The Videotelephone: From Invention to Successful Commercialization

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Technological innovation from the invention stage to the last stage of successful commercialization is not a smooth path. Some technologies become a stunning overnight success, while others take a long time or fail completely. One technology that took a long time and suffered many setbacks is the videophone and its related computer software. Even though the videophone was the most widely expected innovation during the late 1800s, right after the invention of the telephone, it did not become a regularly used technology until the Coronavirus Pandemic of 2020. The videophone's long road from invention to successful commercialization is described in this research study according to five stages: invention, laboratory, demonstration, market formation, and successful commercialization. It took the videophone and video calls 142 years to become a success!

Keywords: videophone, video calls, technological innovation, Zoom

INTRODUCTION

The time it takes for new technology to move from invention to successful or widespread commercialization varies greatly across different types of technologies. Gross, Hanna, Gambhir, Heptonstall, and Speirs (2018), in their research to provide a timeline for their innovation framework, identified three phases for the innovation life cycle: Development, market formation, and growth and diffusion. The development consists of invention, laboratory, and demonstration stages. Market formation refers to the commercialization of the technology in the market. Growth and diffusion can be described as the maturity phase. Widespread commercialization is a point during this stage when the technology becomes significantly accepted by the market. In terms of time, Gross et al. (2018) did not separate the invention and laboratory stages from each other, and they suggested a dormant phase that could be a century-long before the invention stage when the technology may not see any ideation and development. However, ideation and invention are significant in creating a new technology and should be a separate stage. The innovation framework can therefore be divided into five-time stages: invention, laboratory, demonstration, market deployment, and successful or widespread commercialization.

Gross et al. (2018) analyzed their timeline in an empirical review of only 13 new and successful products and technologies. The first category consisted of novel products for new markets, such as cars in the US. These products had a total innovation range of 22 – 69 years, averaging 35.5 years. The second category consisted of replacement products, such as mobile phones in the US, and their innovation range was from 20 – 32 years, with an average of 27 years. The last category consisted of electricity generation technologies, such as solar photovoltaics in Germany, and ranged from 39 – 55 years with an average of 43 years.

The videophone and its related software applications are a replacement technology with a very long innovation timeline and have been even described as failed in the past (Schnaars & Wymbs, 2004). Previous research by Snyman (2022) identified eight historical eras: Science Fiction, First One-way Videophone, First Two-way Videophone, Model I Picturephone, Model II Picturephone, Post 2000, Pandemic, and Post Pandemic. However, Snyman did not place the videophone's development into an innovation timeline. This research tracks the videophone's innovation from invention to its eventual successful commercialization.

THE INVENTION STAGE

The first stage of the innovation framework refers to the ideation of the videophone, which started with the science fiction era in 1878, just two years after the invention of the telephone. There was great excitement in the population about the telephone, and this excitement was quickly transferred to the invention of the videophone. Many in the external environment envisioned the creation of the videophone with various ideas of the appearance of the technology. External ideation, and not only a company's internal ideation processes, is often a very helpful step in innovation (The ultimate guide, n.d.).

The earliest concept of a videophone, wide-screen television, and megaphone (Roberts, 2017) was called "Edison's Telephonoscope" in a cartoon sketch published in the December 9, 1879, *Punch,* a British humorous Magazine. The cartoonist was George Du Maurier, who imagined the Telephonoscope would be Thomas Edison's next invention (Goran, 2016). In 1889, a science fiction writer, Jules Gabriel Verne, wrote "In the Year 2889", a short story about the videophone, which he called the Phonotelephote. It provided video images of a man talking to his wife as she traveled abroad (Levy, 2015). The Phonotelephote was drawn as a means of transmitting and receiving both voice and picture for a personal conversation. In May 1918, Hugo Gernsback, another sci-fi writer, depicted a Telephot which was a form of Skype. He imagined a mirror-type device in the year 2660 where the image in the mirror becomes a woman's face for a video call (Levi, 2015).

The fascination with videotelephony was also depicted in film. In 1927, a videophone was first used in the movie Metropolis. In 1968, a video call was made in the movie 2001: A Space Odyssey (Crowley, 2015). Joe Malia (2012), in his research on the videophone in film and television shows, identified 15 films and television shows. In the 1960s television show, The Jetsons, a videophone was used in the workplace for the first time (Levy, 2015). The science fiction era continued into the 2000s until 2017 when Mack stated that it ended after 138 years with the creation of Amazon's Echo Show product. It is, however, possible that additional depictions of futuristic videophones can occur.

THE LABORATORY STAGE

In the laboratory stage, an invention becomes a reality (Gross et al., 2018) or a practical application (Grübler et al., 1999). However, Gross et al. (2018) stated that the engineering or scientific principles that form the foundation of technology could predate the laboratory stage by many years or decades. Bell Telephone Laboratories, incorporated as an AT&T subsidiary in 1925, was working on fax service and the first videophone for several years before becoming a part of AT&T. Fax service was AT&T's focus of attention in the 1920s. It was eventually commercialized in April 1925. The videophone transformed the fax service over telephone lines (Schnaars & Wymbs, 2004).

AT&T continued videophone development and testing for several years. The first videophone one-way videophone was introduced on April 27, 1927 (please see below). A two-way videophone was developed after that and demonstrated in 1930 (please see below). The first experimental desktop videophone was developed during the 1950s, and the Mod I in 1963 was created and named the Picturephone.

AT&T was not the only developer of the videophone in the beginning. The first two-way audio videophone was developed in 1930 by Georg Oskar Schubert in Germany. By March 1, 1936, the first public videophone service was being built between Berlin and Leipzig post offices. However, the system was abandoned in 1940 due to World War II and was not continued after the war. It was a very expensive system (A missing link, 2011).

In 1967, Bell Labs introduced a model 2 Picturephone with several modifications: a wider display screen; users could remain inside the camera range, faxing was possible as well as videoconferencing. As signs appeared that this model was not going to be successful, AT&T used the technology and, during the second half of the 1970s, developed a Picturephone Meeting Service based on the belief that half of business meetings can take place via a videoconferencing service (Schnaars & Wymbs, 2004). On January 6, 1992, AT&T again announced that it was working on another videophone model, VideoPhone 2500, with many improvements over previous models (Liao, 2020).

Japan, France, Sweden, and the United Kingdom also tried to develop a videophone. During the 1980s, Mitsubishi, Panasonic, Sony, and Kyocera started R&D on a cheaper videophone than what AT&T was promoting and allowing videophones to access existing telephone lines, which was different from AT&T's videophones that developed a new network of lines (Schnaars & Wymbs, 2004). Matra in France was motivated by AT&T's Picturephone in the early 1970s (Frence Tete-a-Tete, 1971). Ericsson in Sweden started developing a videophone in the 1960s. The videophone was tested in two companies in Stockholm but eventually discontinued due to the high cost and users not being impressed by Ericsson's videophone (Jonvallen, n.d.). In the United Kingdom, the British Post Office had 16 demonstration models of its Viewphone (A Viewphone Service, 1966). The British Telecom followed with its Relate 2000 in the 1990s and a second-generation model in the 1990s (Boothroyd, 2013).

Sorenson Media developed the VP-100 model in 2002. The model was created and welcomed by the deaf community. The VP-100 allowed the deaf to see and sign to each other on a big screen in their homes. They were using slow texting services before and other PC-based programs that used Webcam setups that were very complex to set up. The VP-100 was a stand-alone device and simpler to use and is still in use today. Broadband internet, which became available in homes in the early 2000s, made all this possible. It was a breakthrough for the deaf community (Fitzgerald, 2003).

The digital or internet age that started around the early 2000s brought the opportunity to produce smaller, low-cost videophones and video capability on computers and mobile devices. Many new companies came into existence to take advantage of the new technology. Due to the increased number of companies and applications, only the introduction or release dates are emphasized. Cancel (2019) framed the digital and internet age as consisting of three messaging periods with video communication. The late 1990s to early 2000s, the first period, saw the development of AOL Instant Messenger or AIM, which started in 1997 and provided video and audio chat in addition to messaging (Fisher, 2022a); Yahoo! Messenger was released in 1998 for mobile devices, also with video calling (Fisher, 2022b), and MSN Messenger was launched in 1999 (Knight, 2021). These applications were developed to let people communicate in real time.

In the mid-2000s, mobile services like Skype, BlackBerry Messenger, and Google Talk were developed in the second period. Skype was developed in 2002 and released in 2003 with video calls over the Internet. It became a very popular software application and is still popular even though it changed ownership several times. It provided almost free phone services, making it a serious competitor to traditional phone companies (Mayor, 2022). BlackBerry Messenger, released in 2005, was one of the first applications for instant messaging on mobile phones. It provided group chats and video conferencing and became very popular (Alexander, 2019). Google Talk also emerged in 2005 for Gmail users as a messaging platform and later added video and voice calls (Roth, 2022).

In the 2000s to early 2010s, the third period, WhatsApp, Facebook Messenger, and WeChat, were labeled a "communication revolution" by Cancel (2019). People preferred messaging to voice calls! Brian Acton and Jan Koum, two former Yahoo employees, launched WhatsApp on February 24, 2009. The application was first created for iPhone users, but 2010 Android users were added. Location sharing was added in 2010, group chat in 2011, voice messages in 2013, read receipts in 2014, the desktop app and video calling in 2016, and WhatsApp Business in 2019 (Pathak, 2019). Facebook Messenger was named Facebook Chat in 2008 when it was released. In 2011 it was rebranded as Facebook Messenger. It started as a messaging site, but in April 2015, Facebook introduced video calling (Constine, 2015). In April 2021, Facebook added Messenger Rooms that allows up to 50 group members to video chat (Phipps, 2021).

WeChat was released on January 21, 2011, in China by Tencent. In July 2012 voice and video calling were added, and in 2015 WeChat added group video calls to compete against Skype in China (Boyuan, 2015).

Two applications not mentioned by Cancel (2019) are Zoom and FaceTime because they are not traditional messaging applications, and they are video calling and conferencing applications. Eric Yuan and 40 engineers left WebEx Communications in 2011 and developed Zoom, a videoconferencing platform for two years. Yuan received a $3 million investment and launched the first iteration of Zoom in January 2013 and received more investment money from investors that saw great things for Zoom (Montes de Oca, 2020). FaceTime was created by Roberto Garcia, an Apple engineer, in 2007 but was announced by Steve Jobs on June 7, 2010, when it was introduced to the public. It is a video chatting application for iOS users on iPad 2 when it was made available in February 2011 and eventually on all iOS devices (Emerson, 2023). Group FaceTime became available on October 31, 2018 (Grabham, 2022).

In 2020 everything changed due to the Coronavirus pandemic. Everyone will agree that the world we lived in during 2019 was very different than the world of 2020 and beyond. Lockdowns, video calls, and video conferencing using Zoom described the world of 2020 very well (Snyman, 2022). Reed (2022) referred to this period as a fourth period after Cancel's (2019) three periods and labeled it the video wave of messaging by Reed (2022).

THE DEMONSTRATION STAGE

This stage refers to the creation of prototypes, pilot products used in testing, and demonstrating of the technology to a variety of audiences (Wilson & Grübler, 2014). Only some of the technology demonstrations are discussed in this section. On April 7, 1927, Bell Telephone Laboratories demonstrated the first videophone and conducted the first experimental videophone call. Herbert Hoover, Secretary of Commerce at the time, spoke from a video booth in Washington, DC, to Walter Gifford, the president of AT&T, in a video booth in Bell Labs in New York City. The call consisted of a two-way audio connection and a one-way video connection with only Walter Gifford able to see Herbert Hoover and not vice versa. The videophone equipment used was extremely large, taking up half of a room. One end used a small screen with the image too small to see and on the other end a large screen was used but with only a silhouette to see (Schnaars & Wymbs, 2004). By the 1930s, AT&T had developed and was testing a two-way audio and video videophone. On April 9, 1930, Bell Labs made a video call to Bell headquarters in New York City, using television equipment (Borth, n.d.).

The first experimental desktop videophone was demonstrated on August 23, 1956. It was smaller than the first videophone. As mentioned in the laboratory stage, continued R & D led to the Mod I in 1963 which was named the Picturephone, AT&T's trademark name. It was demonstrated on April 20, 1964, at the World's Fair in New York City. For the first time, people attending the Fair could talk and see another person on a screen far away for about 10 minutes at a time (Schnaars & Wymbs, 2004). Bell Lab's second Picturephone was presented to consumers in 1970. On June 30, Pittsburgh Mayor Pete Flaherty looked at John Harper's, chairman of Alcoa, small face and said, "Here's looking at you" (Dormehl, 2020). On July 8, 1982, AT&T commercialized the Picturephone Meeting Service with a public demonstration of a videoconference between New York and Washington (Schnaars & Wymbs, 2004).

With the start of the digital era, several software computer programs capable of video calls and conferences were developed over many years and demonstrated to users via beta software. Most applications mentioned in the previous stage used beta versions to demonstrate the software to several audiences. This beta stage lies between the alpha software development stage and the formal introduction of the software to the market. The purpose of beta software is to work out bugs and problems. Beta software testers can be open (i.e., released to everyone) or controlled (i.e., released to a control group). Feedback, as much as possible, is requested by the owner of the software program. Even suggestions for hardware adjustments and the development of additional software features and programs can be solicited (Fisher, 2020).

THE MARKET FORMATION STAGE

On June 24, 1964, AT&T's commercial service branch of the Picturephone model I began selling it for $600+ for 15 minutes, but the service never became popular. The first model of the picturephone's equipment was too big and expensive. Customers also found the technology too intrusive (i.e., they did not like being seen on a video screen), too slow, and too few enthusiasts to talk to. The first model was a failure (Laskow, 2014).

AT&T's second picturephone model was commercialized on June 30, 1970, and lasted three years, from 1970 to 1973. It was still expensive to use. It costs $160 monthly for 30 minutes of call time and $0.25 for each additional minute. By 1972, only a few Picturephone model 2 sets had been sold in Pittsburgh. By 1973, AT&T's CEO discontinued Model 2 very abruptly, concluding that the model would not be a successful extension of AT&T's telephone service. There was just not enough market for it. Schnaars and Wymbs (2004) identified five reasons for the failure of the videophone: a depressed economy in the 1970s, a lack of critical mass (It does not help to have a videophone when your friends, family, and co-workers do not), high prices, not good enough picture quality, and no consumer need for a videophone.

In 1982, AT&T's Picturephone Meeting Service was made available in 11 cities. AT&T assumed that business meetings could take place via video conferencing, and the service remained available in the market for 3 years and then discontinued. There was no business market for videoconferencing (Schnaars & Wymbs, 2004).

Mitsubishi entered the market in 1986 with the Luma 1000 and in 1987 with the Visitel. However, after a few years, most Japanese companies had left the market. The same reasons for failure plagued the Japanese models: Insufficient bandwidth and no consumer need (Schnaars & Wymbs, 2004).

The VideoPhone 2500 of AT&T was launched in the market during the summer of 1992, and it was sold until 1995 and then discontinued due to low demand (Liao, 2020). The British videophone sold in the 1990s also had minimal sales, just like AT&T's Videophone 2500 (Video from the phone, n.d.).

Sorenson Communications VP-100 was made available in 2003 for the deaf community and immediately started selling very well (Fitzgerald, 2003). The company's newest videophone, the Lumina, was introduced in 2021 and continues to be a successful technology for the deaf community (Bardsley, 2021).

The digital era has seen many market entrances and failures since 1997. According to Cancel's (2019) first messaging period, AIM started in 1997 and was shut down in 2017 to focus on new and improved applications (Fisher, 2022a). Yahoo Messenger was shut down in 2018 due to fierce competition (Fisher, 2022b), and MSN Messenger was phased out in 2014 due to Microsoft's acquisition of Skype in 2011 (Knight, 2021).

Cancel's (2019) second period saw Skype's entrance, and it was estimated to have 1.95 billion worldwide users in 2022 (Mayor, 2022). The second program, BlackBerry Messenger, died in 2019 due to declining users and financial problems (Alexander, 2019). Google Talk, the third program, was replaced by Google Hangouts in 2017 and finally discontinued on June 16, 2022 (Roth, 2022).

Cancel's (2019) third period saw the market formation of three successful programs. WhatsApp grew quickly and reached 1.5 billion users in 180 countries in 2023 (Pahwa, 2023).

By year's end of 2019, Facebook Messenger was the second most downloaded mobile application (Phipps, 2021). WeChat, the third program, became a big social media player (Boyuan, 2015).

Two additional programs, Zoom and FaceTime, have also become very successful. Zoom grew very quickly. By 2014, Zoom had 10 million users because it provided HD video conferencing, mobility, and web meetings for only $9.99 (Montes de Oca, 2020). FaceTime in a survey conducted in March 2020, had the most adult users at 47.6%, with 44.1% of adults using Facebook Messenger, 31.5% using Zoom, 22.5% using Skype, and 18.4% using WhatsApp (Petrosyan, 2022).

THE SUCCESSFUL COMMERCIALIZATION STAGE

Defining this stage is very difficult (Gross et al., 2018). 'Maturity', 'established', 'successful', and 'widespread commercialization' are terms used to describe this stage. However, there is little agreement in the literature on how much market share a new technology should have to be labeled 'mature'. Gross et al. (2018) suggested a market share of at least 20% of the total market.

AT&T spent over $500 million over 75 years on the videophone, and model after model and videoconferencing all failed! AT&T decided to leave the videophone market for good. In 2004, Schnaars and Wymbs analyzed the failure of the videophone up to that point and concluded that the technology needed a critical mass; in other words, many people needed to have and use a videophone. Prices also had to be affordable, and customers' needs had to be fulfilled by the videophone. Another researcher, Andrew McGee, stated in an interview that the videophone needed capacity and circumstance to be successful (Dave, 2021). Capacity refers to Schnaars and Wymbs's affordability and usefulness concepts, and circumstance refers to creating a significant demand for the videophone. Capacity, affordability, and usefulness were met when Skype, which started in August 2003, offered videotelephony, videoconferencing, voice calls, and other services over Voice over Internet Protocol technology (Cowling, 2016) but an internet connection was needed. People were not as connected to the Internet in 2003 as they are today (Internet/Broadband, 2021; Mobile Factsheet, 2021). Capacity had been achieved, but the circumstance was still needed!

In 2018, Manz stated that 20 million FaceTime calls were made every day but when these calls are combined with Skype, Hangouts, and other applications, the number of videophone calls made per day was only a tiny fraction of all types of calls. However, another research study in 2018 by Vonage Video Chatterbox Nation concluded that video calls had become as popular as voice calls because the millennial generation embraced video calls very enthusiastically (Patterson, 2019), but more was needed to push video calling beyond Gross et al. (2018) 20%. The Covid-19 Pandemic era, which started on March 11, 2020, significantly changed society and video calling. The pandemic was the circumstance needed to make the innovation of video calling a widespread commercialized success.

CONCLUSION

The path from invention to widespread commercialization is not a direct path or a path with sequential steps. It is not a linear path (Wilson & Grübler, 2014), and Gross et al. (2018) also mentioned that even though a technology may be out of the R&D stage, it does not mean the R & D stage is over. The videophone went through the R&D stage several times since it was initially introduced to the public by AT&T in 1970. However, persistence paid off. It took 142 years for the videophone and the video call to succeed. The dream of seeing someone on a screen while talking to them never died!

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