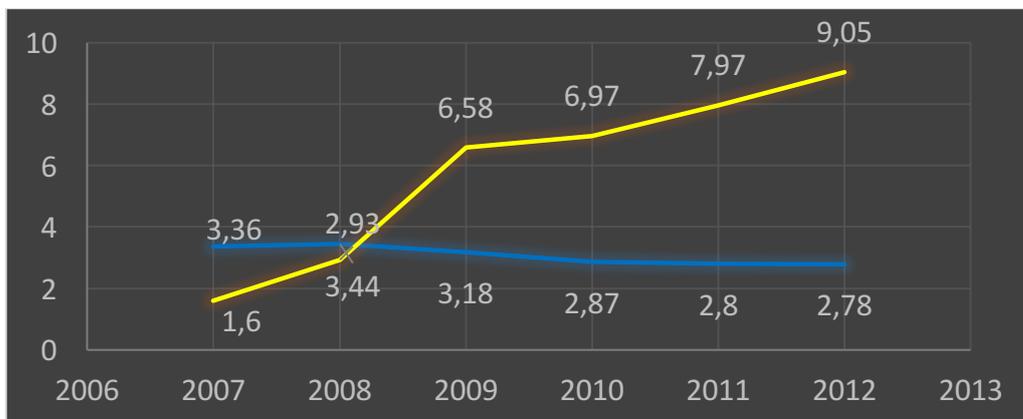


Figure 10: The New Style of Communication in Radio with the Digitalization (Kuyucu, 2014: 129).

Digitalization has radically changed the interaction between radio and listener. While radio listeners as consumers for the radio medium used to interact with radio channels by means of letters, fax and telephone in the past, as a result of digitalization, new interactive communication forms have emerged such as social media posts, electronic mail and on-line chats.



Year	Radio	Digital Media
2007	3.36	1.60
2008	3.44	2.93
2009	3.18	6.58
2010	2.87	6.97
2011	2.80	7.97
2012	2.78	9.05

*Figure 11: The Effects of Digitalization to Radio Economy*

The increase in the share of digital media in advertising spending has forced radio stations to adapt to this media to receive more advertisements in digitalization. The share of the radio's advertising expenditure fell behind the share of digital media's advertising expenditure for the first time in 2009. In 2009, the share of digital media was 6.58 per cent of advertising expenditure, while the share of radio was 3.18 percent. By the end of the year 2018, the share of digital media's advertising expenditure increased to 28.9 percent, while the share of radio stations' advertising expenses was 3.3 percent. This view paved the way for radio to lean towards a compulsory digitalization.

Another effect of digital media on the radio station is that it has pushed the FM band into destruction. The most popular format of digital radio, DAB, has led to the destruction of FM band in Norway. Norway was the first country to turn off the FM band in the world on January 11, 2017, starting to make all radio broadcasts in DAB format in the country. This was an important clue to the future of traditional radio in the world.

## RADIO PLATFORM IN DAILY USE

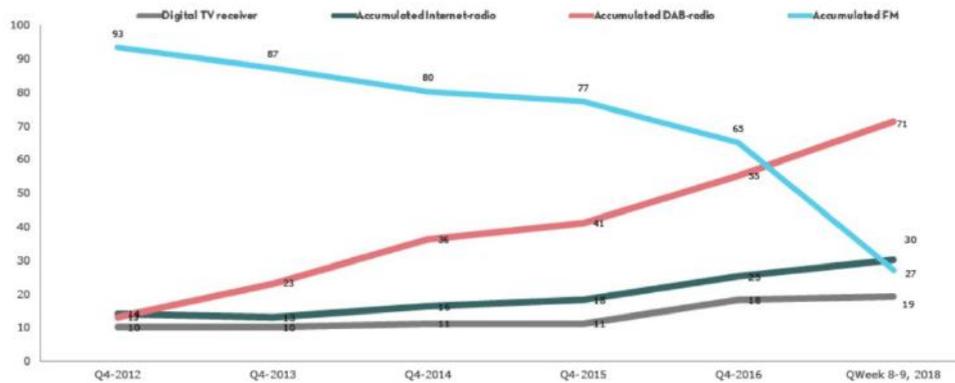


Figure 12: The Change of Radio Listening in Norway After DAB

A decline has emerged in radio broadcasts from the FM band in Norway since 2017, and a serious increase has occurred in DAB – Radio broadcasting.

# 11:11:11

## 11.JANUARY 2017

### NATIONAL FM-SERVICES SHUT OFF IN NORDLAND COUNTY



Launching 5 new services, Norway offers in total 30 national DAB-services

NRK switch their remaining services from DAB to DAB+

Q4: 85% of households have access to a DAB-radio

### 13. DECEMBER 2017

National FM services are shut off in Finnmark and Troms counties. All national radio is now digital.



Figure 13: The Shut-Down of FM Band in Norway

### **The Evolution of Radio on its Digital Journey: The New Digital Forms of Radio**

With the development of new communication technologies, digitalization has begun to make itself felt in the media more and more every day. Each new technological invention also led to the emergence of an innovation in digitalization. Digital technology has contributed to the emergence of different broadcast formats in radio broadcasting at this stage recently. The new forms of radio broadcasting resulting from digitalization can be listed as follows (Kuyucu, 2014: 71).

#### ***Internet radio***

The first effect of new communication technologies on radio stations was radio broadcasting via Internet. Radio broadcasting via the Internet is done in two different formats.

#### ***Broadcasting of terrestrial Radio Broadcasts from the Internet***

These radios broadcast also from Internet via web sites simultaneously with their terrestrial broadcasts. For advertising companies, this is quite attractive, because by this way, they cover both channels. The radio channel can also reach regions where it is not geographically terrestrial. Broadcast becomes open to global access.

### ***Radios only Broadcasting on the Internet***

This group only include radio channels that broadcast via digital-Internet. Although these radio channels are deprived of the benefits of terrestrial broadcasting, Internet radios are attracting advertiser's attention because they provide more reliable results than terrestrial radiations for global publishing and measurement.

### ***Digital Audio Broadcast (DAB)***

As a result of developments in new media technologies, another innovation in the field of radio station is the digital audio radio.

A new frequency, known as L-band, has confirmed for the use of digital radio transmission in the World Executive Radio conference in 1992.

The new system offered a sound quality with virtually no interference, with a clean voice. Canadian publishers and consumers adopted this idea, and radio channels are currently switching from AM and FM to the new L-band.



*Figure 14: DAB Digital Radio*

### ***Satellite and Cable Radio***

Radio enterprises approached cautiously to ever-changing digital services provided by satellite companies.

Although broadcasters had used satellite programming and network services for a long time to increase their wireless terrestrial signal in the past, they did not lean towards the idea of operating radio channels that reach the consumer directly. The idea of satellite radio had been discussed for a long time in the United States.

In the last years of the 1990s, companies such as CD Radio and XM Satellite Radio were licensed to initiate their services.



Figure 15: The Most Popular Satellite Radio SIRIUS

XM Satellite (xmradio.com) launched its service in September 2001 and acquired about a quarter million subscribers a year later. Less than a year after XM Satellite started using the voice service, the Sirius Satellite Radio Business Platform was released.

Satellite radio is chargeable and offers a wide choice of programs including programs of many famous people. Becoming popular in the world in this field, XM Satellite Radio offers 120 channels to radio users in satellite radio platforms like Sirius.

### **LPFM (Low Power FM)**

The LPFM emerged as a micro-radio movement in the 1990s.

The FCC's (Federal Communications Commission) offer claimed 2 new types of licenses on the FM band. It recommended the use of 10 (LP10) to 100 (LP100) watts of power range within service zones that are limited to 3 to 9 miles of bandwidth.

The FCC has compelled Low Power FM license holders to become non-profit organizations.

This rule helped commercial publishers end their concerns about new category stations creating a new competitive threat.



Figure 16: LPFM (Low Power FM) Transmitter

### ***In Band on Channel (IBOC)***

In 2002, the FCC chose the in-band, on-channel (IBOC) system as the method to be used in the transition from traditional to digital radio.

This system allows stations to broadcast on the same channel at the same time with both traditional analogue system and digital system, ensuring that no one has to buy new radio broadcasts to listen to the radio.



*Figure 17: In Band on Channel*

### **Conclusion**

In conclusion, the overall listening remains as high as ever because listeners are benefitting from a rapid increase in the range and number of stations, they choose from including the national and local services, stations and new community stations across the world by means of the internet. successive regulators and governments. Digital radio should have to adapt listening habit as the listeners replace with the older ones. It can be said that AM radio has remained unchanged from the broadcasting days and their main music medium is relegated to talk about the news and sports formats due to which voice sounds good on AM.

For the radio broadcasters, this explosion of choice brings new and unique challenges through the competition in terms of revenues and consumers. Broadcasters face increasing costs due to heavy investments in new platform along with dealing with the increased competition from a wider range of media. All these changes generate significant pressures on traditional pattern of the local radio, which has also emerged as an outcome of deliberate public policy by the successive regulators and governments.

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