DTV IMPLEMENTATION: A CASE STUDY OF ANGOLA, INDIANA

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ABSTRACT

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On June 12, 2011, the United States changed broadcast standards from analog to digital. This case study looked at Angola, Indiana, a rural community in Steuben County. The community saw a loss of television coverage after the transition. This study examined the literature that surrounded the digital television transition from the different stakeholders. Using as a framework law in action theory, the case study analyzed governmental documents, congressional hearings, and interviews with residents and broadcast professionals. It concluded that there was a lack of coverage, there is an underserved population, and there is a growing trend of consumers dropping cable and satellite service in the Angola area.

Dedicated to

Professor & Associate Dean Emeritus Arthur H. Black

Dr. Jeffrey A. Black

Coadyuvando El Presente, Formando El Porvenir

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CHAPTER I. INTRODUCTION

Government officials promised the digital television transition would be the greatest advancement in television (Federal Communications Commission, 1987). The United States was one of the first large industrialized countries to adopt the digital broadcast system. This transition created problems for both industry and regulators, which ultimately resulted in implementation delays, confusion, and higher-than-anticipated costs. The public was also unprepared for the change, but perhaps most significantly, the transition left signal coverage holes between markets, essentially leaving some rural communities completely in the dark and people in larger metropolitan areas with pixilated or incomplete video signals. Broadcast Engineering reported that 8.5 million households in the United States are in these so-called "antenna gap" areas ("Approximately 8.5 million OTA households, in danger of DTV reception trouble", 2009). Most of these instances related to geographic-related reception problems. Months after the transition the FCC was still working with forty broadcasters to fix problems (Grotticelli, 2009). Even in October 2012, stations and the FCC were arguing over reception issues (Tannenwald, 2012). WTHR-TV in Indianapolis, IN, continued asking the FCC for an 83 percent power increase to boost reception past the four-year anniversary of implementation (O'Malley, 2013). This lack of coverage is a problem, because the public relies on broadcasters for information during emergency situations (i.e. severe weather), for civic discourse, and for local news. Moreover, the airwaves have been the public's right of way since the Federal Radio Commission was established and this has been upheld by many U. S. Supreme Court decisions. As Representative Gene Green of Texas commented, "The public owns the spectrum" (The Status of the Digital Television Transition, 2007). Even the Supreme Court held than when

government regulates access to the spectrum, it must balance the First Amendment rights of broadcasters against the rights of the public, and that when these rights come into conflict, the rights of the public are "paramount" (Red Lion v FCC, 395 U.S. 367, 1969).

Steuben County in Indiana represents just one example of the gaps in DTV coverage. This county is located on the northeastern border of the state, sharing its northern border with Michigan and its eastern border with Ohio. Some residents have complained to local television stations and consumer electronic sellers about reception problems in the area. The Federal Communications Commission reports suggest even an antenna sixty feet in the air may not capture a signal strong enough for those residents to watch major network broadcasts. Thus, residents in this area, which is surrounded by markets like Detroit, Fort Wayne, Grand Rapids, Lansing, Toledo, and South Bend, have lost access to broadcast television. Some people have lost a few network stations; some have lost the television market they care about, while others have lost everything (FCC, 2009). In this study, I examine a community caught in the gap of digital television policy. I explore the deliberations of governmental officials crafting the policy and residents' and broadcasters' experiences after the transition decisions had been made. I analyze the experiences of government, residents, and broadcasters and their role in influencing and implementing the digital television transition in Steuben County. The purpose of this case study in Steuben County is to document their problems in the DTV transition and to consider how this case can inform others.

Rationale / Literature Review

On June 12, 2011, the world of broadcasting in the United States changed forever. On this date all full-power broadcast stations were required to broadcast using a digital signal and discontinue their analog transmissions. This literature review about the transition focuses on the

development of the digital standards, their legal or legislative history, and their adoption. There is a paucity of literature post-transition in Lexis/Nexis, Communication and Mass Media Complete, and Film & Television Literature Index, which this study seeks to address.

Development of Digital Standards

The Federal Communications Commission announced in 1985 that it wanted broadcasters to transmit their signals to produce high definition pictures (Hart, 2004). At that time the Japanese had developed a high definition standard called Integrated Services Digital Broadcasting (ISDB) (Fischer, 2008). In response to this development, the United States invested in the development of an all-digital system (Angulo, Calzada & Estruch, 2011). The Federal Communications Commission under Chairman Alfred Sikes turned towards an Advisory Committee on Advanced Television Services (ACATS). In 1987, this Committee considered how to make the transition to the future of broadcasting (Hart, 2010). The consumer electronics marketplace was asked to develop these systems. In response, the industry produced seven systems in time for the June 1990 deadline (Taylor, 2010). There were five industry players in the transition: AT&T, General Instruments, Philips Consumer Electronics, Thomson Consumer Electronics, and Zenith Electronics. These corporations looked to benefit from owning the intellectual property of the new system (Hart, 2010). As the intellectual property owners they stood to make royalties or licensing fees on the technology that they developed. All the intellectual property was put into a Portfolio License that is currently held by Cisco, JVC Kenwood, Philips, LG Electronics, Mitsubishi Electric, Panasonic, Samsung, The Trustees of Columbia University in the City of New York, and Zenith Electronics (Hart, 2004). In 1993, testing done but the ACATS declared all the systems were flawed (Carnevale, 1993). After two years of further development the ACATS made its recommendation to the FCC, explaining the

new system would allow almost double the resolution of standard definition television, dozens of CD-quality audio signals, and rapid delivery of large amounts of data (FCC, 1996). This technology would allow viewers at home to enjoy Blu-ray quality pictures and 5.1 channel (sound from five directional speakers and a subwoofer) surround sound on over-the-air channels. Picture resolution with 1080 lines and six channels of audio would prove to be a huge enhancement over the existing 480 lines and two channels of audio. DTV was also to allow television providers to send data over the air. While most broadcast television stations did not put out electronic newspaper feeds as once hoped in the mid-1990s, they all provide program guides and auxiliary program information through Program and System Information Protocol (PCIP) devices embedded in their broadcast signals. Eventually this system was developed by the Advanced Television Systems Committee (ATSC).

Meanwhile, development in Europe took the form of the Digital Video Broadcasting (DVB) (Laven, 2013). Europe was also developing this system to compete with Japan's high-definition ISDB system (Leiva & Starks, 2009). The major technical differences among the three major systems reflected the markets that they served. ATSC is developed for long rural distances and picture quality that is reflected by the United States landscape (Angulo, Calzada & Estruch, 2011). In Europe and Japan, on the other hand, the focus was immunity from multipath distortion not from transmitters far apart. Their systems are based on the Coded Orthogonal Frequency Division Multiplexing (COFDM) modulation. In a 1996 International Telecommunication Union meeting in Sydney, the United Nations specialized agency gave its blessing to the ATSC & DVB systems.

Legal & Legislative History

The first big legislative move toward digital television in the United States was in the Balanced Budget Act of 1997 (BBA) (Kwerel & Levy, 2006). "Title III: Communications and Spectrum Allocation Provisions" of the Act amended the Communications Act of 1934, to include the first legal definition of digital television and also made provisions for spectrum auction and realignment. Most importantly, it set up the first deadline for the transition. The act prohibited broadcast licensees from transmitting analog television signals after December 31, 2006. However, a provision was added that the FCC could extend that deadline. It was thought that allowing the regulatory body to manage the deadline would allow for a more flexible on-the-ground implementation. While the cogs were in motion it became apparent that this deadline would not be met. In 2005 Congress passed the Deficit Reduction Act of 2005, extending the deadline from December, 2006 to February 17, 2009. Congress did this because the digital penetration rate had not yet reached the target of 85 percent. There also was agreement that content providers were not ready for the switch. Furthermore, there seemed to be more questions than answers about implementation. One question answered by the Act clarified that only full power television stations had to meet this deadline, not all broadcast licensees. Low power stations, those broadcasting below 150 kW of power on Channels 14 through 69, or 3 kW on Channels 2 through 13, were exempt from this transition date (Cianci, 2007). The Act also struck down the Commission's power to extend this deadline and created a coupon program so that the public could purchase subsidized converter boxes to enable digital broadcasting to be seen on analog television sets. It also created a public safety network and a New York City "September 11th" network for emergency responders. By February 2009, broadcasters were ready, but an estimated 6.5% of American households was not prepared for the transition,

because of problems with the coupon program and and the FCC call center being in disarray (Oversight of the Digital Television, 2009). In response Congress passed the "DTV Delay Act" that extended the deadlines of both the coupon program and the switchover. That date remained firm, and in June 2009 the United States ceased full power station broadcasts in analog configurations. Low power stations have until September 2015.

Adoption

At the time of the June 2009 full power cutoff date, 15% of households in the United States had been watching television through over-the-air analog broadcasting signals (Taylor, 2010). The Government Accountability Office found that 19% (20.8 million households) relied exclusively on free over-the-air television (Cotlar, 2005). The majority of Americans used a multichannel video programming distributor (MVPD), for example a satellite or cable provider. Often there are multiple televisions in a household and they might not all be connected to the primary service provider's cable (Hart, 2010). Those television sets might include "for television viewing in kitchens, on patios, in recreational vehicles and at sports events, and for non-television uses such as playing games, VCR tapes, and DVDs," (Cotlar, 2005, p. 299). While many Americans use cable or satellite providers, they still might be dealing with over-the-air sets in their households. The FCC thus estimated the digital transition might have negatively affected 30 million households.

There was much confusion with this transition for both the industry and U.S. citizens. The government developed an advanced schedule to ease the transition to the new standards. For example, television screens of 36 inches or larger had to be DTV compliant by 2004; 25-35 inches by 2005; and, all televisions above 13 inches had to be compliant by 2007 (FCC, 2002). The industry in 2000 started developing the equipment required to broadcast with a resolution set

sufficient to meet digital quality standards. ABC and NBC networks developed 720p resolutions; CBS developed a 1080i signal. Consumers had to deal with acronyms and unfamiliar phrases like CRT, CRT-based projection, DLP projection, DVI, and HDMI, HDTV-capable, HDTV-compatible, HDTV-ready, HDTV-upgradeable, LCD flat panel, LCD projection, LCOS projection, (Hart, 2010). There was also a question of cost related to choosing a system broadcasters and consumers would need to purchase to upgrade equipment. This issue was raised by regulators but no action was taken to force standard language within the broadcast industry, electronics manufacturers, and retail stores.

Broadcast television stations were forced to upgrade equipment. Most stations bought the necessary equipment in stages to help distribute costs. The biggest, costliest piece of equipment was the transmitter pole atop the transmission tower. Studio-to-transmitter equipment had to be changed to pass the HD programming to the HD transmitter. Content providers were now sending both SD & HD (standard definition and high-definition, respectively) output and most stations were carrying both signals. This meant the transmitter had to be able to demodulate the two signals being sent from the studio. Studios also had to purchase an HD encoder, upconverters for video and audio signals, and equipment for acquiring content from providers. Going to DTV also necessitated buying a wing generator to fill out the full width of a 16x9 screen when content was broadcast in 4x3 aspect ratio (width-to-length). This is a sampling of all the equipment change necessitated by the DTV policy. Other pieces of equipment that needed to be purchased included the various devices typical of television station production and transmission, such as video switchers, routers, receivers, graphics engines, air automation, cameras, passports, keyers and servers. The cost to broadcast stations ranged from

tens of thousands to hundreds of thousands of dollars per location (J. Toth, personal communication, October 15, 2013).

One of the major differences between the old NTSC system (National Television Systems Committee, the American television standard of 525 lines of resolution in a 4X3 aspect ratio) and the new digital system is the cliff effect (Cianci, 2007). The cliff effect is named because of the propagation graph it creates. A propagation graph shows signal strength over distance. In analog television the signal decays over distance. The propagation graph is a straight line that slowly sinks until it hits the zero x-axis. The viewer at home would see snow or interference from another station until the picture because unrecognizable. In the digital television propagation graph, at a certain distance too much digital data (signal) are lost and the line drops to zero on the graph's x-axis. The signal is said to "drop off a cliff," meaning suddenly disappearing rather than petering out gradually. Most industry reports in *Broadcast Engineering* and *Telcompaper* report issues with reception. A search of an industry Lexis/Nexis database of articles during the years of the transition related to DTV reception revealed 47 in 2009 and 42 in 2010. Three major themes appeared in the articles: antenna, reception, and reported station problems.

The antenna-themed articles dealt with developing devices to assist with reception. Some articles suggested different orientations and arrays that would boost reception. Another idea was to add a booster or amplifier to the line before it was decoded. A major focus was on indoor antenna reception rather than the traditional outdoor antenna. There was also an emphasis on different products and the lack of consumer and retail education. New products and acronyms confused people. There were reports of misleading information given by customer service representatives at retail stores. The concern was consumers were being told they needed an

HDTV antenna at a $50 price difference from a standard VHF/UHF antenna that would have worked fine. Consumers could use an existing antenna that they owned and add either a television with digital tuner or a converter box (that the government subsidized) to connect an older television. Some store sales reps told consumers to buy a new television without describing the option to just buy a government subsidized converter box. Articles pulled from the time of the transition also gave tips on what to do to increase reception, such as rotating, rescanning, and moving indoor antennas away from televisions. Even geography was discussed. A resident of Glen Ridge, NJ who lived less than 3 miles from the transmitter could not get reception. It was determined that since the broadcast transmitter, which sat atop a 400 foot hill, was too high for reception. The only solution was to build a 50 foot antenna on top of his house—an idea rejected by the viewer (Grotticelli, 2009).

The reception-themed articles dealt primarily with improving picture quality. Some articles pointed to poor reception due to insufficient power allocation (Eggerton, 2009). WPVI, in Philadelphia, received special permission to go from 7.5 kW to 30.6 kW to improve reception (Dickson, 2009). The FCC believed reception issues came from the "noise" floor, caused by other computers and wireless phones (Eggerton, 2009b). It was also noted by a vice president of Nielsen, Eric Rossi, that the media firm's research estimated 1.5 million homes could not get DTV (CEDW, 2009). The reported station reception problems were all over the country, including in Chicago, Colorado Springs, Dallas, Dayton, High Point (NC), New Orleans, Philadelphia, Santa Fe, and Washington, D.C. Massive problems were noted in Alaska, Arizona, California, Colorado, New Mexico, and Utah. This problem became evident in these communities because digital signals are an all-or-nothing prospect. When analog signals would fade, people might see a "ghost" or "snow" on their screens. Digital reception just cuts out if too

many bits of data are lost (Cianci, 2007). To combat the cliff effect, Maine Representative Michael Michaud introduced the DTV Cliff Effect Assistance Act of 2009 (Kennedy, 2009). The act would have created funding for local communities for construction and equipment to build digital television translators to specifically fill the gaps created by the analog-to-digital transition (DTV Cliff Effect Assistance Act of 2009, 2009). These translators would pick up, amplify, and then retransmit the signal, effectively increasing the coverage area, particularly in the western United States and Canada. This bill was referred to the Subcommittee on Communications, Technology, and the Internet; where it died. It was never mentioned in any committee transcripts that I read. Maine Senator Olympia Snowe introduced a similar bill to the Committee on Commerce, Science, and Transportation, where no action was taken.

The existing literature on DTV transition problems focuses on both technical and legal development of digital television. The adoption process and the challenges that faced all the stakeholders have been addressed. This is where the academic literature ends and only industry literature exists on the problems broadcasters and consumers faced post-transition (i.e. *Broadcast Engineering*). There is a lack of research combining the four major players of the transition: the content providers (broadcast, cable, and satellite providers), the consumer electronic, the government, and the public. I fill in part of this gap by examining how a community experienced the transition. The importance of such a study has also generated interest outside of academia from people in broadcasting, U. S. Representative Marcy Kaptur, U. S. Senator Sherrod Brown, and top level executives at media conglomerates. [Stations continue to argue with the FCC about what their reception pattern actually is [DA 12-1734] (FCC, 2012).] One community that has problems with reception is Angola, IN. Angola is in Steuben County and is a mainly rural community experiencing this digital gap. Angola sits between broadcast markets

that have lost over-the-air television that they had prior to the transition. The reason for the case study is to see establish how policy has failed this community and consider reasons why.

Case Study

The community for this case study is Angola, IN. It is located 85 miles west of Toledo, OH and 167 miles east of Chicago. It is 43 miles north of Fort Wayne, IN on Interstate 69 and 91 miles south of Lansing, MI. It is the county seat for Steuben County. The 2010 population for the city was 8,612. The population's median age is reported as 30.3 years (U.S. Census Bureau, 2010). It is a community whose workforce is concentrated in manufacturing, retail, and recreation. The majority of its residents are high school educated or have completed some college. It is a small city at the crossroads of two major interstates (I-69 and I-80/90) and a major highway (US 20). Steuben County is home to 101 lakes due to the glacier ice that inhabited the area 10,000-15,000 years ago. This geography contributes to antenna-reception issues, as the ground reflects substantial changes in elevation. Angola is home to Trine University, a private non-denominational school with 2,465 students. It offers associate's, bachelor's offering associates, bachelors, and master's degrees. I chose this area because while working as a broadcast engineer in Toledo during the digital television transition, I was aware of areas west of Toledo that no longer received a broadcast signal. Doing primary research, I saw that the coverage area from each of the markets surrounding Angola didn't reach the city or that surrounding stations provided very weak signals. Part of my job during the transition was to answer viewer questions about digital television. In order to do that, I completed the FCC training course in digital television broadcasting.

Angola is in the Fort Wayne demographic market. Of the 210 markets in the United States it ranks 109th (Nielson, 2014). The market registered a total of 267,680 homes in 2014.

This grew from the last measurement by 2,290 households. The market is unique because of the number of over-the-air users. Nationwide cable and satellite penetration was around 90%. (Nielson, 2014) Fort Wayne had 18.4% of households relying on over-the-air (Television Bureau of Advertising, 2014). There was a change in the market at the time of the transition. The previous six rating periods before the June 2009 analog-digital switch saw an average of 79.68% households relying on cable or satellite. Post transition that number rose to 81.48% of households relying on cable or satellite. Looking beyond the six rating periods to nine years before and almost five years post transition shows an even larger growth towards the reliance on cable post transition. On average 10,108 more households have a MVPD provider post transition. The data collected cover the entire Fort Wayne market. This designated market area (DMA) is Adams, Allen (Fort Wayne), DeKalb, Huntington, Jay, Noble, Steuben, Wabash, Wells, and Whitley counties in Indiana; Paulding and Van Wert counties in Ohio.

The rationale for using a case study method is its ability to combine different sources of evidence. I combined ethnographic interviews with document analysis, which allowed me to study an area that was affected by the analog-to-digital transmission policy. "Case study facilitates the conveying of experience of actors and stakeholders" (Stake, 2008). This method allowed the study of issues and problems with the digital television transition as explained in the interviews and governmental documents. Case study method lent itself best to tell the stories of a community, an industry, and a government. At this place, in this time, this is how people dealt with an issue.

This study about how individuals dealt with this transition adds depth to the literature. Most of the literature on the digital transition revolves around how the decisions were made, not the impact those decisions (Kwerel & Levy, 2006). The literature shows why decision makers

chose the system they did (Angulo, Calzada & Estruch, 2011; Carnevale, 1993; Fischer, 2008; Hart, 2010). It also shows the rhetoric that accompanied the change (Dickson, 2009; Eggerton, 2009; Eggerton, 2009b; Grotticelli, 2009; Taylor, 2010). I intend to explain what happened after the transition took place, what problems the public actually had, and how they dealt with those issues.

On the first day of the transition, 317,000 calls were made to the FCC. This is still the single highest volume of calls the regulatory body has seen. WLS in Chicago reported 1,735 on Friday June 12th alone and logged more than 5,000 calls by the end of the week (Wong, 2009). Most of the stations in Toledo and Fort Wayne logged about 600 calls each. Some had to deal with converter box questions, but a majority dealt with reception and antenna issues (Hart, 2010).

The research questions pursued in this study included:

RQ1: What were the government's expectations of the digital television transition?

RQ2: What were broadcast professionals' (station engineers and consumer electronic providers) perceptions of the digital television transition in and around Steuben County?

RQ3: What were Steuben County residents' perceptions of the digital television transition?

RQ4: Did the government's expectations match what happened in the transition to digital television in a remote community?

RQ5: What does the Angola story tell us about government understanding of digital television technology and the ability to plan and regulate?

CHAPTER II. LAW IN ACTION & METHOD

Theoretical Framework

I have used the law in action theory as a framework to do this case study. The term "law in action" was first used by Roscoe Pound in a 1910 article he wrote while at Harvard Law School called *"Law in Books and Law in Action"* (Pound, 1910). Law in action theory was founded in the early twentieth century and has its basis in legal realism. It states laws can be interpreted differently, evolve, or even show unintended consequences. While laws exist on paper, they live in life and they sometimes have limitations and flaws (Tamanaha, 2009). These thoughts were championed by the likes of Oliver Wendell Holmes, Roscoe Pound, and John Chipman Gray. Holmes and Pound, in fact, are two of the most cited legal scholars of all time (Sharpiro, 2000). They believed that law should be examined by how the law manifests itself in society at large (Bybee, 2006). Justice Holmes in *The Common Law* points out that "the life of the law has not been logic: it has been experience." (Holmes, 1881).

Law in action is a legal theory that tries to address the discrepancies between the law on the books, and the law as it works in society. Pound urges lawyers to try to get law in action to fit efficiently within the guidelines of the law in the books. "Law has always been and no doubt will continue to be in a process of becoming. It must be as variable as man himself." (Pound, 1910). My study relates to this theory by looking at how the transition policy was implemented and the experiences of those living with it. Using this framework I will set up what the government expected through the laws and policy they created and compare it with what happened in Angola. The importance of this framework is that to understand a law, one has to see how it is applied in real life. The case study allows me to look at real life and see how the law affected people.

Method

Given the complexity of this case, when viewed from different social angles, the embedded case study method works best. The method allows adoption of evidence from different sources. Embedded case studies are multi-faceted; they can have more than one unit or type of analysis, allowing researchers interested in policy and impact to gain a broad picture of decision-making (Scholoz & Tietje, 2002). Case study methods are becoming popular with how policy is implemented. Sources in this method typically include documents, archival records, and open-ended interviews (Scholoz & Tietje, 2002). As McGloin (2008) writes, "The case study provides an intensive, in-depth method of enquiry focusing on real-life single case using a variety of sources and evidence" (Vallis and Tierney, 2000; Hewitt-Taylor, 2002). I used interviews with community stakeholders and policy documents as sources of data because it allowed me to make an argument for a full account of the transition to digital broadcasting. The largest limitation to using a case study is that the findings cannot be applied directly to a broader population (McGloin, 2008). The other major limitation is that using a smaller sample size may just identify circumstance more than fact (Palmquist, 2006).

Governmental Documents

I gathered two major categories of governmental documents that discuss the transition to digital television, including FCC reports and congressional committee reports. The FCC reports concerning the two major discussions of DTV contained in MM Docket Numbers 87-268 and 00-39. These reports were issued periodically from 1987 until 2008 to review the progress and make corrections necessary to achieve success. The unit of analysis was each Report & Order. I also looked at congressional reports from 2001 until 2009 around the DTV transition to see if government officials were aware of the problems. These hearings are from the House

Subcommittee on Telecommunications, Trade, and Consumer Protection. This subcommittee reports to the Committee on Commerce. Senate reports are from the Committee on Commerce, Science, and Transportation. I also reviewed government documents that were relevant to DTV mentioned in both the congressional reports and the policy documents.

Participants

I interviewed three major groups by doing ethnographic interviews, including six residents of Angola who experienced the transition to this new system as customers. They were all female and long-term residents of the area. Second, I interviewed local broadcasters each with more than two decades of experience in Fort Wayne, Toledo, and South Bend about how they dealt with the change. Third, I talked to local antenna installers. Finally, I interviewed two MVPD (cable and satellite) carriers about how they assisted residents with the transition.

Procedures

I interviewed residents, broadcasters, and MVPD providers. I recruited residents by posting fliers in coffee shops, bars, churches, and diners to invite people to talk about their experiences with the transition (see Appendix A). I used snowball-sampling beginning with residents with whom I had personal contact in the community. I contacted all the broadcast stations in the markets of Fort Wayne, Toledo, and South Bend through email and also conducted on-site visits. The MVPD providers I knew through personal contact and connections. All of the interviews were recorded for analytical purposes. I completed interviews until saturation was reached. Saturation was reached when no new information was coming from the interviews.

The Human Subjects Review Board of Bowling Green State University approved the study procedures (Appendix B). I obtained informed consent by explaining to participants the

approved document. I informed participants that they could withdraw at any time or not answer any of my questions. To ensure confidentiality after the interview, pseudonyms were given to the protected audio files.

I approached the semi-structured interviews in a conversational way. While I started with some basic questions (See Appendix C), I allowed the conversation to dictate the wording and order of the questions. I refined these questions after reflecting on the dialogue in the literature as well as my own knowledge base of the situation. Because I was a broadcast engineer for a television station during this transition, I was aware of the problems that viewers were reporting to us.

I talked to residents to see how they dealt with the digital transition. Questions included how they receive television within their homes. I also asked whether they use a MVPD, to investigate if all the televisions are connected to it and the rationale for the choice to purchase that system. For those using over the air service, I asked about their reception and their antenna information. I also asked when it came time for the transition whether they utilized the coupon, had a television that was compatible, or bought a compatible television. If when buying products for the switch did they know what they were looking for? Did they know about the switch well in advance? I was hoping these questions would reveal how consumers dealt with the transition. I wanted to get a real picture from the consumers in their own words about how they watched television in terms of reception.

I also talked to broadcast engineers, station management, and antenna installers in the area. They had helpful knowledge of what the transition looked like for the community. I also asked them how the transition went and how their stations prepared the public. Furthermore I was looking for information after the transition about their volume of calls and whether they had

details of those calls. I would also ask if they knew how the reception of their signal is in their area. I was looking to elicit what happened in their communities. While residents gave me a case-by-case look at what happened, broadcasters colored in the picture with broader generalizations that they and their viewers experienced.

Finally I talked to cable providers in the area to see how the digital transition affected them. Did they see a larger number of subscriptions either pre- or post- transition? I questioned whether they had any promotional deals to help residents receive local channels. I was looking to identify whether consumers turned to cable providers in the area as a solution to reception issue—including whether they may have been encouraged to subscribe to a pay service because of the transition.

Analysis

I kept a research journal while I conducted interviews in Angola. I listened to these recorded conversations and analyzed them inductively in conjunction with my research journal. I used the research journal to make theoretical memos and notes. The fresh impression from my memos and then listening again to the interviews later allowed for a stronger analysis.

Interviews

I began the process of analysis by using open coding, creating categories, and abstraction (Elo & Kyngas, 2007). Open coding means creating freely generated categories (Burnard, 1991). For example, a code was made for closed captioning standards, such as font size and percentage of content that must be covered. After this, I reflected upon the codes to see whether there were any connections. Once these categories were refined, I grouped them under higher order headings (McCain 1988; Burnard 1991). Closed captioning was placed under technical information. Due to my experience as a broadcast engineer, I had sensitizing concepts starting

out: power, reception, and frequency. These sensitizing concepts were theoretical notions that framed the way I observe reality (Jonker & Pennink, 2009). These concepts helped in examining why a gap existed in Angola and if there was talk about the cliff effect or its attributes in the discussions.

Documents

I used each governmental document as a unit of analysis. For the FCC reports I found eight open codes that I collapsed into technical information, including: video standard, audio standard, station licensing, closed captioning, transmission requirements, bandwidth, simulcasting, and allotment. There was also a second higher code that addressed coverage area. I chose these eight primary codes because they deal with distinct areas of the broadcast requirements of transmission.

For the congressional transcripts the initial read through produced a number of codes, the second read through left me with 20 codes: auction, children, converter box, deadline, delays, legislation, minority, MVPD, OTA, power, public education, public safety, spectrum, wireless, white space, coupon program, oversight, antenna, coverage, and seniors. I chose these codes because of the extensive talk in the transcripts about each of the topics. What I noticed as I looked for higher codes was the opportunity to collapse these into four main topics: public interaction, future use, implementation, and demographics.

The FCC policy documents created nine codes; most were collapsed under a higher code of technical information, while one code became coverage area. For each document I produced a coding sheet (see Appendix D). Appendix E is the table of codes with definitions for the governmental documents that I found.

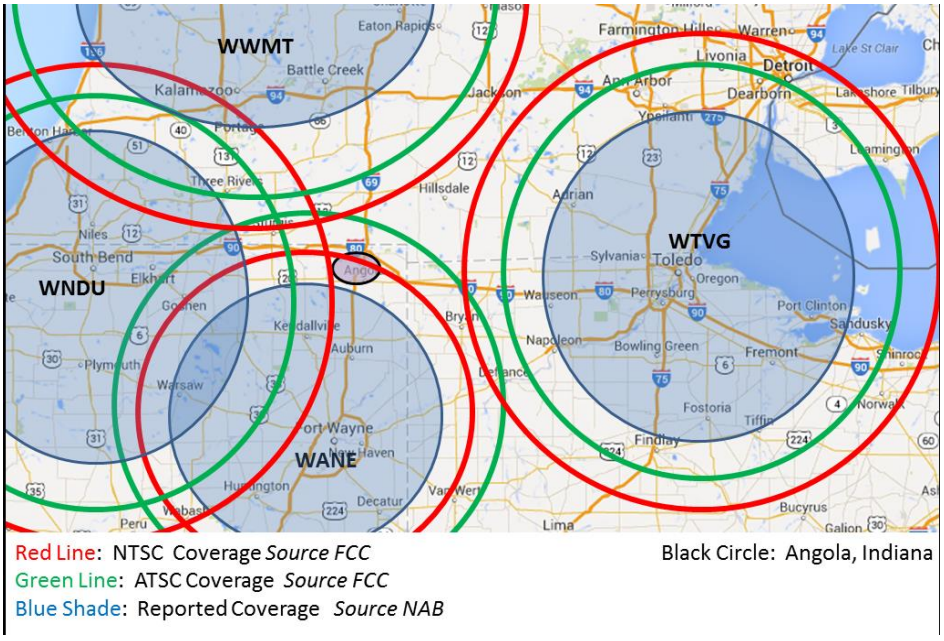
Angola Reception

I took a spectrum analyzer, a device that measures signal strength, and drove around the Angola area in March 2014. I made three stops in Angola. The first was to the high school on the far southwestern side of town. I found four channels, but only one that would actually display a picture. Next I drove to the southeast side of town, Trine University, to find two channels on the spectrum. Neither of those channels had enough power to break through. I then drove to the northern edge of the city limits and stopped outside a large grocery chain store. I replicated my first results of four stations, only one broke through to provide a viewable reception of a station.

As reception was poor in Angola I set my criteria to pick up three broadcast stations and record the locations. I traveled north and south along Interstate 69 and east and west along Interstate 80/90. To the south I only needed to drive about 15 miles to the next town. In Waterloo I picked up most of the Fort Wayne stations. Heading west to pick up South Bend stations, I needed to travel to LaGrange (about 22 miles from Angola). In Michigan to the north I had to drive to Marshall about 42 miles from Angola. Toledo stations were the farthest from Angola. I had to drive 49 miles away in Wauseon to record a usable signal.

These findings are illustrated in Figure 1. The map shows the FCC's record for NTSC propagation (analog) and ATSC propagation (digital). It also shows the National Association of Broadcasters coverage area for those stations.

Figure 2.1: Broadcast Propagation Map



Under analog broadcasting Angola was on the fringe, but residents could pick up some channels. They were able to do this because the amount of signal strength needed to see a picture was less than for digital reception. The FCC penalized stations that return to the VHF spectrum. In Table 1 shows the power difference between VHF and UHF, also the overall reduced power. WANE and WNDU are UHF stations. WTVG and WWMT are VHF stations. Effective radiated power (ERP) is standardized theoretical measurement of radio frequency energy (International Telecommunication Union, 1996). The measurement takes into account output, line resistance, and directivity.

Table 1: UHF VHF power

Station	**Pre-Transition ERP**	**Post-Transition ERP**
WANE (Ft. Wayne)	2,450 kW	1,000 kW
WNDU (South Bend)	4,170 kW	560 kW
WTVG (Toledo)	795 kW	16.7 kW
WWMT (Grand Rapids)	100 kW	25 kW

Coverage area and power issues have appeared in the past on radio. To help cover vast areas of the country clear channel stations were created. Airwaves became crowded as the number of stations began to grow. In 1945 there were 930 AM stations, by 1952 that number increased to 2,350 (Slotten, 2010). With the diffusion of television, channel co-sharing became an issue. Stations in different markets would clash if they were on the same frequency. Since the 1940s the policy to fix coverage areas was to just increase power (Vivian, 2003). The conversion to digital meant the elimination of analog interference from everyday objects. The FCC determined that they would lower a station's power after the transition.

CHAPTER III. GOVERNMENTAL DOCUMENTS

This chapter addresses the governmental expectations of the digital television transition. It looks at the government documents produced by the FCC in MM Docket Numbers 87-268 and 00-39 and the coverage maps. It also summarizes the congressional transcripts that I analyzed. The conclusion addresses RQ1: what were the government's expectations of the digital television transition?

In 1995, the Federal Communications Commission said "broadcast television has become an important part of the fabric of our society" (FCC, 1995). The governmental dialogue produced around 3,300 pages in FCC reports and congressional testimony dealing with a range of issues that continued until the transition took place. The overall purpose was to create a smooth transition from the old NTSC to the new ATSC standard.

The FCC

The Federal Communication Commission documents held the two codes of technical information and coverage area.

The very early reports were filled with information of ideals and goals the government and the industry wanted out of the transition. In 1987, the FCC stated their goal was to promote the development of advanced television that would deliver service to the public with greatly enhanced visual and aural clarity (FCC, 1987). During the next decade reports were published about different formats and standards to broadcast the next generation of television. These discussions of screen size, audio quality, picture quality, and required auxiliary services were debated and lobbied. Eventually a consortium called the Grand Alliance developed the standard. Past the Grand Alliance decision that set the standard for transmission of digital television the

FCC goals change from the broad better-television and into more narrow concrete applications. They set forth four main goals: 1) preserving a free, universal broadcasting service that meets the definition of "public interest, convenience, and necessity"; 2) fostering an expeditious and orderly transition to digital technology that will allow the public to receive the benefits of digital television while taking account of consumer investment in NTSC television sets; 3) managing the spectrum to permit the recovery of contiguous blocks of spectrum, so as to promote spectrum efficiency and to allow the public the full benefit of its spectrum; and 4) ensuring that the spectrum - both ATV channels and recovered channels will be used in a manner that best serves the public interest (FCC, 1995). The first level codes that I used in these documents were: video standard, audio standard, station licensing, closed captioning, transmission requirements, bandwidth, simulcasting, coverage area, and allotment. I collapsed all these codes into a higher code of technical information. I defined technical information about the technical standards of the digital television. For example, the debate of the audio processing protocol to use in the new standard. I did this because in the analysis all the discussions of the codes were about technical specifications.

The one exception to this was coverage area. This code became its own category. In terms of coverage area for consumers, the FCC stated that their calculations would allow for "broadcasters [to] have the ability to reach the audiences that they now serve and that viewers have access to the stations that they can now receive over-the-air (FCC, 2001b)." It was determined that residents should not need to use a high-gain receiving antenna to see their local station (FCC, 2001a). They created maps for each market and the communities they served. Angola was included in the Fort Wayne market.

The FCC documents brought to light the government's discussion about how to technically broadcast and also the government's hope for increased coverage area with the new standards.

Congress

Congress had much to discuss about the DTV transition, with hearings taking place from 2001 until 2008. The House Subcommittee on Telecommunications and the Internet, part of the Committee on Energy and Commerce, held nine meetings. The Senate Committee on Commerce, Science, and Transportation held five meetings. I have found that there were five main substantive discussion points: public interaction, public education, implementation, future use, and demographics. There was no discussion of coverage.

The largest part of the discussion was *public interaction*. This means how the public, primarily consumers, interacted with the policy, programs, and information, including comments about the digital converter boxes. The following issues were addressed: the costs to consumers and the process of implementing the converter box voucher programs going to work? What was the status of the voucher programs. "Consumers didn't ask for this transition. They don't know it is coming and they are not going to appreciate being hit with a $50 TV tax," said Representative Bart Stupak (The Status of the Digital Television Transition, 2007). There was concern that consumer electronics stores were providing inaccurate information.

The second biggest topic was *public education*. The congressional members were concerned about how to get the message of digital conversion out to the masses. This discussion included programs from both industry and the FCC. The worry that people would not pay attention and, as Representative Greg Walden (OR) said, that consumers would "turn on their televisions; if they don't work, you had no place to go except to the phone book to call your

Member of Congress. I would prefer they go to Radio Shack or somewhere else" (The Status of the Digital Television Transition, 2007). The other debate was over how much was being spent by private industry and the government. Representative Michael Doyle (PA) remarked: "Proctor & Gamble spent $128 million in 2004 to market the Swiffer broom to American consumers, and GM has pledged $100 million to promote its new Malibu. But NTIA has only $5 million to inform American consumers" (The Status of the Digital Television Transition, 2007).

The *future use* code captured the discussions about how the government would use the spectrum in the future. The goal of the digital transition seemed to be more about freeing up (or making more effective use) of the electromagnetic spectrum. Naturally a great topic to talk about is what would happen with this new spectrum created by the analog to digital transition. The two major topics were public safety and the auctioning of the new spectrum. Congress expected Emergency-911, wireless alerts, and that "public safety will receive unbroken slices of our airwaves to enable interoperable communications and improve information-sharing" (Preparing Consumers for the Digital Television Transition, 2007). The events of September 11th were fresh on the minds and a factor in why public safety was mentioned so much.

The other side of future use was the auction. Senators were told in 2005 that the "estimate from the Congressional Budget Office that the auction of the analog spectrum will bring the Treasury $10 billion is conservative" (The Digital Television Transition, 2005). There was money to be made and everyone wanted to know how the spectrum was to be sold, who was going to buy and sell it, and how much the government stood to make. The two big programs were a national Wi-Fi and speculation on the wireless telecom industry to buy up spectrum. The other issue that was debated was selling the white spaces—the guard band between signals that protect against interference—to make even more money.

When Congress talked about *implementation*, the members mainly discussed who was in charge, and the delay and deadlines. The deadline and how the industry was progressing were topics at almost every meeting. Congress wanted to make sure that the FCC did not jump before the industry and consumers were ready but realized that if they did not hold the FCC and broadcasters to account nothing would get done. Coverage area was discussed sometimes but it was always minimized in any action.

On September 8, 2008, at noon, Wilmington, North Carolina, became the first market to switch completely to the DTV standard. One of the takeaways from the test was coverage area. When asked about the "coverage loss" and "cliff effect" experienced during the Wilmington test, FCC Chairman Kevin Martin told the Senate, "The engineers have gone back through and they are trying to estimate it. They estimate that somewhere in the neighborhood of around 15 percent of the markets may have a station that will shrink in some significant way." (Status of the DTV Transition: 154 Days and Counting, 2008) That would mean that 32 markets would see significant loss. However, no one questioned FCC Chairman Martin as to what "significant loss" was or what that would mean for the public in those markets. When it came to MVPDs, the concern of the representatives reflected by their questions and remarks were the "must carry" rules and the range of services that would be provided. Must carry rules require MVPDs to carry local stations and not just distant stations. This discussion included the use of phone and internet service to MVPD consumers, not just cable television.

The last code that was not mentioned much at length, but appeared in almost every hearing, was *demographics*. These were topics that involved minorities, children, and seniors. At every committee hearing some special interest organization such as the United Church of Christ, the Leadership Conference on Civil Rights, or the National Hispanic Media Coalition

appeared. They were concerned with public interest obligations: How would the expansion of channels help spread minority voices? Would programming be dedicated to public affairs? What would be the new requirements on children's programming? These organizations were given their chance to advocate their positions, but not much action came out of their discussions in the meetings. They were given time to talk about a specific issue, which was never discussed by legislators outside the organization's time at the hearing.

The congressional transcript provided five main points of analysis: public interaction, implementation, public education, future use, and demographics.

Government Expectations

Combining both the FCC documents and the congressional transcripts I was able to answer RQ1. In what the government expected from the digital television transition there are lots of answers; however, a few main themes pop out. These themes were implementation, coverage area, spectrum and its future use, and public interaction. The government expected a certain level of broadcasting quality that the standard would be ATSC propagated by 8-level vestigial sideband (8vsb). The eight amplitude levels allow the large bandwidth necessary to carry high definition television. The government expected that the coverage area would stay the same or even increase slightly. They wanted to reclaim the spectrum to repurpose it. It was not definitively decided what would happen to all the recovered spectrum but many ideas were placed on the table. Some of the ideas were for purposes of public safety, others for sale. Finally, the government demanded high quality in public interaction especially the cost of the new policy to consumers. Overall they expected consumers to have a seamless transition.

CHAPTER IV. PUBLIC & BROADCASTERS

In this chapter I address what happened on the ground in and around Steuben County. I answer research questions two through four. RQ2: What were broadcast professionals' (station engineers and consumer electronic providers) perceptions of the digital television transition in and around Steuben County? RQ3: What were Steuben County residents' perceptions of the digital television transition? RQ4: How did the government's expectations match what happened in the transition to digital television in a remote community? I found that what happened on the ground was quite a bit different from the smooth transition that the government expected. Residents' perceptions of the transition seemed to vary between excitement and apathy. There was also lingering confusion about what the digital television transition meant. I found that the major discussion points and concerns were about coverage area, consumer education, and power.

Research Sample

I interviewed six female residents of Angola, IN. The first five all use cable in their homes because over-the-air (i.e., antenna) reception is not possible there. The sixth interviewee opted to have a large antenna built. For the interviews, we met in the Carnegie Public Library of Steuben County. My first interview was with Sara, a stay at home mom in her forties who seemed very comfortable with technology. She made a remark that she wished that she could get over-the-air more reliably, because she notices how much better the picture looks compared to the cable signal. I next interviewed Crystal, a nurse and lifelong resident of the area in her sixties. She was aware of DTV, but in our conversations she recited several factual errors, one of which was, "The only way to get that stuff is to buy a brand new television." My third interview was with a quiet 70-year-old woman, Heidi. In our conversations I noted that she was not really

comfortable with new technology. I contacted her via telephone because she did not own a computer. She noted that she only has one "old television" and does not watch it much. I asked her what she meant by "old television." "I think I bought it back when the first Bush was in office," she said. Her main concern about digital television and the cable that she currently has is the expense. She is on a fixed income and does not want to spend money on something she is not using.

My fourth interview was with Samantha, a tenured associate professor at the local university. She has cable at home and did not know that digital television existed. "When we moved here in the '90s we just got cable." She watches a lot of movies, and her husband loves professional sports. "I guess I never considered broadcast television could provide that content." My next interview was with a businesswoman in her fifties, Holly. She noted that she had lived in Colorado and that getting television has always been a problem. "Geography and terrain has such an effect on getting stations. I was used to that living in the mountains but completely surprised moving to Indiana and having issues." My last interview was with Nancy. She is a retired executive living in one of the more expensive lakeside properties in the area. She paid to have an antenna installed.

Coverage Area

The residents who have lived in Angola year -round had more of the opinion that to get any television you just needed to get cable. Sara noted that "it is just easier to get cable than deal with trying to get a signal." What was interesting in talking with the residents was that I found that even with NTSC broadcasting era, reception was sometimes an issue. Crystal mentioned that in the last 20 years she has had cable. "If you talk to about half the residents here you will find cable in most homes." Heidi, a woman in her seventies on a fixed income, mentioned that

all she wants to do is watch the local news and *Wheel of Fortune,* but she pays around $120 a month for cable. She explained that she believed that topography has a lot to do with it. "This community with all of it hills and especially if you move around one of the lakes creates reception problems," she noted. The residents' responses concurred that there seemed to be high cable penetration in the area and that most residents could not rely on over-the-air television.

Jack, the owner of the local consumer electronics store, had mentioned stories about having to climb trees to put antennas in place. He seemed to view the reception problems as a challenge. His advice to solve reception issues was spending a few hundred dollars to build a good outdoor antenna that, which would pay for itself after a few months, being cheaper than months of cable bills. He said that 60 percent of residents received their television over-the-air reception based on his business. His business provides a sheet of approximately 90 channels available over the air for free. When asked about how many channels he could usually get customers the numbers were a bit different. It was mostly a directional issue, he noted. "You could buy a motor to change the direction, but the cheaper $400 option was to just fix the antenna to the market that you wanted to see." When asked about the most channels he has ever gotten someone the answer was 67, but it was not within Steuben County. It appeared that a lot of his work with installing antennas was based around the county's many lake communities and not in the center of town.

One resident, Nancy, who had purchased an antenna from Jack noted that while the price seemed a little high it was worth the cost. She was only really in the area at most a week per month. "I'm not here enough to justify cable, and it allows me to grab Toledo stations." She mentioned that there are a fair number of "recreational" residents from northwest Ohio. They live and work in Toledo, Defiance, Napoleon, and Archbold but spend weekends and holidays in

Angola. Nancy speculated "most people live in the Toledo viewing area and want to know what is happening there. They are not quite as invested in Fort Wayne or South Bend." Jack also confirmed that the Toledo stations are a request he usually gets but even with all of his equipment the signal fades out west of Interstate 69. He said back in the analog days it was a lot easier to tune in those stations.

The broadcast engineers all noted that they had lost viewers in the transition. I would show them the maps the FCC provides of their stations and I was greeted with laughter. "The problem is in part with the Longley-Rice model," Bob, a chief maintenance engineer and avid ham radio operator, explained. The Longley Rice model is an algorithm, first published in 1968, to create a coverage area for radio propagation in a terrestrial environment (NTIA, 1982). The equation uses multiple parameters: frequency, distance, antenna height, polarization, terrain irregularity, electrical ground constants, surface refractivity, climate, deployment parameters, and reliability (FCC, 2004). Longley-Rice was created to more accurately predict FM station coverage over rough terrain shaped by, namely hills and small mountains. It looks at terrain over a radial and calculates a correction factor to extend or reduce the coverage in that direction (Society of Broadcast Engineers, 2009). The FCC chose it for TV based on the wide acceptance in the FM community. Given the model is 40 years old, I inquired about why there were problems now. He explained, "the calculations were always off, however it benefited radio broadcasters at the time." The model overestimated the population that can receive the signal. A chief engineer, Tom explained, "consultants discovered an anomaly in the Longley-Rice algorithm that they could exploit for their clients to enable the signal contours to be stretched to allow greater flexibility in locating studios or in licensing a station to a new city. There are apparently ways of manipulating the "delta h" or change of height variable that allows contours

to extend considerably. This allows exaggerated contours. FM consultants use this every day to allow coverage that does not exist. When it came time to define coverage for TV stations, especially VHF TV stations, FCC picked Longley-Rice due to its wide use in FM. Then it hit the fan…because TV coverage became non-existent."

Consumer Education

One thing that was noticeable in all talks with people in Steuben County was that people were confused about the digital television transition. Only two residents, Holly and Sara, really had a firm grasp of what the digital television transition was and its offerings. Holly said she just let her husband buy a new television. No one said had utilized the coupon program; most were unaware that it even existed. Heidi pointed out that "it does not do me any good if I can't get reception anyway." Broadcast engineers, consumer electronics retailers, and MVPDs all echoed the sentiment that consumer education seemed to be a problem. Each of the three handled their public relations differently. Television stations created Public Service Announcements (PSAs) and phone banks. The consumer electronic stores talked to people that came into their shop. MVPDs tried to help their subscribers in understanding the transition by putting flyers with the monthly bills.

Perceptions of the residents of Steuben County residents' perceptions of the digital television transition (RQ3) were two-fold, in that some have enjoyed it while others barely knew that it existed. However two major themes came out of the discussion. The first code is the *coverage area*. In Angola and throughout the area there is a lack of television coverage that even pre-dated the digital television transition. There were unique ways to solve the problem, but all cost money. If you have disposable income you can spend money to resolve the problem, but that seems to disenfranchise citizens from a public service. The second code is *consumer*

education. While multiple ways to inform people were tried it was clear that people were not informed.

Power

One unique topic that broadcast engineers discussed was power. This topic consisted of comments about the reduction of transmission power that coincided with the analog-to-digital conversion. Most stations were told that with the new digital signals, they did not need the high power to propagate their signal. Matt, a television station engineer, recalled "we went from over 150 kW to currently running 16.7 kW after we petitioned to have more power." This power reduction is what the engineers believe underlies the signal gap problems. Another station engineer, Bob, said "we just are not getting the penetration with the lower power." This issue is still something that the engineers want addressed, however the FCC has put a moratorium on power increases until after the spectrum auction. One of the other reasons the government reduced power was to help stations reduce electricity consumption. "We actually pay more now in electricity than we did before," described Tom. He explained "the intense power to the transmitter cause[s] a lot of heat, so we never had to heat the transmitter building before, and with the lower amount of energy we use, we lost the bulk electricity rate."

MVPD

The cable providers, while having to provide infrastructure within their own systems, did not see major changes. Their concern was providing space in their system to accommodate both analog and digital channels. Both cable companies I talked to were in the middle of switching their own system from analog to digital as well. In terms of the digital television reception, they were aware that if there were bad antenna reception and if residents wanted television, they would have to purchase it from them. Rob, a top level cable executive, noted that for a while

they provided a local channel only package "we would try to upsell to our other cable packages." He also observed that some consumers "couldn't pay their bills so we shut off their service." They all had programs to help their cable customers understand what the digital television transition meant. "We trained our customer service reps to tell our customers that as long as their televisions were plugged in to us, they didn't have to worry," he said. Inserts in bills and public service messages were also included to try to help customers understand the DTV transition.

Broadcast Expectations

Depending on what group of broadcast professionals you were talking to, there were different answers about their perceptions (RQ2). Broadcast engineers saw problems and complaints about consumer education and coverage areas and they also added the discussion about power. Consumer electronics retailers saw a problem and figured that if you can put money to the problem you can find a solution; it is only a matter of how high you need an antenna built. Cable providers saw a business pursuit. The one thing the broadcasters all agreed on was consumer education could have been better. Broadcast stations ran PSAs and phone banks, consumer electronics did face-to-face, and cable providers told their customers in billing statements.

Government Expectations

The government's expectations did not match what happened in the transition in Steuben County (RQ4). There were no explicit conversations about rural communities dealing with the DTV transition. First, the government expected a certain level of broadcasting quality. For the full-powered stations, that was accomplished; the low power stations were given extensions and are currently undergoing their transition. Currently everyone is broadcasting (legally) with the

new standard set forth for them. Second, government officials expected that the coverage area would stay the same or even increase slightly. In Angola that did not happen. While there were a few voices telling governmental leaders this, the policy was moved forward anyway. Testimony was given to the House of Representatives that said, "It is inevitable that certain households for topographical reasons or due to their distance from the broadcaster's tower will not be able to receive an over-the-air digital signal" (Advancing the DTV Transition: An Examination of the FCC Media Bureau Proposal, 2004). A GAO report stated, "even when stations do have their digital facilities fully operational, they might not broadcast their digital signal to the exact coverage area that their analog signal covered" (The Status of the Digital Television Transition, 2007). There were concerns by members of the committee about rural areas where they "cover a lot of territory, are sparsely populated, and are disproportionately dependent on analog transmission" (The Status of the Digital Television Transition, 2007). This was dismissed by saying that trying to replicate could cause interference. Third, the government wanted to reclaim the spectrum to repurpose it. While some of this has been done for public safety, a vast majority is awaiting the spectrum auction. Finally, the government demanded high quality in public interaction. In terms of education there was a significant gap in what the government expected and what was actually done.

This chapter addressed broadcast professionals, (RQ2) and Steuben County's residents' (RQ3) perceptions of the digital television transition. It also examined what happened in Steuben County and government expectations (RQ4).

CHAPTER V. CONCLUSION

This chapter addresses what the Angola story reveals about government understanding of digital television technology and the ability to plan and regulate (RQ5). Then the chapter summarizes the findings, future study opportunities, limitations, and the impact of this study.

This case study looked at Angola, Indiana, a rural community in Steuben County. It examined the literature that surrounded the transition. Using as a framework law in action theory, the case study analyzed governmental documents, congressional hearings, and interviews with residents and broadcast professionals. It concluded that there was a lack of coverage, there is an underserved population especially in time of emergencies, and there is a growing trend of consumers dropping cable and satellite service.

Government & Technology

The Angola story tells two major points about how the government understands technology and its ability to plan and regulate (RQ5). The first point is that regulation takes a long time. Technology, on the other hand, is constantly moving forward. The period of the time from discussing technology to actually implementing it means by the time the switch actually happens the technology is outdated. It is hard to regulate and implement an overarching policy on technology. That showed itself in the digital television transition. There were major deadlines missed because adoption did not reach saturation in the marketplace. Originally it was supposed to happen in 2006, then 2008, then February 2009 before it finally happened in June 2009. Even as of this writing low-power stations still have until September of 2015 to convert to digital television. In that period of time from concept to implementation technology moved ahead. Consumers went from buying LaserDisks, Beta and VHS tapes to buying Blu Rays for

home viewing. Even in the broadcast industry technology had changed. Japan's NHK had tested a new standard called Super Hi-Vision in the 6 MHz UHF range (current US allotment for a channel) that produces 8K video (4,320 lines) and a 22.2 channels of audio.

It also shows, as the law in action framework suggests, that one has to look at what the law or policy does in the real world. Looking at just the governmental documents, I would see a system that was implemented despite obstacles. I would not see the pockets and gaps in the policy. However in Angola and, as suggested, other surrounding communities there are gaps. These problems have not been addressed suggesting that the spirit of the policy has not been achieved. Stations have requested modifications to help fix coverage gaps; however the FCC has denied requests or has given a fraction of what is requested (Oxenford, 2013). The law in action framework suggests that policy is certainly not black and white but rather an infinite rainbow with endless voices. The concept of law in action guided my thinking during the analysis of this study by setting up a framework that illustrates how laws and policy can be seen by different people in different areas. Just as prosecutors and defense attorneys can see the same law in different light, so too, can policy makers and broadcasters. Law in action is a legal theory that tries to address the discrepancies between the law on the books, and the law as it works in society. Law on the books saw an increase in broadcast coverage area and increased picture quality; the policy saw a coverage gap for Angola.

Future Study

There is much research that can further the issue of digital television. First, the power strength could be examined. How much power would it take broadcasters to fulfill their old analog coverage areas? A second inquiry would be the issues of digital broadcast television in the world of residents choosing are streaming services. Consumers, especially Millennials, are

more likely to use streaming services instead of paying for cable or satellite (Spangler, 2014). These consumers are combining over-the-air television along with these streaming services. Production companies are moving resources into television production. Disney noted in their annual report that their movie sector had an operating income of $661 million, whereas its media networks (television) made $6.82 billion in the same time period (BusinessWire, 2013). Third, along the lines of new technology is mobile television. Television stations can broadcast straight to cellular devices. As the smartphone takes a stronghold in the mobile market, what services will consumers demand? Fourth is taking this issue to a national scope. How many other markets have been impacted by loss of broadcast signal coverage? One government report said that it is "estimated that somewhere in the neighborhood of around 15 percent of the markets may have a station that will shrink in some significant way" (Status of the DTV Transition: 154 Days and Counting, 2008). Did this estimate turn out to be accurate? There are many areas where this study can be expanded.

Limitations

The major limitation of this study is that it only represents a small area. The findings cannot be generalized. The findings could be unique to this time and place. Another limitation is that while I used the two major dockets of the FCC, there are discussions in other dockets that do not necessarily focus on the digital television transition.

Conclusion

This case study has three implications for the residents of Steuben County. First, and foremost, there is a lack of coverage. Ever since 1927, the Federal Radio Commission, later the FCC, and a long list of court cases have treated the airwaves as public property and in the public trust. As such, the FCC has placed an emphasis on establishing standards that assure the public

good is served through its policies. Therefore, a policy that appears to leave consumers in the dark is in sharp contrast to this longstanding tradition. Limiting access to broadcast transmissions to parts of the population, even if they are rural and sparsely populated, is against the first goal that the FCC wanted. That goal was to preserve a free, universal broadcasting service that meets public interest, convenience, and necessity.

Second, there is an underserved population especially in time of emergencies. Despite the pervasiveness of the Internet, television remains the major way to communicate information to the public. This point is best illustrated by the public's response to natural disasters. When people want information they turn to their television sets. Cellular phone networks, which increasingly make available more of this same information, often are overwhelmed by a sudden surge in traffic and/or infrastructure disruption in these emergent situations.

Finally, there is a growing trend of consumers "cutting the cord" or dropping cable and satellite service. The growing cost and lack of competition have some consumers relying on over-the-air news and entertainment programming. This means broadcast television is the primary source of information for the public, especially for information about issues of local/regional interest.

The government set up a list of expectations and spent the better part of 20 years debating the details. However when it came to implementation there were still and continue to be problems with the policy (O'Malley, 2013). It is understandable that any massive overhaul of policy is going to have issues. However, the problems still exists four years after the transition (O'Malley, 2013). This problem has left residents of Angola without access to crucial information from local broadcasters. To obtain access residents are paying hundreds of dollars in solutions to bridge the gap the policy has left. This case study has shown how difficult and

slow adoption can be. While this study has only looked at one community, there are reports of other communities that have had similar issues (Dickson, 2009; Eggerton, 2009; O'Malley, 2013). While some might argue that this is the process of adoption, should such a process leave whole communities disenfranchised? While the FCC turns its attention to other matters, they have seemed to leave behind these communities.

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APPENDIX A. RECRUITMENT FLYER

Digital Television

Please participate in an interview to share your experience with the digital television transition.

Purpose:

- Look at how DTV affected residents in Steuben County

To Participate:

- Must be 18+
- Living in Steuben County

Interviews will be at a place you deem comfortable.

Your confidentiality will be maintained.

You have the ability to withdraw from the study at any time.

Interviews typically last an hour but can be longer/shorter based on how much you want to share!

Andrew C. Black
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APPENDIX B. HSRB APPROVAL

BGSU.
BOWLING GREEN STATE UNIVERSITY
Office of Research Compliance

DATE:	April 23, 2013
TO:	Andrew Black, BA
FROM:	Bowling Green State University Human Subjects Review Board
PROJECT TITLE:	[408010-2] DTV Implementation: A Case Study of Angola, Indiana
SUBMISSION TYPE:	Revision
ACTION:	APPROVED
APPROVAL DATE:	April 22, 2013
EXPIRATION DATE:	April 2, 2014
REVIEW TYPE:	Expedited Review
REVIEW CATEGORY:	Expedited review category # 7

Thank you for your submission of Revision materials for this project. The Bowling Green State University Human Subjects Review Board has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a project design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

The final approved version of the consent document(s) is available as a published Board Document in the Review Details page. You must use the approved version of the consent document when obtaining consent from participants. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require that each participant receives a copy of the consent document.

Please note that you are responsible to conduct the study as approved by the HSRB. If you seek to make any changes in your project activities or procedures, those modifications must be approved by this committee prior to initiation. Please use the modification request form for this procedure.

You have been approved to enroll *20* participants. If you wish to enroll additional participants you must seek approval from the HSRB.

All UNANTICIPATED PROBLEMS involving risks to subjects or others and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office. All NON-COMPLIANCE issues or COMPLAINTS regarding this project must also be reported promptly to this office.

This approval expires on April 2, 2014. You will receive a continuing review notice before your project expires. If you wish to continue your work after the expiration date, your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date.

Good luck with your work. If you have any questions, please contact the Office of Research Compliance at 419-372-7716 or hsrb@bgsu.edu. Please include your project title and reference number in all correspondence regarding this project.

APPENDIX C. INTERVIEW QUESTIONS

Broadcast Engineer Questions

- What was the process of DTV implementation like?

  Why did your network choose the DTV standard that it did?
- Do you feel the switch to DTV was forced or welcomed by local television stations?
- What are the challenges of broadcasting multiple channels as opposed to just one?
- Is your digital signal broadcasting on the same frequency as your analog signal did?
- What is your power pre- & post- transition?
- Do you see any new technologies being implemented by over the air broadcasters? If so, please give an example.
- Do you feel the public was served by the DTV implementation?
- Is your broadcasting area greater, less, or about the same when you were broadcasting analog?
- What was your most common viewer complaint in the days following the transition?
- What was your call volume like in the days following the transition?
- Did your station do any awareness campaigns to help the public? If so, please give an example.
- How would you describe the DTV implementation now that we are three years out?
- The FCC deemed giving more power to broadcast would increase interference between stations and cause higher electricity bills “threatening the economic viability” of stations.

Public Questions

- How do you receive your primary source of television?
- Is your antenna indoor or outdoor?
- Do you subscribe to cable or satellite?
- Do you have a television not connected to either cable or satellite?
- How many stations did you receive prior to the transition?
- From what cities were these stations from?
- Has your number of stations increased or decreased after the transition?
- Were you aware of the switch to digital television prior to June 2009?
- Were you made aware of the digital converter box coupon program?
- Did you buy a converter box before the transition?
- Did you buy a new television to be with the new transition?
- Did you buy a new antenna for the transition?
- How do you feel about the DTV implementation?
- What did you think of the DTV implementation?

MCVD Questions

- Did you see a bump in subscribers prior to the transition?
- Did you see a bump in subscribers post transition?
- Did you see an increase of call volume with questions about the transition?
- How did you train customer service representatives to answer consumer questions?
- Did you provide any promotional deals to help residents receive local channels?

- What steps had to be taken and what equipment was required to transmit the new digital television stations?
- What was the cost on your end to complete the digital transition?

APPENDIX D. CODE SHEET

Date Published: _____

Document # _____

Docket # _____

TITLE: _____

Slugs (themes):

Summery Brief:

Quotations:

People:

Reflexivity:

APPENDIX E. LITERATURE CODE SHEET

Code	Definition (Conversations/Commentary related to:)	Example
Public Interaction	How the government interacts with the public through programs and information.	
Converter Box	Talk related to the digital converter box.	"One hundred fifty-six converter box models, different models, had been approved for purchase with the coupons, 82 of which can pass through the analog signal for low power stations." (Status of the DTV Transition: 154 Days and Counting, 2008)
Coupon Program	Related to the official government coupon program.	"Under the Digital-to-Analog Converter Box Program, eligible U.S. households may obtain up to two coupons of $40 each to be applied toward the purchase of a digital-to-analog converter box. The Act authorizes NTIA to use up to $990 million to carry out this program." (Senate, Preparing Consumers for the Digital Television Transition, 2007)
Public Education	Programs and outreach to educate consumers about what they need to do to comply with the new digital television policy.	"Local broadcasters should also work with churches, firefighters, schools, and other grassroots groups to help prepare consumers and answer the phone to answer their questions." (Status of the DTV Transition: 154 Days and Counting, 2008)
Future Use	Discussion about what to do with the freed up spectrum post-DTV transition.	

Code	Definition (Conversations/Commentary related to:)	Example
Auction	Talk about auctioning off the spectrum.	"Aloha has estimated in previous filings with the House Commerce Committee that the remaining 700 MHz spectrum could generate between $20 to $30 billion for the U.S. Treasury if an auction were held in the near future." (The Digital Television Transition, 2005)
Public Safety	Talk about dedicating spectrum to emergency services.	"This additional spectrum will be especially useful in improving communications systems and the ability to deploy forces for first responders during national and local emergencies. The need for this spectrum is greatest in many of our nation's major metropolitan areas currently suffering from spectrum shortages." (Advancing the DTV Transition: An Examination of the FCC Media Bureau Proposal, 2004)
Spectrum	General discussion about what space will be available, what will be reserved and what will be sold.	"Equally important, 108 megahertz of the spectrum will be recovered for use by other services, including public safety and advanced video and data services." (Advancing the DTV Transition: An Examination of the FCC Media Bureau Proposal, 2004)
Wireless	Talk about telecommunication and broadband services using broadband.	"the proposal will free up spectrum that can be used for wireless broadband services. Chairman Powell has identified the deployment of broadband infrastructure as a central communications policy. In addition, there is strong bipartisan

Code	Definition (Conversations/Commentary related to:)	Example
		support in both the House and the Senate to make broadband deployment a national policy objective. This plan will further those national broadband ambitions." (Advancing the DTV: An Examination of the FCC Media Bureau Proposal, 2004)
White Space	Talk about the elimination and use of white space or guard bands once the new spectrum is set up.	"I have just a few questions for you as it relates to the white space technology as that issue of technology pertains to the DTV transition. Is it your opinion that continued testing of these devices by the FCC will interfere with the DTV transition?" (Status of the DTV Transition: 370 Days and Counting, 2008)
Implementation	Status updates about the transition and debate about what governmental agency were doing and deciding.	
Legislation	Discussion about pending legislation on the digital television transition.	"There is bipartisan legislation called H.R. 107, which would make it clear that products that allow you to do just what you want like that are legal. It is before your committee and I urge you to support it." (Advancing the DTV Transition: An Examination of the FCC Media Bureau Proposal, 2004)
Oversight	Talk about government programs and authority outside of Congress to create, implement, and enforce policy.	"Congress directed NTIA to implement a Digital-to-Analog Converter Box Program, provide financial assistance to those consumers that wish to continue to receive broadcast programming over-the-air, using existing analog-only

Code	Definition (Conversations/Commentary related to:)	Example
		televisions." (Preparing Consumers for the Digital Television Transition, 2007)
Antenna	Discussion about consumer antennas.	"Therefore, the DTV and NTSC rules defining directional antennas are identical and the practices and policies that have been applied to NTSC directional antennas will also be applied to DTV directional antennas." (FCC, 2001 [01-24])
MVPD	Discussions about cable and satellite operators were dealing with.	"The FCC also decided to permit cable operators to carry only one of a station's multiple channels of free, over-the-air programming rather than requiring cable systems to carry all such free programming. This decision was also wrong." (Transition to Digital Television, 2001)
OTA	Information about those who rely on over the air broadcasts and the broadcasters that use the airwaves.	"I'm concerned that, as of fairly recent data from Nielsen and the broadcasters, one in five Missourians is getting over-the-air signal right now. I mean, frankly, this scares me, politically. I mean, there is no anger that comes close to the anger of an American who can't get television." (Preparing Consumers for the Digital Television Transition, 2007)
Power	Discussion about the power output needed for coverage.	"Our OOBE standard requires that base and fixed stations reduce power into the public safety bands by a factor of 76 + 10 log P dB." (FCC, 2001 [01-2])

Code	Definition (Conversations/Commentary related to:)	Example
Delays	Talk that addressed the delay the start of full power television stations to broadcast in digital.	"So it is important that we don't make any rash changes today. Doing so will only recreate the uncertainty that was delaying the transition in the first place and preventing us from clearing spectrum for public safety in advance wireless service, the third generation." (Status of the DTV Transition: 370 Days and Counting, 2008)
Deadline	Setting the start date of full power television stations to broadcast in digital.	"In the Balanced Budget Act of 1997, Congress prescribed that analog broadcast facilities would be turned off on December 31, 2006 or when 85 percent of television households had the capability to receive digital programming. For this reason, one of the critical tasks confronting the FCC is implementing this provision of the 1997 statute." (Advancing the DTV Transition: An Examination of the FCC Media Bureau Proposal, 2004)
Demographics	Discussion about specific groups of the population.	"Beyond utilizing multicast capabilities to offer increased local news and other local programming including public affairs, weather and sports, broadcasters have also indicated their interest in using multicasting to air minority-oriented, children's, and educational programming." (The Digital Television Transition, 2005)

Code	Definition (Conversations/Commentary related to:)	Example
Children	Talk about children requirements in the new digital television age.	"Media Policy Coalition which seeks to improve the media environment for our children and is urging the FCC to ensure that broadcasters meet their public interest obligations to children in the digital age." (Advancing the DTV Transition: An Examination of the FCC Media Bureau Proposal, 2004)
Minority	Talk about minority ownership and public affairs in the new digital television age.	"If we don't find a way to communicate to our most vulnerable consumers how and when the transition occurs, we run the risk as a country of shutting off democratic debate and crucial emergency services to low income, rural, minority, and older Americans." (Preparing for the Digital Television Transition: Will Seniors Be Left in the Dark?, 2007)
Seniors	Talk about seniors and efforts to make sure they can easily switch to digital television.	"We are here today to bring attention to the unique needs and vulnerabilities of seniors as well as others across our country as the Nation transitions from free over-the-air analog TV to digital TV, commonly referred to as the DTV transition." (Preparing for the Digital Television Transition: Will Seniors Be Left in the Dark?, 2007)
Technical Information	Information about the technical standards of the digital television.	

Code	Definition (Conversations/Commentary related to:)	Example
Video Standard	Talk about the video picture.	"The DTV video will still be coded and compressed as specified in the ATSC DTV Standard, generally required to conform to the MPEG-2 Video Standard." (FCC,1996 [96-493])
Audio Standard	Talk about the audio quality.	"The Standard also allows for the broadcast of CD-quality audio signals." (FCC, 1997 [97-116])
Stations Licensing	Talk about how stations would be licensed.	"Prior to the first round of channel elections, the Commission required all licensees to file a certification (via FCC Form 381) by November 5, 2004 in order to define their post-transition facility." (FCC, 2008 [08-72])
Closed Captioning	Talk about closed caption requirements.	"that the requirement contained in Section 305 of the Telecommunications Act of 1996"" for the Commission to assure that video programming is fully accessible through the provision of closed captions is being examined in MM Docket No. 95-176." (FCC, 1996 [96-493])
Transmission Requirements	Technical/Engineering talk about requirements related to transmission.	"They argue that the rationale for not adopting transmission standards for DBS, PCS, MMDS, and DARS applies to DTV." (FCC, 1996 [96-493])
Bandwidth	Talk about the size bandwidth broadcasters would have.	"Commission's Advisory Committee on Advanced Television Service. It provides for flexible use of the spectrum, enabling a broadcaster to vary the bandwidth dynamically to provide multiple programming streams during some dayparts

Code	Definition (Conversations/Commentary related to:)	Example
		and high definition television during other dayparts." (FCC, 1996 [96-493])
Simulcasting	Discussion about during the transition broadcaster transmitting in both analog and digital.	"In our 1992 Second Report/Further Notice , we determined that DTV licensees should simulcast on their NTSC channel the programming offered on their DTV channel." (FCC, 1997 [97-116])
Allotment	Assigning channels and protection against interference.	"a table will be created to the extent to which DTV causes interference to itself and other signals and resists interference from other signals." (FCC, 1996 [96-493])
Coverage Area	Talk about the coverage area of the new digital signals.	“Even when stations do have their digital facilities fully operational, they might not broadcast their digital signal to the exact coverage area that their analog signal covered [this could occur due to changes, among other things, in channel number or antenna type, location or height]” (The Status of the Digital Television Transition, 2007)