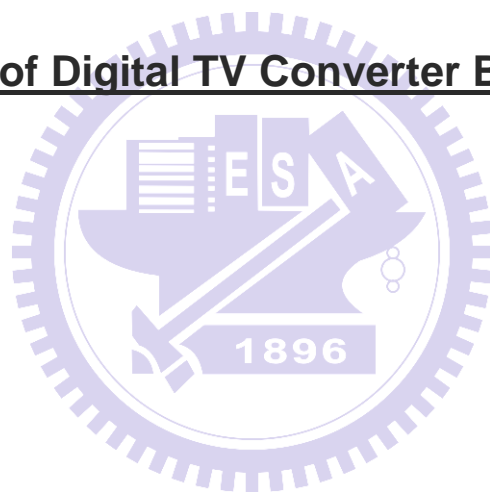


# 國立交通大學

## 企業管理碩士學位學程

### 碩士論文

#### Market Study of Digital TV Converter Boxes in Bolivia



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中華民國一百年七月

# Market Study of Digital TV Converter Boxes in Bolivia

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## English Abstract

### Market Study of Digital TV Converter Boxes in Bolivia

The transition currently occurring all over the world from analogue TV broadcasting to digital TV broadcasting has most certainly had an effect on how viewers access television content. Although this shift brings with it great potential benefits it unfortunately has also caused some detriment to the users. Amongst the most inflicting drawbacks to this new technology is the necessary investment every household should make in order to prepare themselves for the change, this is due to the fact that if they currently do not possess a TV capable of receiving digital signals they would either have to purchase a new one or opt for a DTV converter box, the latter being the more economical of both solutions. Countries with developing economies would more likely feel the pressure from this switch since most of their citizens would not have the means to purchase new TV's, therefore they would be presented with one option, either purchase a DTV converter box or remain excluded from the transition. This thesis embarked on a journey to determine the impact of this change and the potential market for DTV converter boxes in one of those developing economies, were the citizens would have to make this decision, Bolivia. The findings obtained by this study have determined that the influence of perceived usefulness on behavioral intention is not moderated by age so the effect is not stronger for the younger generation. The analysis also concluded that gender does have a direct negative effect on behavioral intention; this effect is stronger for females. Furthermore it was concluded that awareness plays a role of moderation. Therefore the higher the awareness in the individual the higher the positive effect on the relationship between PEOU and BI. Finally it was concluded that there is a strong positive correlation between perceived ease of use and perceived usefulness on behavioral intention.

These results are intended to facilitate the market entry of DTV converter box manufacturing companies into Bolivian market, as well as ease the efforts of the government towards a full transition to digital TV broadcasting.

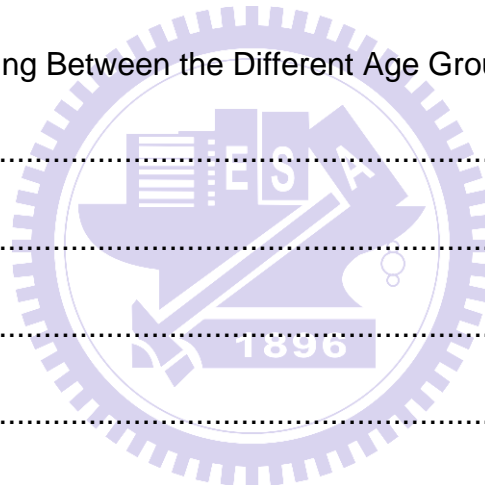
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## Chapter 1: Introduction

Currently most of the world's countries are undergoing a transition from the analogue television signal broadcasting system to the more advanced and interactive digital television broadcasting system. There are many reasons for this change, some of which include an improvement in quality of image and sound, the introduction of interactivity between users and the service providers and the digital dividend, the last one is perhaps the most commercial and economical of all other drivers behind this switch, as will become evident further into this study. <sup>1</sup>This switch from analogue to digital TV has been completed in most of the world; however it has not been a smooth process. In many countries it has caused unnecessary burdens that could have been avoided if the correct preemptive measures were taking. In addition this is not an inexpensive process and it has demanded great economic investment by government,

service providers and the public. The reason for this is that it requires a modification of the equipment used to emit and receive television broadcasts. This study will focus on the latter, the consumer's perspective. The needs and demands of the targeted customer for this media outlet will be the center of this analysis.<sup>2</sup>Many studies have been made in regard to this field; however they focus on either the actual acceptance of digital TV or the different standards of digital TV and not on the instrumentation the consumer must purchase in order to have access to the new broadcasting system, which in this case is the digital TV converter box. Adding to the uniqueness of the topic of this research is the fact that most of these studies have been conducted in countries where the analogue switch off has been in progress for many years now, not the case of Bolivia. Bolivia has only recently begun this process and therefore the research surrounding digital TV has been exclusively related to the standard the country would adopt when transitioning into digital broadcasting.

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<sup>1</sup> Galperin, Hernan (2004). New television, old politics: the transition to digital TV in the United States and Great Britain. Chapter 8, p. 186.

<sup>2</sup> Hart, Jeffery A. (2004). Technology, television, and competition: the politics of digital TV. Chapter 7, p. 137.



## Background of the Study

Television is today's most diffused communication medium.<sup>3</sup> It is known that work on its development began as early as 1876 when Paul Julius Gottlieb Nipkow B., a German technician, patented a rotating disc that could be used to capture and display an image using electricity. Although he had the patent, he never developed a useful working system with the disc and the patent expired some twenty years later. Then in 1925 John Logie Baird, a Scottish engineer, invented the world's first practical and publicly demonstrated television system. His system showed moving images being delivered via an electrical signal. The system used the Nipkow disc to produce the images so Baird's work was based on research carried out many years before. Despite the use of the disc, Baird was the first to successfully produce an operational television. Then in 1929 the BBC began public television broadcasts using Baird's system from their London television studio, these continued for seven years until they moved to a new fully electronic system in 1936.<sup>4</sup> Meanwhile, Philo Farnsworth was working on similar ideas in America and in 1927; he also demonstrated an electro-mechanical television system. Just two years later in 1929, he demonstrated a fully electronic system with no moving parts. This was an important development as there were significant limitations with the electro-mechanical systems. Farnsworth's electronic system provided a means to increase resolution far beyond that of the Nipkow method.

Another pioneer of the early television set was<sup>5</sup> Vladimir Zworykin, who was a Russian-American that in 1923 filed a patent for the "iconoscope" or the first electronic camera tube. Zworykin led a team of engineers at the Radio Corporation of America (RCA) in the development of the first commercial broadcasting of television in the US by 1939. The Iconoscope tube created by Zworykin was used for the first years of broadcasting but later in the 40's it was replaced by newer tubes with a more sensitive and higher resolution. Just about when black and white television had been exposed to the world a new goal was placed a head. Color television was the new destination and in 1925

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<sup>3</sup> Barbirato, W.; Morassutto, L.; Temporelli, M. (2008). Fracarro, from the disk of Nipkow to the digital convergence. History of telecommunications conference, 2008.

<sup>4</sup> Farnsworth, Russell. (2002). Philo T. Farnsworth: The Life of Television's Forgotten Inventor.

<sup>5</sup> Abramson, Albert. (1995), Zworykin: Pioneer of Television. University of Illinois Press, pp. 51-52.

<sup>6</sup>Logie Baird began developing a color version of his earlier creation. By 1928 he was able to demonstrate his full color version which was based on the electro-mechanical system used by him on the previous version; however it never went into commercial production. Nonetheless, it proved the concept of using red, green and blue signals to capture, deliver and display color television signals. Those principles are still in use today.

At the start of World War II television had become a viable medium of communication, therefore establishing technical standards in transmission and reception equipment was of vital importance. In 1940, the <sup>7</sup>National Television Systems Committee (NTSC) set the guidelines for the transmission and reception of television signals. With the US leading the charge into early broadcasting in the late 1940s, the technology available at the time became entrenched. For almost 60 years, television broadcasters have transmitted signals based on the "NTSC standard." This standard has not been significantly modified since it was adopted by the FCC in 1941. The major modifications made to it have been the introduction of color television in 1953; "ghost canceling"; the use of a previously unused portion of the transmission signal to send closed captioning; and stereophonic sound.

Engineers had long discussed ways of upgrading the existing NTSC standard, however for many years the broadcast community, <sup>8</sup>Congress, and the FCC placed little interest in undertaking such a large and complex challenge. In the mid 80's this attitude would change due to the development of HDTV and the MUSE analogue format proposed by Japanese companies, threatening the U.S. electronic companies. At this period in time the FCC was considering reassigning vacant portions of the broadcast spectrum to be used by Land Mobile users such as police departments, emergency services and others. By then television broadcasters had manifested their interest in reserving a percentage of the spectrum for the future development of HDTV. In order to further explore HDTV

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<sup>6</sup> R. W. Burns (1998). Television: An International History of the Formative Years, IET, p. 98.

<sup>7</sup> Abramson Albert (2003). The history of television 1942 to 2000, Jefferson, NC, and London, McFarland.

<sup>8</sup> National Television System Committee Reports (1951–1993), Library of Congress Online Catalog.

the FCC created the <sup>9</sup>Advisory Committee on Advanced Television Service (ACATS), this was a 25 member advisory panel dedicated to foster the development of a unique U.S. HDTV standard, reviewing the technical issues and recommending an ATV system to the FCC.

In their first congressional hearing regarding HDTV on October 1987, ACATS announced an open competition for the development of the best advanced television standard. ACATS decided that any new standard would have to be analog and could not interfere with any existing television technology. Twenty-three organizations submitted high-definition proposals to the congressional committee, and six were chosen to create prototypes that could be tested by 1991. Then, an American company, General Instrument, demonstrated the feasibility of a digital television signal. This breakthrough was of such significance that the FCC was persuaded to delay its decision on an ATV standard until a digitally based standard could be developed. Once the feasibility of Digital TV was clear the FCC decided that the new standard of ATV should be more than a simple enhancement of the analogue signals. The new standard should offer an image with at least twice the resolution of the existing standard. ACATS also determined that consumers **would not have to purchase a new television set** in order to continue to receive conventional television broadcasts, therefore the new standard needed to be capable of being “simulcast” on different channels.

This new standard would allow Digital Television to be created based on new design principles. This new standard was incompatible with the existing NTSC standard but it would bring many improvements such as:

- Progressive Scanning, which is a way of displaying, storing or transmitting moving images in which all the lines of each frame are drawn in sequence in contrast to the interlacing used in traditional television systems where only the odd lines, then the even lines of each frame are drawn alternately
- Square pixels, with 1,920 pixels per line displayed on 1,080 lines per frame, allowing a much sharper resolution than that of the current NTSC format.

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<sup>9</sup> Wu, Y.; Hirakawa, S.; Reimers, U.H.; Whitaker, J. (2006). Overview of digital television development worldwide.

- Increased frame rates, the more frame rates per second the more realistic the motion displayed will be.
- Additional lines per frame, allowing video images to be sharper in resolution.
- Different aspect ratios, giving a wider field of view.
- Higher sound quality, there are five discrete channels providing CD-quality sound.

These innovations to television broadcasting would allow the current programming more attractive; however this was not the only goal of the new standard. The FCC stated that it wished to promote a better free, local television service using digital technology that would allow the viewers access to both entertainment as well as public interest programming. The adoption of a uniform standard would also permit stability and continuity in the broadcast market, an issue which was of key importance amongst television set manufacturers. In order to once and for all select the adequate standard the Advisory Committee on Advanced Television Service decided to collaborate with the Advanced Television Systems Committee (ATSC) to obtain technical support over this query. In 1993 the ATSC established that digital television was superior over analog television, however they still found certain deficiencies in the four digital standards that were being considered at the time. This situation encouraged the competitors to bond and form coalition of the different digital systems in order to combine the best features of each of the standards, this coalition was given the name Grand Alliance. In 1995, after extensive testing, the ACATS formally recommended a set of prototype DTV protocols -- the Grand Alliance standards -- to the FCC. The major factors influencing this decision were video/ audio quality, interoperability with other video delivery media, spectrum efficiency issues, and cost.

In 1996 the FCC proposed adopting the <sup>10</sup>Grand Alliance standards and later that year it adopted them subject to some modifications. The cable and satellite companies were not affected and the G.A. standards covered five major technical subsystems: scanning, video compression, audio compression, packetized data transport, and radio-frequency

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<sup>10</sup> Hopkins, R. (1994). Digital terrestrial HDTV for North America: the grand alliance HDTV system.

transmission.<sup>11</sup> The Grand Alliance standards were composed of 18 different transmission formats, which caused certain conflicts with several industries such as broadcasting, television set manufacturers, film studios, and computer and software makers. Later that year it was made official, the old NTSC analogue standard would have to be replaced over a constrained period. Television producers would be required to upgrade their equipment in order to develop the broadcasted content under the newly established digital standard; this meant they would have to purchase new television cameras that were capable of filming in a widescreen digital format. Television stations would have to acquire new digital equipment as well and began a simulcast process. This also required viewers to prepare themselves for the end of analogue. This shift in technology would not pass unnoticed because it would require most viewers adapt their equipment to the new standard. Those who had subscribed to a cable service were not affected by the DTV transition since they already transmit digitally; it applied only to full-power broadcast television stations, stations that use the public airwaves to transmit their programming to viewers through a broadcast antenna. The rest would either have to buy a TV set with a digital tuner or have to purchase a digital-to-analog converter box to connect to their analogue television set.

In electronics, a digital-to-analog converter (DAC or D-to-A) is a device that converts a digital (usually binary) code to an analog signal (current, voltage, or electric charge). The converter box, also known as a digital television adapter (DTA), captures a digital transmission and transforms that digital signal into an analogue television signal that can then be viewed on an analogue television. Prototypes of the first converter boxes appeared at the NAB show in 2006. The National Association of Broadcasters (NAB) is a trade association representing the interests of for-profit, over-the-air radio and television broadcasters in the United States. LG Electronics showed its model connected to a TV from 1980 and Thomson Consumer Electronics used a television from 1987 for its demonstration.

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<sup>11</sup> Federal Communications Commission (December 24, 1996). *Fourth Report and Order in MM Docket No. 87-268, FCC 96-493.*

There are significant differences between analogue and digital TV. For one thing analogue TV broadcasting is restricted to audio and video signals that are transmitted over air waves, just like radio stations. In analogue broadcasting each TV station uses a single frequency over which it broadcasts signals, these frequencies are better known as channels. Due to its "over the air transmission", the signal is much weaker and some of the disadvantages of this type of broadcasting include interference with the frequencies, which creates a channel with noisy static and annoying "snow" disrupting the program you are attempting to view. Also, because analog TV broadcasting signals vary and fluctuate depending on several factors, you may experience instable color, brightness and sound quality.

<sup>12</sup>On the other hand digital TV broadcasting utilizes "packets" of compressed data to transmit television programs. The audio and video workings of a program are packaged together and broadcasted to the digital TV or analog television with a converter, cable, or satellite box. The system used to transmit sound, picture and even text in digital TV broadcasting is very similar to the way pictures and sounds are transmitted to your computer through the Internet. Digital television broadcasting is not subject to the same type of interference experienced by analog TV. There is no such thing as a weak digital TV signal, it either works or not. Digital TV allows a consistently clear, bright picture, high-quality audio and no static or snow. Digital TV broadcasting allows television stations to transmit more data using the same bandwidth they were using to broadcast analog television. Therefore they can supply more features such as surround sound or high-definition programming using the same amount of space it took before to broadcast basic audio and video, even allowing for interactive content.

The superiority of digital TV broadcasting over analogue TV broadcasting is obviously one of the major reasons behind this transition. However this decision was not merely based on image or sound quality. The roots of the transition to digital television broadcasting lie in a more effective use of radio-frequency spectrum. In analogue TV broadcasting is done through radio-frequency channels. Each TV channel transmitted

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<sup>12</sup> Lundström, Lars-Ingemar (2006). Understanding Digital Television. An introduction to DVB systems with satellite, cable, broadband and terrestrial TV distribution.



requires an entire frequency and in order to avoid interference the same frequency can only be used again when there is a large distance in between broadcasters. Digital TV on the other hand enables the use of advanced compression algorithms to compress audio and video signals, consequently we can use one frequency channel to transmit more than one service (usually three to ten and even more TV channels), and we can build a network of transmitters operating on the same frequency thus significantly lower the number of frequencies (channels) needed to cover a territory.

As analogue broadcasting is substituted by digital broadcasting it is possible to accommodate the existing analogue TV channels in fewer spectrums than before. This means that once the analogue switch is completed the amount of spectrum that will be released will be of a significant amount. The release of this spectrum is known as the “Digital Dividend” and will serve for many purposes:

- For starters it will allow many more digital television broadcasting services of conventional quality and resolution,
- A new service concept (partially or totally) that allows for indoor, portable and mobile reception including digital TV services for reception on hand-held receivers,
- Enhanced sound and picture quality, like High Definition TV, Three-Dimensional TV
- New potential users that do not belong to the broadcasting family of applications could use it to deliver ubiquitous broadband Internet access to areas not yet reached by landlines, thus helping to overcome the digital divide.

All these new possibilities have sparked the interest of several telecommunication companies searching to acquire this newly released spectrum. It is important to state that the amount of spectrum that this transition into digital broadcasting will release will depend on the characteristics of each country such as geography, the degree of penetration of cable and/or satellite services and the spectrum usage of neighboring countries. The amount of released spectrum will also depend on the technology used to replace the analogue broadcasting in that country. Therefore there will be variations in the size of released spectrum from country to country and from region to region within

each country. Despite the fact that not every country will be able to free up the same amount of spectrum there is great potential for its development, especially in regard to mobile communications, however if the digital dividend is to be utilized by mobile services, a worldwide or at least a region-wide frequency harmonization is required. If possible, such harmonization would create enormous benefits in terms of social impact and increased productivity.

### Progress into Fully Digital Broadcasting

<sup>13</sup>The first country to fully switch off all analogue broadcasting and transition into the digital age was Luxemburg on Friday September 1<sup>st</sup> 2006 followed, short after by the Netherlands in December of the same year. The switch for both these countries was relatively easier since before the switch 90% of the citizens already were subscribed to a cable service. This means that those who had cable TV, which was almost the entire population, would have access to digital TV regardless of the fact that their TV's were or were not equipped with a digital tuner since the cable box they already had served the same purpose. <sup>14</sup>Many European countries like Sweden, Finland and Switzerland were also among the first to shift into digital broadcasting, the main reason for this was that these countries had a high penetration of cable and satellite television services; therefore the switch was made easier and almost seamless for the users. However other countries did not share the same conditions and took a longer time to fully transition. Germany for instance began the switch off in 2002 but continued with simulcast well into 2009 when the transition was completed. <sup>15</sup>The United States was the first non-European country to switch off all analog signals in June 12 2009. According to the Digital Transition and Public Safety Act of 2005, full-power broadcasting of analog television in the United States was originally scheduled to be ceased after Tuesday February 17, 2009 and in order to help U.S. consumers through the conversion, the Act also established a federally-sponsored DTV Converter Box Coupon Program. The

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<sup>13</sup> OECD Communications Outlook (2007). Organization for Economic Co-operation and Development

<sup>14</sup> DigiTAG - The Digital Terrestrial Television Action Group (2008). Analogue switch-off learning from experiences in Europe.

<sup>15</sup> DTV delay act. United States Law No: 111-4 (introduced 1/29/2009).



transition in the United States proved to be somewhat more complex than that of the European countries again due to the level of penetration of cable and satellite systems.

<sup>16</sup>As mentioned before, the United States government established a federally-sponsored DTV Converter Box Coupon Program which was targeted to aid low-income, elderly, disabled, inner city, immigrants, and rural Americans, because these groups mainly watch analog antenna TV more than any other groups. Through this program, analog TV households could request two \$40 coupons towards the purchase of a digital-to-analog converter box. This program was destined a \$990 million budget with an additional \$510 million back up. It was destined only to “Over the Air” users and received additional funding in 2009. Each coupon was valued at \$40 and could only be used one at a time. The coupons were tracked electronically and would expire within 90 days from their emission. Not all the converter boxes were covered by this program. The coupon would only be valid towards the purchase of a “Coupon-eligible converter box” or CECB. The qualifying boxes were selected by the National Telecommunications and Information Administration (NTIA).

Although the original date established for the cease of all analogue broadcasting in the U.S. was February 17<sup>th</sup> 2009, this soon proved to be impossible. For this reason the DTV Delay Act, which was enacted on February 4<sup>th</sup> 2009 and later on signed into law by President Barack Obama on February 11<sup>th</sup> of the same year, rescheduled the mandatory shut off date to June 12 2009. The reason for this extension was necessary since millions of households had not been able to get their coupons because the demand for these coupons exceeded the funding initially designated for this program and millions were placed on a waiting list to receive the coupons. In 2009, through the American Recovery and Reinvestment Act, funding for extra coupons was approved. On the midnight of February 17<sup>th</sup> 2009 641 TV stations, which made up 36% of the U.S.’s full power broadcasters, switched to full digital transmission. The U.S. government was under great pressure from the public to handle this transition carefully, without causing any avoidable cost to the citizens since a projected 1.8 million people would lose access to all “Over the Air” broadcasting of TV due to the digital transition.

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<sup>16</sup> Moller N. Alane, Pletson E. Charles (2008). Telecommunications and media issues.

The examples mentioned above include only those countries where the transition has been completed. Now we shall discuss the progress in those countries which are currently in the middle of the transition. It is important to point out that there isn't a single Latin American country which has completely transitioned into digital broadcasting. This means that some of the largest players of the global economy like Brazil and Mexico have not been able to completely shut down their analogue broadcasting; they have each set a tentative deadline for the switch. Brazil plans to go digital by June 29, 2016 and Mexico originally scheduled the blackout by 2021 but later reduced that period to the year 2015. Interestingly enough is the fact that Australia, France and Russia have also been unable to complete the shift, although they have scheduled to do so later this year with the exception of Russia who has scheduled the shift to be completed by 2015. Japan has been running an intense nationwide campaign announcing the planned switchover to digital terrestrial and satellite television on Sunday, July 24, 2011. The United Kingdom has scheduled a full shutdown of all analogue broadcasting by the year 2012. The Four Asian Tigers, which include the economies of Hong Kong, Singapore, South Korea and Taiwan (ROC), have announced their transition to end by 2012 with exception of Singapore who has established that this change will occur anywhere between 2015 and 2020.

<sup>17</sup>As previously mentioned no Latin American country has been able to convert to full digital broadcasting. In the case of Bolivia, as of July of 2010 it announced it entered an agreement with Japan to switch Bolivia's TV system from analogue to digital. Analogue technology in Bolivia is scheduled to be switched off in 10 years' time.

There are several standards for digital TV; these standards include DVB/T, ATSC, ISDB/T and DMB-T/H. The Foreign Minister of Bolivia, Mr. David Choquehuanca, announced that Bolivia adopted ISDB-T as the standard of the digital terrestrial TV. This is the same standard for digital broadcasting adopted by the majority of Latin America and Japan. It is often referred to as to the Japanese-Brazilian standard. Latin America is following a different trend in this transition than that of the U.S. and Europe which have opted for the ATSC and DVB/T standards. The ISDB-T format was originally developed

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<sup>17</sup> Franquet, Rosa. Larrègola, Gemma (1999). Comunicar en la era digital.

in Japan and later modified in Brazil. It was designed to allow radio and television stations through digitalization as well as permitting the transference of data. This format for digital TV was improved thanks to the recommendations of Brazilian researchers and universities who suggested the addition of H.264 compression to this standard. The advantage ISDB-Tb (b for Brazil) offers is that it has a “1-Seg” feature which allows embedding a free-for-all low resolution signal for mobile phones and netbooks as well SD and HD quality broadcasting. The way this works is that ISDB-Tb divides each channel into 13 segments, with a further segment separating it from the next channel. Digital TV occupies 12 of the 13 segments allowing the 13<sup>th</sup> segment to be used by mobile receivers hence the name “1-seg”.

The existence of diverse standards for digital broadcasting has initiated a battle between the different patent holders to install their format in as many countries as possible.<sup>18</sup> The fiercest competition for a while seemed to be that between the U.S. and Europe. Each of them has developed their own standard for digital broadcasts, ATSC and DVB/T. As a result they began a strong campaign to promote their systems in foreign states. The most sought out nations were China, South Korea, South Africa and Central and South America. The importance of winning these markets is that many companies from the U.S. and Europe hold patents behind these systems and therefore expect to sell equipment to broadcasters and consumers around the world worth billions of dollars. Then another big player came into the picture, Japan with its Integrated Services Digital Broadcasting (ISDB) format, this is the most advanced international standard on digital terrestrial television broadcasting format and soon began to take the lead in the Digital Broadcast Standard race. Between October 2009 and June 2010, Venezuela, Ecuador, Paraguay and Costa Rica had all adopted the ISDB-T standard confirming Japan’s dominance in this region. Only Colombia and Uruguay opted for Europe’s DVB standard. On June 18 2010 the Philippines became the first Asian country to adopt the ISDB-T system after Japan. The reason given by the Philippine officials was that the terrestrial digital TV standard developed by Japan and Brazil offers better reception quality than

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<sup>18</sup> Grimme, Katharina. (2002). Digital television standardization and strategies.

the US-European design and allows the emergence of more programming choices for viewers.

As of this moment <sup>19</sup>Africa is perhaps one of the most controversial regions over the matter of deciding on a standard for digital broadcasting. Take South Africa for instance, they initially had agreed on implementing the European DVB standard but in May 2010 they announced that they would reconsider their decision. It is believed that they began to review Japan's ISDB technology after South African Broadcasting Chairman (SABC), Ben Ngubane, a former South African ambassador to Japan, met a Japanese delegation. A highly controversial decision since a number of signal distributors had already installed a number of DVB digital broadcast transponders since the original European DVB standard was adopted in 2005. Fortunately this matter was resolved on January 14 of this year after a recommendation from the Southern African Development Community (SADC) mandated that the Southern African region adopt DVB-T2 as its DTT standard ending the long battle between the European DVB-T and Japanese ISDB-T digital broadcasting standards in South Africa. Another African country surrounded by controversy over this matter is Ghana seriously upsetting the International Telecommunication Union (ITU) who has threatened to withdraw protection of their TV stations if this country those not switch from analogue to digital broadcasting in the following six years.

South Korea was indecisive for a while before it chose to join a small group of countries that have opted for the American ATSC standard. The importance of the Korean market is due to the fact that they are regarded as the world leaders in mobile TV. Around 27 million people regularly enjoy TV on their mobile phones; this translates to 56% of the country's entire population. The giant of the world, China, has surprised everybody by developing its own standard which is said to be one of the most sophisticated standards out there. They initially observed the ATSC and DVB standards but later decided that they could develop a better system, coming up with the GB20600-2006 standard which supports both fixed and mobile systems and is also capable of sending high resolution images. The Chinese system supports payloads of 24Mb/s while the U.S. only supports

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<sup>19</sup> Dhir, Amit. (2004). The digital consumer technology handbook: a comprehensive guide to devices, standards, future directions, and programmable logic solutions.

19Mb/s, and mobile reception speeds greater than 200km/h. This meant a significant market loss for patent holders and manufacturers from other countries. China has developed a superior standard and will not depend on any outsider to supply its digital broadcasting equipment.

Not only does the transition from analogue to digital cause change in the broadcasting of television but it also means broadcasters and viewers will have to update their equipment. As mentioned before this was an important factor driving the battle to set up the broadcasting standards in each region, since it would mean that all the equipment required for the switch would have to be designed to fit these standards. An important piece of equipment necessary to successfully complete this transition is the converter box of which have already discussed before. If more countries adopted the Japanese standard well then it would also mean that the Japanese converter manufacturers which hold the patents for this technology would benefit. This is why having selected ISDB/T as the standard for the majority of Latin America meant a great win for Japan, especially since this one of the regions in more need of converter boxes. The reason why this region is in a higher need of converter boxes is the fact that these are countries in development and therefore, in contrast to the U.S. and some European countries, their citizens cannot cover the cost of purchasing a new television and will require a low cost solution. Bolivia is a perfect example of this situation.

### **Bolivia and its Digital TV Situation**

<sup>20</sup>Bolivia is a country with nearly 10 million residents; many of who live below the poverty line, 30% of the population lives with an amount below the equivalent of \$4 U.S. dollars a day. This one of the poorest and least developed countries in the continent despite its great reserves of natural gas, oil and several other minerals. The reason for its current economic situation can be traced back to the 1980's when the country underwent a severe financial crisis accompanied by one of the worst hyperinflations in history. Before 1984 the highest denomination was 1,000 pesos Bolivianos, but by 1985 the highest denomination was 10 million pesos Bolivianos. During this period of hyperinflation 1million pesos Bolivianos were worth only 55 cents in U.S. dollars. In the 90's several

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<sup>20</sup> <https://www.cia.gov/library/publications/the-world-factbook/geos/bl.html>

privatizations were carried out by the ruling government which initially sparked the economy but later caused significant social problems. Between 2003 and 2005 Bolivia suffered from a remarkable period of political instability. Racial tensions were at a high, accompanied by several protests and marches carried out in their majority by the poorer indigenous class, which for several years has been regarded to a treatment of a second level citizen. On December 18, 2005 this whole situation changed when Bolivia elected its first indigenous president, Mr. Evo Morales. With 53.7% of the popular vote he annihilated his competition in a historic victory of which no previous candidate had been capable. Two and a half years later Morales proved an increase in his popularity when a recall referendum on August 14, 2008 showed that more than two thirds of voters voted in his favor. Morales reelected as president in December 2009 by 63% and currently continue to occupy his role as head of state.

<sup>21</sup>The history of Bolivia's political and economic situation reflects the difficulty of this market. The financial situation of the majority of its inhabitants and the constant political instability makes it difficult to adapt to sudden change, especially when the cost of the change must be bared directly by the citizens. It seems that whenever governments intend to introduce a new policy or plan which will entail a cost for the citizens, it is harshly criticized and mass mobilizations take place in protest. An example of this would be the stir up that occurred when on late December of 2010 the government found necessary to raise the prices of fuel in the country. The government had frozen the price of gas and diesel for six years, subsidizing the cost. The subsidy allowed the price of the fuel in Bolivia to be significantly cheaper than that of its neighboring countries, this situation created a serious consequence which was the propagation of contraband of fuel to these countries. It was estimated that contraband is responsible for an annual loss of up to \$105 million dollars a year. It would make sense why this measure should be implemented however the measure was not well received by the public which once more mobilized in masses to protest, practically paralyzing the entire nation and forcing the president to revert this measure. The result was that the president of Bolivia caved in to the pressure after simply a couple of hours from setting it in motion. The reason it is

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<sup>21</sup> Mesa de José, Gisbert Teresa, Mesa D. G. Carlos. (2007). Historia de Bolivia



important to present a real example of the political situation in Bolivia is to allow for a better understanding of the risks most newly adopted policies are presented with.

Switching from analogue to digital will surely cost Bolivians money, there is no denying that, the importance resides on what measures the government intends to take in order to reduce this cost to a minimum and how much people are willing to invest personally in this process. It will take a conjunct effort between government, the private sector and the consumers to allow for the proper conclusion of this process. It is clear that purchasing a new television set with a cost of around \$250 U.S. dollars in order to have access to television broadcasting will not be accepted by the population and it will surely cause, once more, a civil uprising that can jeopardize the political stability of this nation. The solution to this issue seems to be the digital converter box. With a lower cost and with the capability of fitting older equipments, it will surely fill a need. The question now is how exactly the government must conduct this transition along with the promotion of the converter box which will allow all sectors of the population access to this basic means communication.

### Statement of the Problem

This study addresses the lack of empirical information regarding the acceptance of the transition from analogue television broadcasting to digital television broadcasting and the perceived public need for digital signal converters in the Bolivian market. Although the transition into digital television broadcasting is mandatory due to global acceptance of this technology it is still necessary for the government to understand the public's perception towards this change in broadcasting systems in order to facilitate the process. The unique conditions of a country such as Bolivia, which has a history marked by several years of social instability and civil disobedience in reaction to governmental policies that require any economic disbursement from its citizens that is collectively viewed as unnecessary has been the cause behind several government overthrows, has made of it a difficult market to analyze. This is why several companies dedicated to the manufacturing of technology related products skip this market all together during their sales forecast and targeting. However the opportunity for business is evident, especially for those companies involved in the commercialization of digital signal converters; the reason for this is that a high demand for such products will be created due to mandatory

nature of the transition from analogue to digital. This will force all of those members of the public who do not possess a television capable of receiving digital signals to either purchase a new television or acquire a digital converter box, the second option being the more realistic for an economy such as Bolivia. In order to analyze the acceptance of this new technology and in order to evaluate the perceived need for the digital converters this study will apply the technology acceptance model (TAM).

### Significance of This Study

There is an evident lack of empirical research related to the market for digital converters in Bolivia. It is important to understand that due to the economical and social circumstances present in Bolivia the population is not capable of undergoing sudden changes without first being consulted. An average family in Bolivia lives on a daily budget of less than 8 dollars a day and therefore they are strictly restrained in their expenses. Even the most essential products and services are many times unobtainable by a typical Bolivian family; therefore luxuries of any kind are out of the question. If a family decides to spend an important amount of its income on a single product they must be convinced of the importance of this investment. It is for this reason that when discussing the market opportunity for products such as digital converters, which are not crucial to the survival of the members of the household, it is even more necessary to clearly establish the beneficial factors behind the purchase of such goods. Although having access to television may be perceived as superfluous we must understand the true nature and purpose behind this media outlet, which is the access to information. The majority of the information dissipated to the public in today's world is possible through television broadcasting; this is perhaps the most accessible way to obtain a variety of information second only to the internet. If we think about the significance of free and unrestrained access to information, money should not be an obstacle. This is why the Bolivian government, in the pursuit of fortifying and confirming its democracy has decided to improve its citizens access to information. As part of this initiative they have accepted to implement digital television broadcasting in the coming years. The government believes that digital television will improve the quality of the content transmitted as well as allowing the possibility of interactivity between users and the broadcasters, creating an unprecedented and useful tool for education. Although the



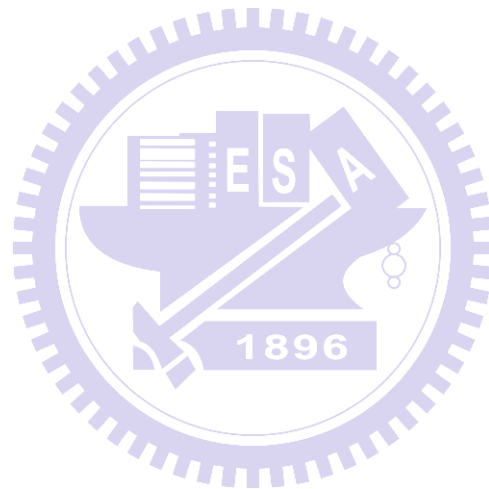
government has decided to fully assume this transition it has not yet begun investigating the necessary procedures to allow the initiation of the process. It is for this reason that studies like this are vital. It is important to collect the Bolivian citizen's views and opinions over this matter In order to avoid a rejection of this technology by the public since it has the potential to truly improve their access to information of a higher quality.

### **Bolivia; “Bottom of the Pyramid”**

The concept of the bottom of the pyramid in economy is the largest, but poorest socio-economic group. There are 2.5 billion people around the world who live on less than \$2.50 per day. Due to the fact that Bolivia is a developing country with 60% of its population living below the poverty line, many of its citizens certainly make up part of this group. Traditionally technologic products are targeted towards the wealthy elite and the expanding middle class and rarely target the masses in these countries who account for 65% of the world's population. Although the purchasing power of each of its citizens is low, it does not mean that Bolivia should be overlooked when it comes to technology related products. International marketers have been turning increasingly to markets in developing countries as markets in developed countries reach saturation point. important to indicate that this study will have to be conducted under special conditions and cannot be compared to previous studies conducted on developed countries since the target market as well as the marketing strategy itself will have to be customized to , the populations needs and possibilities.

There are a several ‘western’ models to measure buyer behavior; however research has shown a need for these models to be modified when doing business in developing countries. Different tastes, customs and habits are likely to result in different preferences. For instance the model of innovation diffusion does not apply uniformly to all international markets, reason for this are the differences in culture. Different cultures have a different attitudes towards past, present and future technologies. This thesis will follow the T.A.M. (Davis, F. D. 1986). It is important to indicate that this model has been modified in order to correctly measure the necessary factors for this study. The problem with models like these is that they view most markets as being similar and do not differentiate between groups within such markets on socio economic lines. However buyer behavior is likely to be different between the wealthy and the poor rural masses.

The present study has taken into consideration these special conditions and characteristics and has adjusted the model to better fit Bolivia's situation.



## Chapter 2: Literature Review

### Introduction

Due to the inevitable switch from analogue to digital television broadcasting the demand for the equipment necessary to perceive this new way of television signal broadcasting will evidently rise.<sup>22</sup> The global market for digital converter boxes is expected to hit 226 million in 2015, most of the growth in this market will be in the Asia-Pacific, Latin America and Eastern European regions, the digital converter box market for China will grow at nearly 10% a year between 2010 and 2015 (Broadcasting & Cable magazine). Latin America's digital converter box market is expected to reach 18mn units sold in 2015 compared to 10.8mn in 2010, (ABI Research senior analyst Sam Rosen, BNamericas). Of the amount sold in 2015, 62% will correspond to terrestrial digital TV STBs, most of which will belong to the Japanese ISDB-T standard that has been selected by Brazil, Chile, Argentina, Ecuador, Peru, **Bolivia**, Paraguay, Costa Rica and Venezuela.

<sup>23</sup>The Dominican Republic, Honduras, El Salvador and Mexico picked the US standard ATSC. Currently some 50% of STBs sold are in Mexico, but Brazil is due to take over as the biggest STB market, seeing a 38.5% CAGR from 2010-15. While Brazil has already been perceived as the clear target for all digital converter box manufacturers the Bolivian market has been overlooked. Although the size of this market cannot compare to that of Brazil the potential for great economic gain still remains, as long as manufacturers act quickly and obtain a first mover advantage. If a large enough manufacturer, capable of covering the needs of the Bolivian citizens, entered into agreements with Bolivian government it could easily secure this market. As of the moment no such agreement has been initiated. In order for both manufacturers and the government itself to feel more secure about the current situation and future potential of this market it is necessary to conduct an analysis of the public's acceptance of digital television but more importantly of digital TV converters. The following paragraphs offer a

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<sup>22</sup> Barker, Dennis. (2008). Digital TV set-top box sales break 100M barrier, says Strategy Analytics. EE Times news & analysis.

<sup>23</sup> Dasari S. Jayant. (2009). Set-Top Boxes: Outlook, Parks Associates.

brief explanation of the model used to determine the acceptance of this new technology and how they will be applied to this specific case.

### Technology Acceptance Model (TAM)

In order to determine the intended usage and perceived usefulness of a new technology from the user's perspective, several researchers have utilized the technology acceptance model. It is considered to be the most influential and commonly employed theory for describing an individual's acceptance of information systems. The TAM model was originally proposed by Davis 1986, it evolved from the Theory of Reasoned Action introduced by Ajzen and Fishbein in 1980, which presented a crucial weakness which was the use of abstract concepts such as "belief" and "evaluation" as factors influencing attitude. The TAM on the other hand proved to be a more powerful and robust model for predicting and explaining user behavior. Although this model presented a superior and more complete option than the Theory of Reasoned Action, it still lacked the inclusion of social factors that play an important role in an individual's attitude.

For this reason the TAM was modified by researchers such as <sup>24</sup>Venkatesh and Davis who proposed the TAM2. This new form of TAM included subjective norm, voluntariness, and image, as well as cognitive instrumental processes. It was discovered that social influence and cognitive instrumental processes influenced user acceptance significantly. Social influence is a relevant factor when analyzing a technological upgrade that will affect the society as whole, regardless of the social-economical level of the individual user, as is the transition from analogue to digital television broadcasting. This revised form of the traditional TAM receives the name of the "Unified Theory of Acceptance and Use of Technology (UTAUT)". The importance of social influence in the Bolivian society has made of this theory the basis of this study. Social influence and in particular identification with fellow citizens and the subsequent internalization of this concept is how Bolivians seem to accept change. The reason for this is the long tradition of populist leaders who single handedly influence a sizeable size of the population. Their seems to be a group pressure on the group itself, therefore if the technology switch is not

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<sup>24</sup> Viswanath Venkatesh, Fred D. Davis. (2000). A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies.

collectively accepted it can easily be rejected, although there may be sectors that agree with it, they will simply follow the rest. This is not a phenomenon exclusive of Bolivia but of most Latin American nations. The second reason why this is a proper tool for the current research is that subsequent validation of UTAUT in a longitudinal study found it to account for 70% of the variance in BI and about 50% in actual use. For these reasons this model will be used to determine the perceived ease of use and perceived usefulness of this new technology in the Bolivian society.

The <sup>25</sup>TAM2 (UTAUT) assumes that an individual's acceptance is determined by two major variables:

- **Perceived Usefulness (PU)**
- **Perceived Ease of Use (PEOU).**

This model also accepts several external concepts which include:

- **Voluntariness**→ the degree to which use of the innovation is perceived as being voluntary, or of free will (Moore and Benbasat, 1991).
- **Relative Advantage**→ The degree to which an innovation is perceived as being better than its precursor (Rogers 1983).
- **Complexity**→ The degree to which an innovation is perceived as being difficult to use (Rogers 1983).
- **Observability**→ The degree to which the results of an innovation are observable to others (Rogers 1983).
- **Trialability**→ The degree to which an innovation may be experimented with before adoption (Rogers 1983).
- **Image** The degree to which use of an innovation is perceived to enhance one's image or status in one's social system (Rogers 1983).
- **Self efficacy**→ The belief that one has the capability to perform a particular behavior (Bandura 1977).

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<sup>25</sup> Venkatesh, V.; Morris; Davis; Davis (2003), "User Acceptance of Information Technology: Toward a Unified View", MIS Quarterly, 27, pp. 425–478.

- **End User Support** → A high level of support that promotes more favorable beliefs about the system among users as well as MIS staffs (Igbaria et al. 1995).
- **Objective Usability**→ A construct that allows for a comparison of systems on the actual level of effect regarding to complete specific tasks (Card et al.1980).
- **Personal Innovativeness**→ An individual trait reflecting a willingness to try out any new technology (Agarwal and Karahanna 2000).
- **Social Presence**→ The degree to which a medium permits users to experience others as being psychologically present (Fulk et al. 1987).

The TAM2 (UTAT) has been applied to different technologies, under different situations, with different control factors and different subjects. According to the TAM2 (UTAT), if a user perceives a specific technology as useful, she or he will believe in a positive use-performance relationship. Since effort is a finite resource, a user is likely to accept an application when she or he perceives it as easier to use than another. As a consequence, new technology with a high level of PU and PEOU is more likely to induce positive perceptions. The relation between PU and PEOU is that PU mediates the effect of PEOU on attitude and intended use. In other words, while PU has direct impacts on attitude and use, PEOU influences attitude and use indirectly through PU.

According to the basis of this model, in order for a user to accept the new technology it is crucial that he or she believes that this new version is superior, easier to use and posses higher benefit when compared to the previous version. In this specific study this comparison will be made between analogue broadcasting and digital broadcasting. Once the importance of digital TV is confirmed we will proceed to determine the acceptance of the digital converter box. Therefore in order to successfully introduce this product into the Bolivian market it is important to initially determine the degree of importance digital TV has for the typical Bolivian citizen. Acceptance of digital TV will be the independent variable that will influence the dependent variable which is the acceptance of the converter boxes. Besides the external factors already mentioned demographic variables like age, economic level and gender will also influence the intended usage of a new technology.

**Table 1: Previous research related to the topic**

No.	Topic	Researcher
1.	An empirical study on the adoption of information appliances with a focus on interactive DTV.	Jieun Yu, Imsook Ha, Munkee Choi and Jaejeung Rho 2004
2.	Extending the TAM for a t-commerce.	Hun Choi, Minseok Choi, Jinwoo Kim and Hyoshik Yu (2002)
3.	Predictors of audience interest in adopting Digital television.	Atkin, J.A., Neuendorf, K., Jeffers, L.W. & Skalski, P. (2003).
4.	Audience knowledge, perceptions and factors affecting the adoption intent of terrestrial digital television.	Chan-Olmstead, S.M., Chang, B. (2006).
5.	Perceived Usefulness, Perceives Ease of Use and User Acceptance of Information Technology.	Davis, F.D. (1989).
6.	Analogue to digital switch over: Human aspects of adoption, A scoping study for the Digital Television Project.	Sapio, B., Turk, T., Cornacchia, M., Papa, F., Nicolò, E., Livi, S. (2002).
7.	Building scenarios of digital television adoption: a pilot study. Submitted to Journal of Technology Analysis & Strategic Management.	Sapio, B., Turk, T., Cornacchia, M., Papa, F., Nicolò, E., Livi, S. (2009).
8.	Microsimulating the Adoption of Digital Television and T-Government Services. Proceedings of the Workshop “Digital Television Revisited: Linking Users, Markets and Policies”.	Sapio, B., Turk, T., Cornacchia, M., Papa, F., Nicolò, E., Livi, S. (2008).

The present study has conducted its analysis following primarily the first two studies listed on the chart above due to their proximity in terms of methodology and topic of analysis. In the case of the first paper the researchers developed a theoretical model of



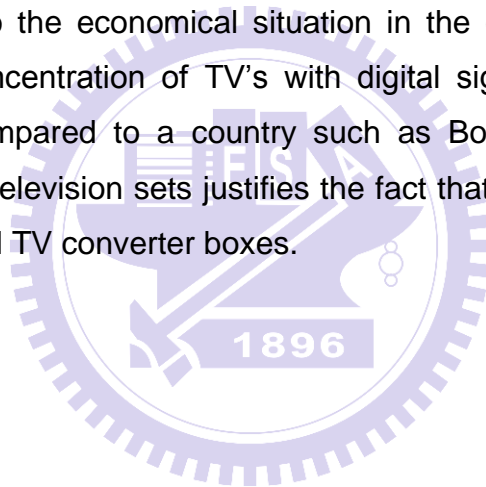
technology adoption specific to interactive TV, a representative example of information appliances, based on prior research regarding general technology acceptance. This is completely congruent with the objective and approach adopted by this thesis. As it has already been previously mentioned, the objective of this thesis is to measure the acceptance of digital TV with specific emphasis as to the use of digital converters to access this type of broadcasting. Following the work of the researchers Jieun Yu, Imsook Ha, Munkee Choi and Jaejeung Rho on technology adoption specific to interactive TV, the present researcher has developed a model for measuring perceived ease of use, perceived usefulness and awareness of digital TV and digital converter boxes amongst the Bolivian society.

The research conducted by the Korean experts has utilized a large-scale online survey to test the validity of their proposed model; this has also been the selected tool to analyze the validity of this thesis' model, as will be further explained in the coming chapter. Both the guiding research and the current study shared a common result which was that there are three major factors influencing behavioral intention which were attitude, subjective norm and perceived behavioral control. The second study titled "Extending the TAM for a t-commerce", has also influenced the direction and procedure of this research extensively, specifically as to the type of TAM model applied. This second study focuses on explaining the factors that influence potential users' adoption of t-commerce by extending the technology acceptance model through a theoretical and empirical analysis. The study compared factors influencing t-commerce adoption between experienced and inexperienced users. The major contribution of this paper to this thesis was the extension it introduced to the TAM for t-commerce adoption by potential users in the home environment. This same extension was applied to the present study introducing the concept of awareness as part of the factors influencing perceived ease of use and therefore behavioral intention. The researchers Hun Choi, Minseok Choi, Jinwoo Kim and Hyoshik Yu concluded that PU and PEOU are insufficient factors for determining consumers' adoption of t-commerce because of the characteristics of this technology. They decided to add trust and entertainment as determinating factors to measure the adoption levels for this product, the reason for this was that television itself conveys a sense of enjoyment and t-commerce requires a



monetary transaction. In similarity to this approach the present study has added the already mentioned factor of awareness since it will prove necessary for individuals to have some consciousness towards the shift from analogue to digital TV broadcasting and the required measures to be taken in order to receive this service if we are to obtain clear and concise insight from this research.

The studies mentioned above are related to the adoption of Digital TV in their region however they focus on the interactivity of DTV services and how they can successfully commercialize them. The uniqueness of the present study is that it does not intend to concentrate on the services or the acceptance of Digital TV as such. The intention of this study is to determine the acceptance levels for digital TV converters. The reason why the referenced studies have not considered the acceptance or rejection of the DTV converter boxes is due to the economical situation in the countries where they have been conducted. The concentration of TV's with digital signal reception capability is noticeably high when compared to a country such as Bolivia. For Bolivia the large number of analogue only television sets justifies the fact that this study is concerned as to the acceptance of digital TV converter boxes.



## Chapter 3: Methodology

### Research Design

This study was conducted following the cross-sectional quantitative survey design in order to allow the observation of all of the population, regardless of the social-economical level or education background of the participants. The aim of this investigation was the measurement of the perceived usefulness, perceived ease of use and other factors influencing the usage and acceptance of digital TV converter boxes in Bolivia. All of the recipients of the survey were Bolivian natives residing within the Bolivian territory.<sup>26</sup> This survey was developed following the TAM model developed by Davis; however it extended that model in order to incorporate additional questions related to both the dependent and independent variables. These variables were perceived usefulness, perceived ease of use. There were also three moderators considered during the elaboration of the questionnaire which are awareness, gender and age.

As a primary assumption it was considered that all of the participants in the survey would answer in an honest manner providing only accurate answers. A second assumption was that the participants had access to a television set and, in different measures, enjoyed viewing television. It proved necessary that surveyed had access to a television set and that they viewed television on a regular basis, since only under these circumstances would they be sufficiently familiar with the current quality and the system used for television broadcasting as well as being able to know the specifications of their own television set. The surveyed must fit the already mentioned criteria in order to adequately measure the perceived usefulness, perceived ease of use and the other factors influencing their usage and behavioral intention of digital TV converters.

### Research Goals

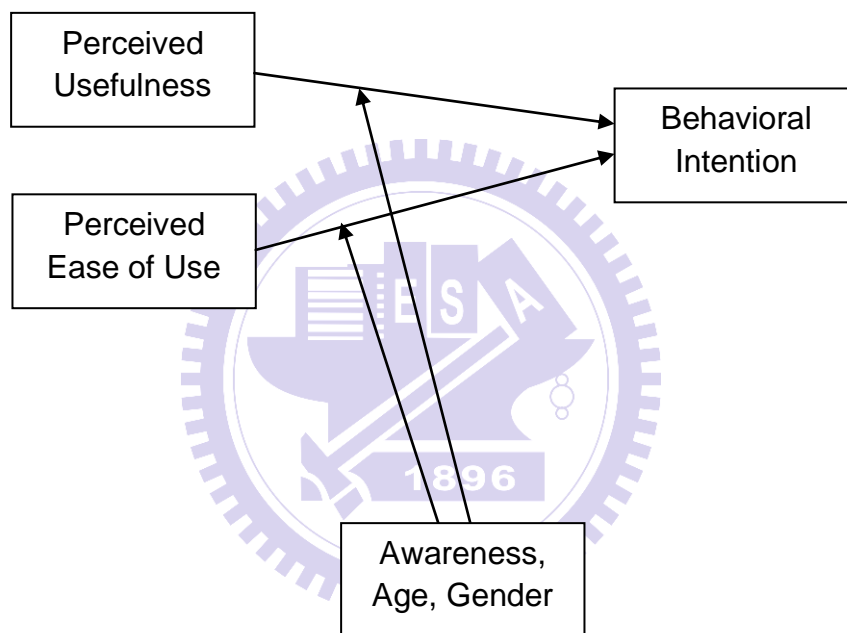
- Address the lack of empirical knowledge related to the transition from analogue to digital TV scheduled to occur in Bolivia in the coming years.
- Recollect the general opinion of the average Bolivian citizen in regards to DTV and DTV converter boxes.

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<sup>26</sup> Davis, F.D. (1989, September). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 318-340.

- Determine the awareness amongst the Bolivian population in regards to this new technology.
- Establish the level of acceptance or rejection to this technology and the transition towards digital TV.
- Provide insightful recommendations for both government and the DTV converter box manufacturers involved in this transition of technology.

### Conceptual Framework

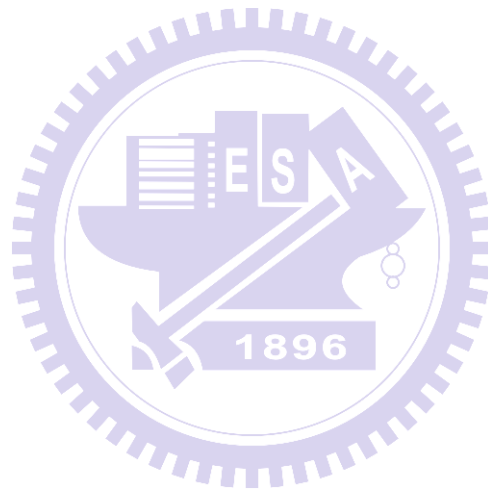


### Moderators

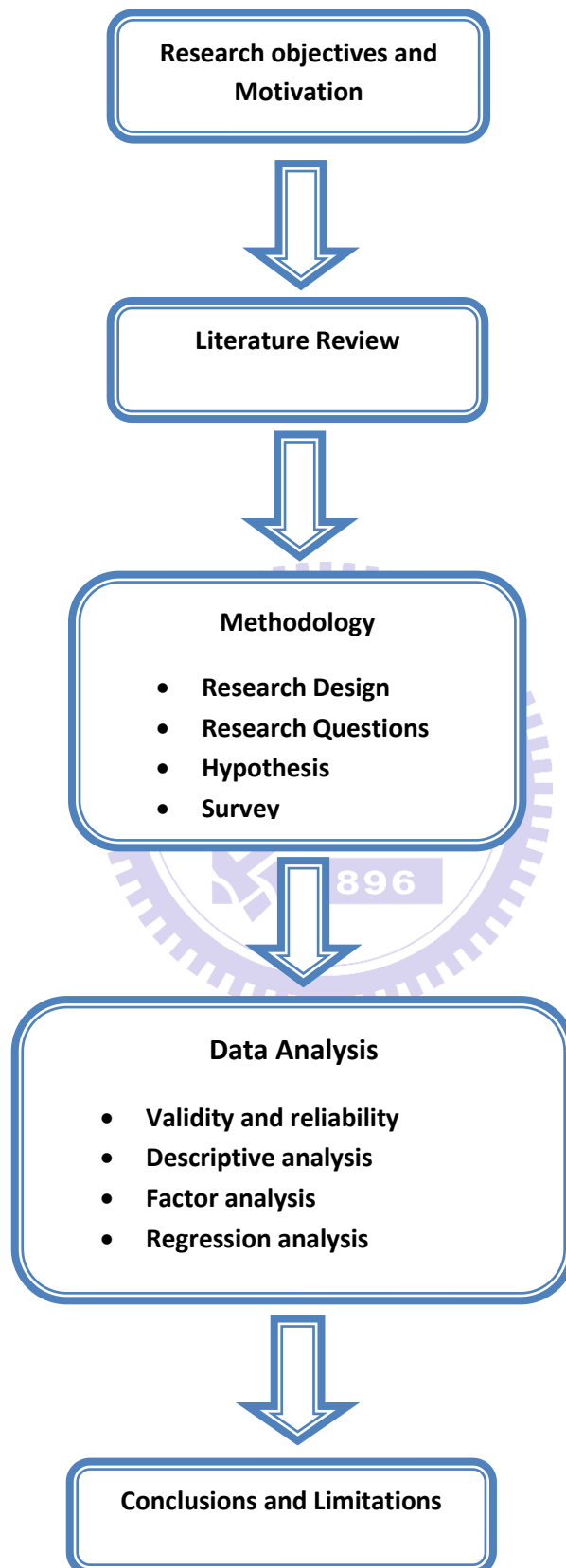
The moderators utilized in this model played a crucial role in determining and studying the different factors that influence the behavioral intention of potential users' acceptance of DTV converter boxes. Age was of significance to this study since as mentioned previously in this study since the majority of Bolivia's population is part of the "Bottom of the Pyramid" it will be the younger population the one responsible for introducing new technology to the rest of the family since the older members of the family may not have been exposed to these kind of products due to the lack of open information in previous years, a situation that has improved in recent years thanks to an opening of information and access to it. Therefore in low income families, children will have a better chance at

observing and learning about recent developments in technology and therefore introduce them to the rest of the household since the exposure to them is much higher than what their parents ever experienced.

Gender was also chosen as a moderator due to the fact that Bolivia is matriarchal society. Women play the role of head of the household especially in the country side amongst farming families, which make up 80% of the Bolivian population. Therefore it was necessary to introduce the concept of sex into this model in order to take into account this unique characteristic of Bolivian society. Finally awareness was an evident choice as one of the moderating factors that could influence PEOU, since it is only normal that those who have a higher level of familiarity with a specific technology will find it easier to use and therefore be more inclined to accept its introduction.



## Research flowchart



## Research Questions

The questions to be answered by this research have been conceptualized on the basis of the TAM model.<sup>27</sup> The obtained data from the survey will serve the purpose of measuring the extent to which the subjective norm, perceived usefulness and perceived ease of use will influence Bolivian citizens into adopting and accepting Digital TV converter boxes.

The research questions are:

1. What is the influence of perceived usefulness on behavioral intention?
  - 1.1. Is the influence moderated by age so that the effect is stronger for the younger generation?
  - 1.2. Is the influence moderated by gender so that the effect is stronger for females?
2. What is the influence of perceived ease of use on behavioral intention?
  - 2.1. Is the influence moderated by awareness so that the effect is stronger for those users who are more familiar with this technology?
3. Is there a strong positive correlation between perceived ease of use and perceived usefulness on behavioral intention??

## Hypotheses

1. The influence of perceived usefulness on behavioral intention will be moderated by age so that the effect is stronger for the younger generation.
2. The influence of perceived usefulness on behavioral intention will be moderated by age so that the effect is stronger for females.
3. The influence of perceived ease of use on behavioral intention will be moderated by awareness so that the effect is stronger for those users who are more familiar with this technology.
4. There is a strong positive correlation between perceived ease of use and perceived usefulness on behavioral intention.

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<sup>27</sup> Davis, F.D. (1989, September). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 318-340.

## Sample and Data Collection

The population surveyed in this study was made up of Bolivian citizens residing in Bolivia since it would focus on a problem with exclusive repercussions to those permanently living within the Bolivian territory. All of the participants had access to a television set and viewed television at least once a week, this was important because they needed to be able to distinguish between analogue broadcasting and digital television broadcasting, besides this point it was important to collect their views on the quality of the current available programming and if they thought that digital television could improve their viewing experience. The survey was made available only to those 18 years of age and above in order to obtain mature and informed opinions. As to gender, both males and females were surveyed. The participants were from different social-economical levels and of different education backgrounds. The reason why the surveyed were so diverse was that it would allow for a sample truly representative of the total population, which is important since the switch from analogue to digital television broadcasting would affect all the Bolivian citizens regardless of their unique conditions.

## Instrumentation

The instrument of this study was a survey developed under the application of the parameters of the Technology Acceptance Model which are the independent variables: subjective norm, perceived ease of use and perceived usefulness; and the dependent variables: behavioral intent and actual usage. The participants surveyed indicated their response through a series of yes or no questions, multiple choice questions and <sup>28</sup>5-point Likert scale questions using ratings related to digital television box variables under evaluation. The survey is composed of three parts, the first of which is dedicated to analyze the consumption behavior of analog TV, the second part is focused on the consumption behavior of digital TV and the final segment of the survey is demographics. The survey was made up of a total of 26 questions. Out of the 26 questions included in the questionnaire 12 were directly related to the constructs of the TAM. Table 1 illustrates the variables and measurements examined in this study.

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<sup>28</sup> Scott, J., & Marshall, G (2005). *A Dictionary of Sociology*. New York: Oxford University Press.

**Table 2:** Survey questions for the digital TV converter box function: Constructs and Measurement

<b>TAM Construct</b>	<b>Measurement</b>
Perceived usefulness	Strongly agree, Agree, Don't know, Disagree, Strongly disagree
Perceived ease of use	Strongly agree, Agree, Don't know, Disagree, Strongly disagree
Awareness	Strongly agree, Agree, Don't know, Disagree, Strongly disagree

### Survey Distribution

Due to the fact that this research focused on the Bolivian market and that the researcher was located in Taiwan, it had to be conducted under special circumstances. In order to surpass this limitation the survey was internet based. This allowed the distribution of the survey to Bolivian citizens without having to physically hand out the survey. All of the surveyed were invited to fill out the survey through an email invitation. The website used to conduct the survey is the Taiwanese my3q.com. The responses were automatically collected by the website and entered into an online database. This database was then used to analyze the response of the surveyed. The initial section of the survey explained the content and purposes of the questionnaire and clearly instructed the participants as to how they were to mark their answers on each section of the questionnaire. Bolivia's official language is Spanish therefore the entire survey has been designed in Spanish. The survey was completely voluntary and the participants would be able to stop at any time.



## Chapter 4 Data Analysis

All of the participants' responses were coded in order to examine the data through the use of the SPSS software. <sup>29</sup>The questions analyzed had responses corresponding to a 5 point Likert-scale. The data obtained was transformed into mean and percentage scores in order to analyze broad patterns of correlation. The coding scales were coded using a 5-point bipolar category. Table 2 illustrates the coding for each variable.

PU=perceived usefulness

PEOU=perceived ease of use

AWA=awareness

BI=Behavioral Intention

**Table 3: Coding of Survey Responses**

<b>TAM Construct</b>	<b>Response</b>	
Perceived usefulness	Strongly agree	5
	Agree	4
	Don't know	3
	Disagree	2
	Strongly disagree	1
Perceived ease of use	Strongly agree	5
	Agree	4
	Don't know	3
	Disagree	2
	Strongly disagree	1
Awareness	Strongly agree	5
	Agree	4
	Don't know	3
	Disagree	2

<sup>29</sup> Scott, J., & Marshall, G (2005). *A Dictionary of Sociology*. New York: Oxford University Press.

	Strongly disagree	1
Gender	Male	0
	Female	1
Age	18-25	1
	26-30	2
	31-40	3
	41-50	4
	51-60	5
	61 or over	6

For each of the survey responses the means, averages and standard deviations were calculated related to perceived usefulness, perceived ease of use and awareness. The analysis of the responses was conducted using the Statistical Package for Social Sciences (SPSS). The SPSS software was used to analyze the responses and the relationship among the variables.

**Table 4:** [Analysis of Survey Responses](#)

<b>Research question</b>	<b>Research sub-questions</b>	<b>Survey instrument questions</b>
1. What is the influence of perceived usefulness on behavioral intention?	1.1. Is the influence moderated by age so that the effect is stronger for the younger generation?  1.2. Is the influence moderated by	PU Q.11 Q.12 Q.13 Q.14  Gender Q. 19  Age Q. 20

	gender so that the effect is stronger for females?	
2. What is the influence of perceived ease of use on behavioral intention?	2.1. Is the influence moderated by awareness so that the effect is stronger for those users who are more familiar with this technology?	PEOU Q.15 Q.16 Q.17  Awareness Q. 6 Q. 7 Q. 9 Q.10
3. Is there a strong positive correlation between perceived ease of use and perceived usefulness on behavioral intention?		PEOU Q.15 Q.16 Q.17  PU Q.11 Q.12 Q.13 Q.14

### Validity and Reliability

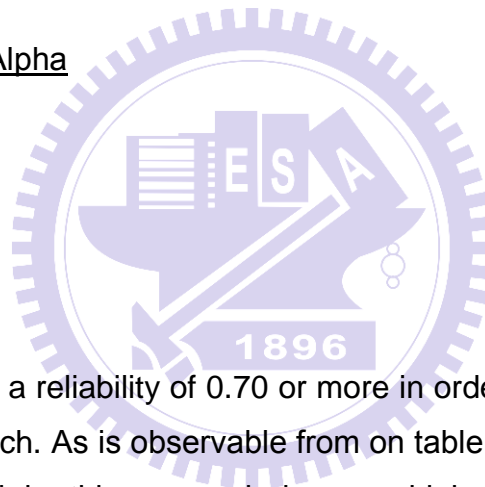
As previously demonstrated in this research, several studies have successfully utilized the TAM model to measure and analyze the acceptance of a new technology. The

studies baring the closest proximity to the present study were “An empirical study on the adoption of information appliances with a focus on interactive DTV” conducted by Jieun Yu, Imsook Ha, Munkee Choi and Jaejeung Rho in 2004 and “Extending the TAM for a t-commerce” by Hun Choi, Minseok Choi, Jinwoo Kim and Hyoshik Yu in 2002. Both of these studies based there analysis on the application of the TAM to measure the acceptance of Digital TV and its services. This confirms the validity and reliability of this model to conduct the research proposed by this study. The reliability of the modified version of the TAM applied to this study was evaluated through the use of Cronbach’s alpha. The results are shown in table 4.

Table 5: [TAM Reliability Statistics](#)

Reliability test:

<u>Concept</u>	<u>Cronbach’s Alpha</u>
PU	0.819
PEOU	0.887
AWA	0.738



<sup>30</sup>Most researchers advise a reliability of 0.70 or more in order to accept the instruments being used in basic research. As is observable from on table 4, the Cronbach’s alpha for all the constructs utilized in this research have a higher level than the minimum recommended of 0.70, which implies that they possess a strong internal consistency and therefore are effectively analyzing that which they were intended to analyze.

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<sup>30</sup> Lehman, Ann. (2005). JMP for basic univariate and multivariate statistics: a step-by-step guide.

## Descriptive Analysis

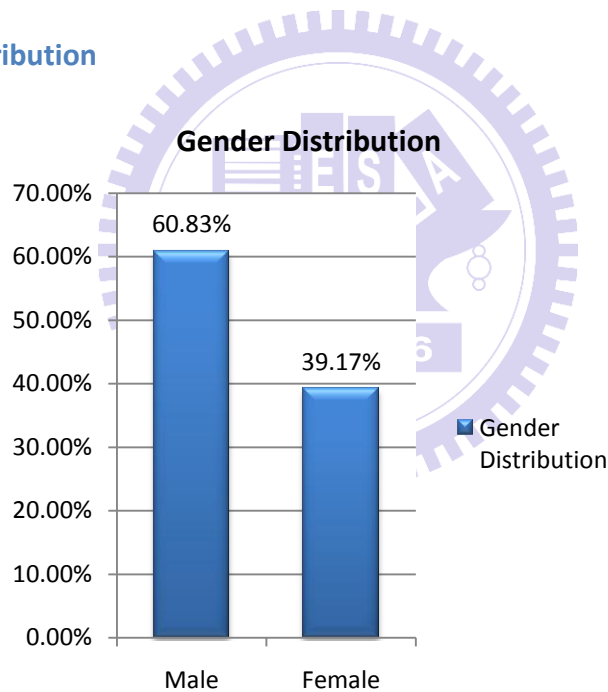
A total of 120 questionnaires were collected. The following graphs express the results:

## Demographics

**Table 6: Table 6 Gender Distribution**

	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
<b>Female</b>	47	39.17%	39.17	39.17
<b>Male</b>	73	60.83%	60.83	100.0
<b>Total</b>	120	100.0	100.0	

**Figure 1: Gender Distribution**

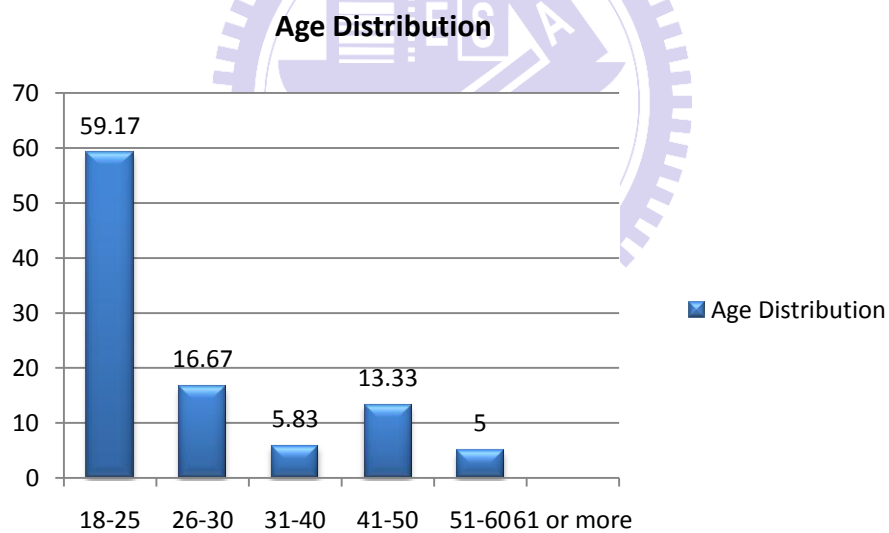


Of all the collected questionnaires, 39.17% (47) were completed by females and 60.83% (73) were completed by males.

**Table 7: Table Distinguishing Between the Different Age Groups**

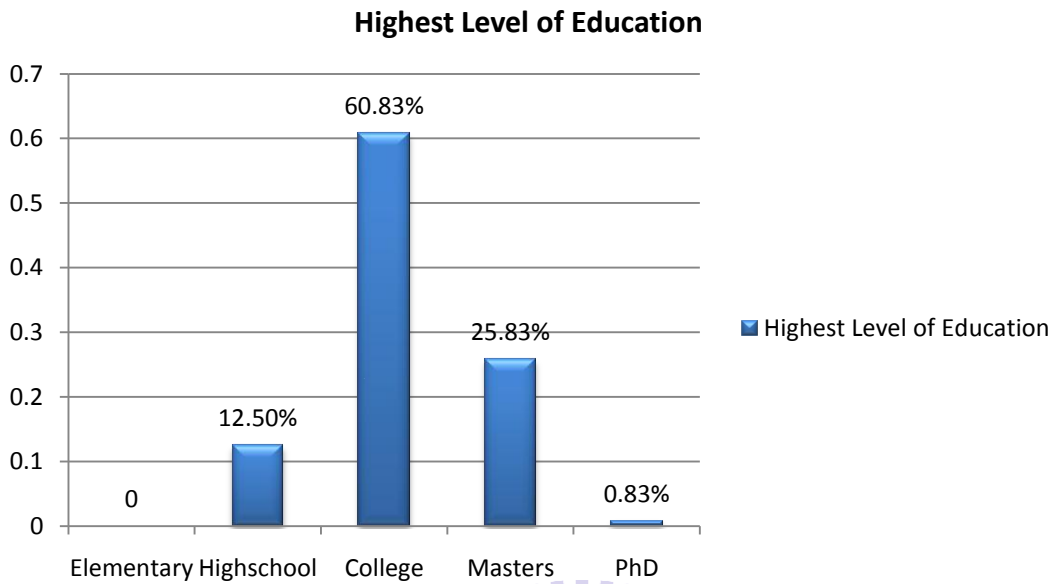
	Frequency	Percent	Valid Percent	Cumulative Percent
<b>18-25</b>	71	59.17%	59.17%	59.17
<b>26-30</b>	20	16.67%	16.67%	75.84
<b>31-40</b>	7	5.83%	5.83%	81.67
<b>41-50</b>	16	13.33%	13.33%	95.0
<b>51-60</b>	6	5%	5%	100.0
<b>61 or more</b>	0	0%	0%	
<b>Total</b>	120	100.0	100.0	

**Figure 2: Age Distribution**



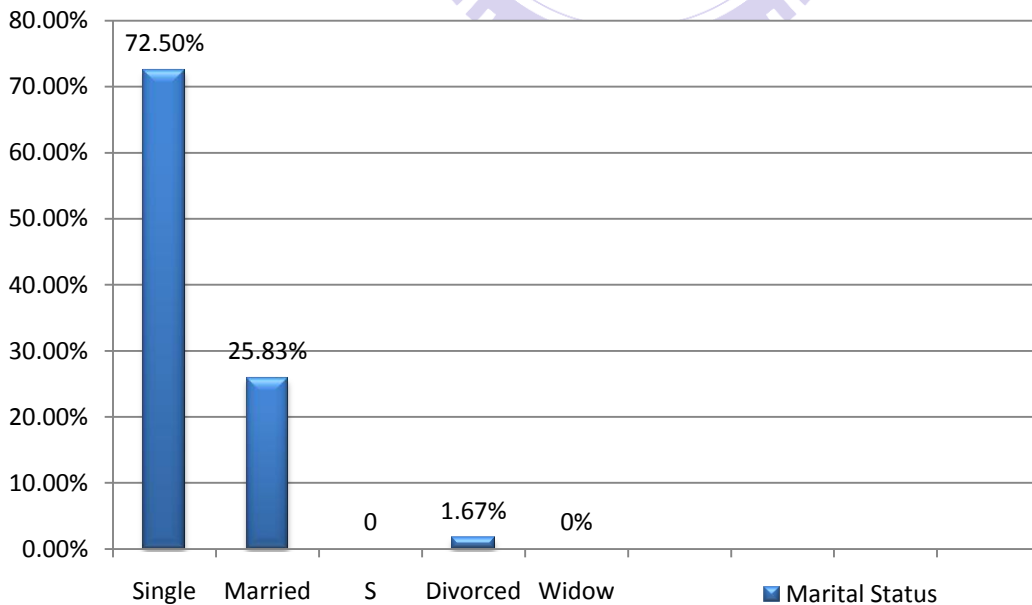
Of all the collected questionnaires, 59.17% (71) were completed by participants between the ages of 18 and 25, 16.67% (20) between the ages of 26 and 30, 5.83% (7) between the ages of 31 and 40 and 5% (6) between the ages of 51 and 60.

**Figure 3: Education**



The majority of the participants in this survey, 60.83% (73), have obtained a college degree. 25.83% (31) culminated a graduate program. 12.50% are high school graduates and 0.83% (1) of the participants has a PhD.

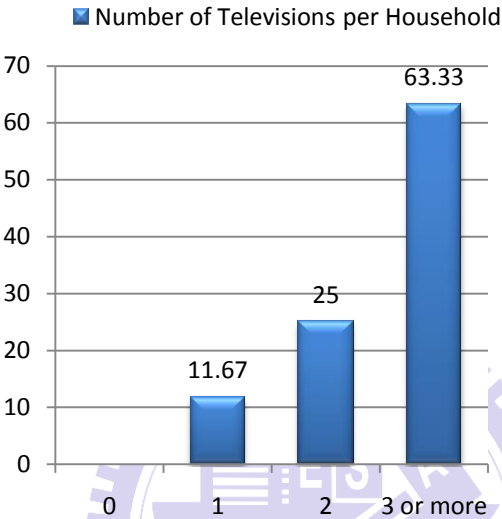
**Figure 4: Marital Status**



72.50% (87) of the participants were single, 25.83% (31) were married and 1.67% (2) were divorced.

**Number of Televisions per Household**

**Figure 5: Number of Televisions**  
**Number of Televisions per Household**



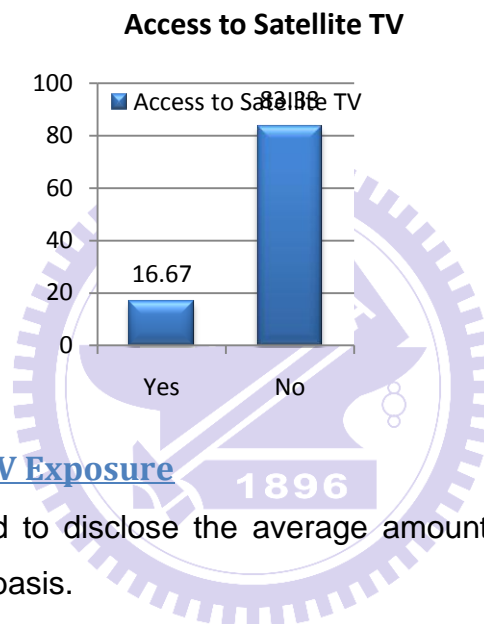
In order to determine the potential demand for digital TV converters, it proved necessary to establish the average amount of televisions found in typical a Bolivian home. Every television without digital signal reception capabilities will require a digital TV converter box in order for it to continue to receive TV broadcasting. The majority of those surveyed admitted to having 3 or more televisions per home. This is an important piece of information since it signifies that a potentially large demand for digital TV converter boxes will be eminent once the switch from analog to digital TV broadcasting is complete. This inference is further supported by the other inquiries present in this survey. When asked if their TV was capable of receiving digital TV signals 55.83% (67) of the surveyed answered yes, while 44.17% said no. Therefore nearly half of those surveyed admitted that their current TV is not equipped or compatible for the eminent switch from analog to digital TV broadcasting, this is a high percentage and it reflects the true significance of this study.



### Number of Homes with Access Satellite TV

As was discussed previously on this study, the switch from analog to digital broadcasting would not affect those users who have access to a satellite TV service, regardless of the type of equipment (television with or without digital signal reception capability) they possess since the equipment necessary for the reception of Satellite TV already allows for the reception of Digital TV. However in Bolivia the majority of the population does not have access to satellite TV, as it was demonstrated by the survey results of this study.

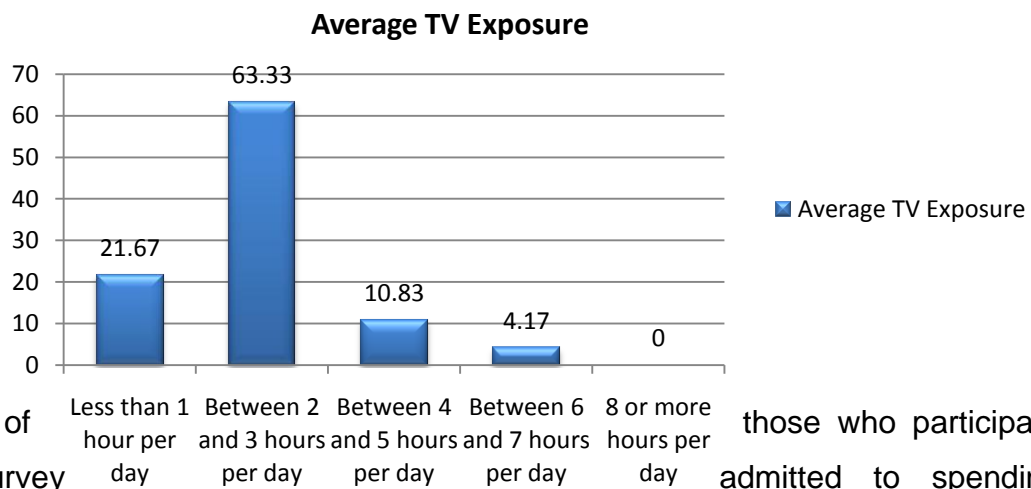
**Figure 6: Access to Satellite TV**



### Current Frequency of TV Exposure

The surveyed were asked to disclose the average amount of time they would spend watching TV on a regular basis.

**Figure 7: Average TV Exposure**



63.33% of those who participated in the survey admitted to spending at

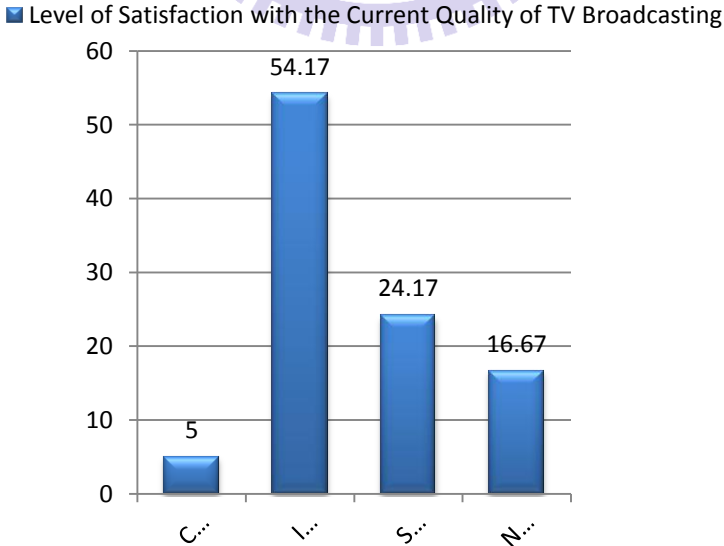
least 2 to 3 hours per day watching television. This signifies the importance and the level of regularity with which Bolivian users watch TV. This information tells us that TV is a significant source of entertainment, information and communication in this country. This is further supported by the fact that there are some participants who spend between 4 to 5 hours watching TV on a daily basis. From all of this we can conclude that users will place certain importance on maintain their access to television after the switch from analogue to digital broadcasting occurs.

**Level of Satisfaction with the Current Quality of TV Broadcasting**

The majority of the surveyed, 54.17% (65) expressed being satisfied with the quality of the majority of the current TV broadcasting available to them; however there were some, 16.67% (20), who were not satisfied at all with the quality of this service. This proves important since it means that while some are content with the quality of the image and sound of analog TV, there are some who are demanding improvement of this service and will be willing to invest in the necessary equipment to obtain a better quality of TV broadcasting.

**Figure 8: Level of Satisfaction with current TV broadcasting**

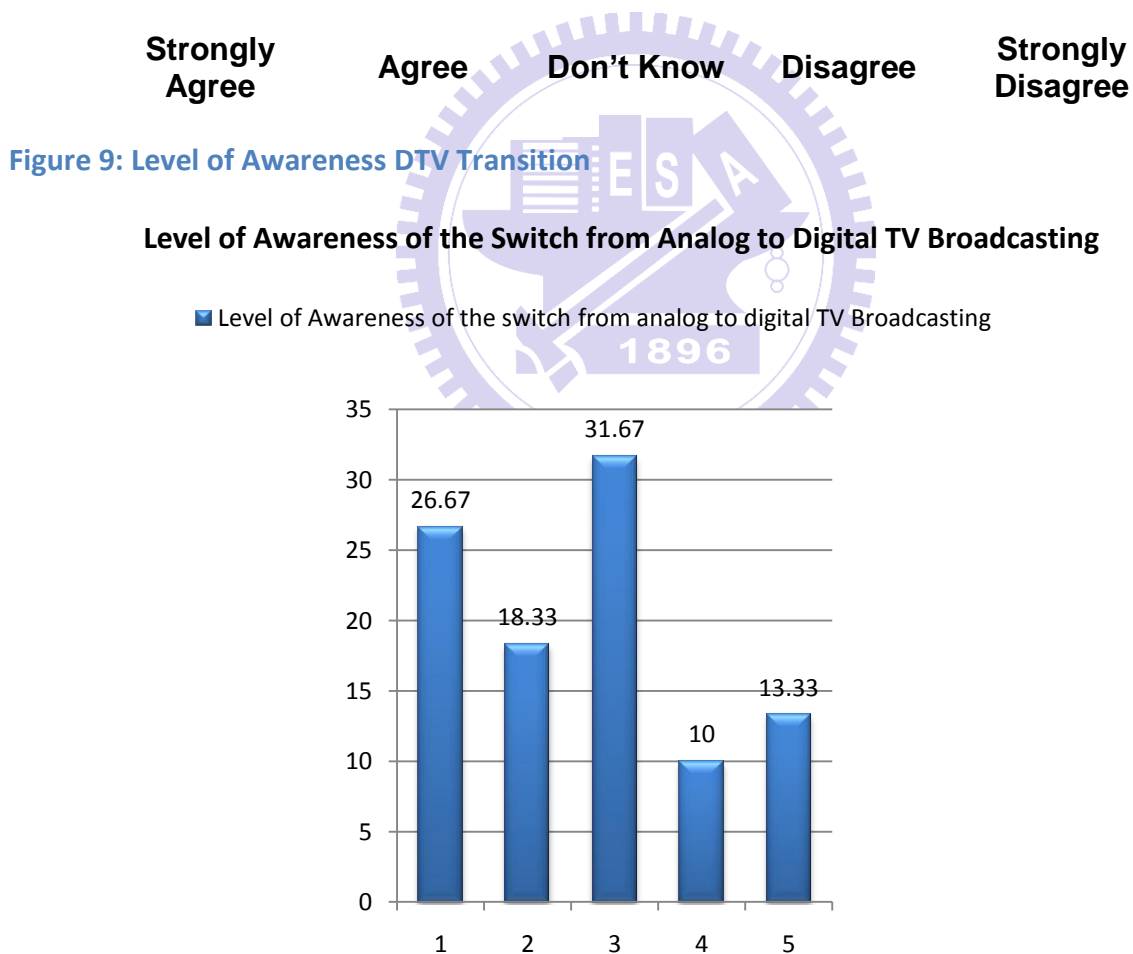
**Level of Satisfaction with the Current Quality of TV Broadcasting**



## Awareness and Perceived Need of the Switch from Analog to Digital Broadcasting

As was previously discussed in this research it is crucial for this study to determine what is the awareness level of the population in regards to the switch from analog to digital TV broadcasting, programmed to occur in the coming years. This is one of the moderators utilized in the extended and modified TAM model applied to this study. There are several questions related to this aspect and their results are as follow.

### Level of Awareness of the switch from analog to digital TV Broadcasting



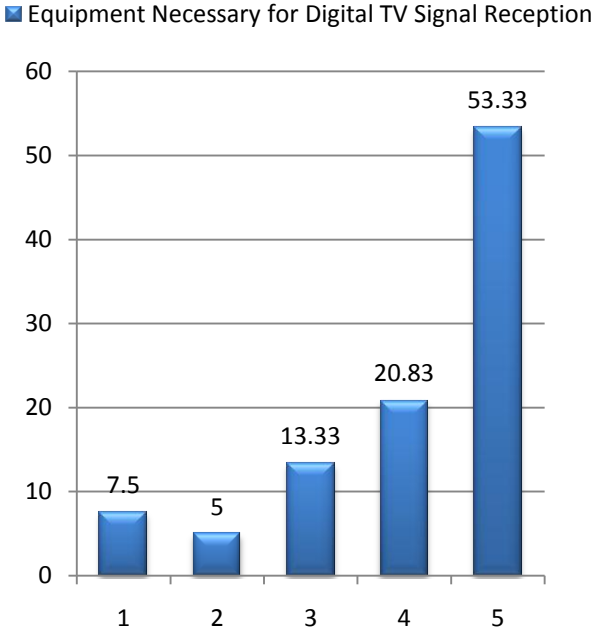
The results obtained indicate that an important amount of the population surveyed expressed being fully aware of the switch from analog to digital, 13.33 (16). However 31.67% (38) was unable to manifest that they were fully aware of the switch. This

manifests that the majority of those surveyed has not been previously conscious of the significance of this change in technology and therefore may not understand the implications of this occurrence.

**Level of Awareness as to the Equipment Necessary for Digital TV Signal Reception**

**Figure 10: Level of Awareness Equipment**

**Level of Awareness as to the Equipment Necessary for Digital TV Signal Reception**



While most of the participants expressed not being completely informed about the switch from analog to digital TV broadcasting the majority of them, 53.33%, did admit understanding that they will need a TV capable of receiving digital signals or a digital converter box in order to continue to receive television broadcasts once the transition from analogue to digital has been completed. This allows us to infer that they are familiar and aware of the functions of a digital converter box and that they understand the role this equipment will play in the transition from analog to digital TV broadcasting.

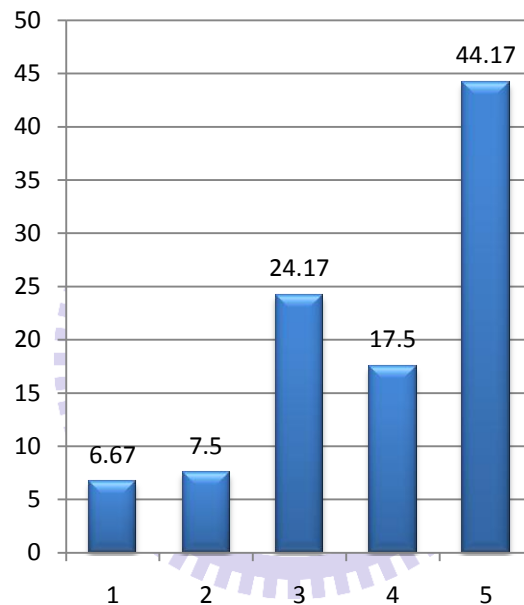
## Perceived Need for the Transition from Analog to Digital TV Broadcasting

As part of its main purpose, this study set out to determine the user's perception of the transition from analog to digital TV broadcasting. This is a significant element to measure since it will allow insight to the users' opinion of how necessary this change is and will allow predicting in some way how they would react once it was set in place.

Figure 11: Need for DTV

### Perceived Need for the Transition from Analog to Digital TV Broadcasting.

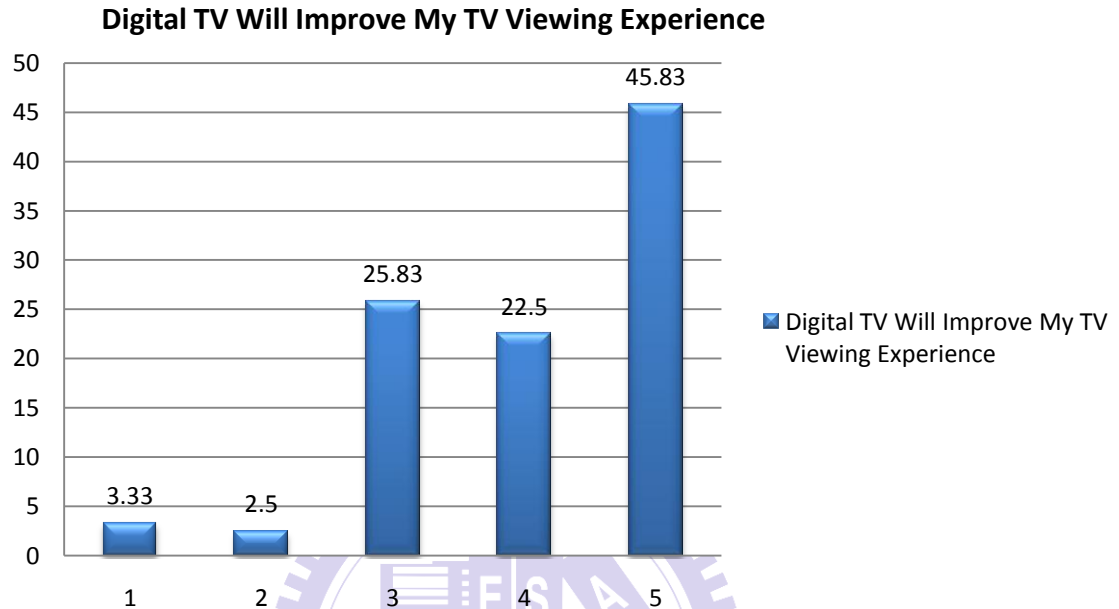
■ Perceived Need for the Transition from Analog to Digital TV Broadcasting.



The majority of the participants in the survey, 44.17% (53), expressed that they found the transition from analog to digital TV broadcasting necessary. This is significant information since it reflects the population's perception of the necessity of the change in TV broadcasting. If they find this change to be necessary it reflects the society's willingness to partake in this process and therefore be acceptant of any related technology as well, in this case the digital TV converters. Only 6.67% (8) out of all those who participated in this survey disagreed completely that this transition is necessary. This is a positive statistic for digital TV converter box manufacturers looking to enter this market as well as those authorities of the Bolivian government responsible for guiding this country into the digital era.

## Digital TV's Perceived Improvement on Users' TV Viewing Experience

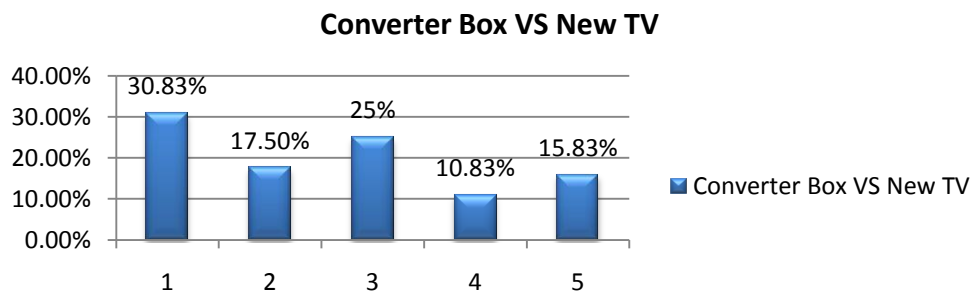
Figure 12: DTV Will Improve my TV Viewing Experience



45.83% (55) of the participants of this survey agreed that having access to digital TV would improve their viewing experience. From this we can conclude that there is great interest and understanding of the services Digital TV has to offer. Only 3.33% (4) of the surveyed disagreed with this statement showing that the majority of the population is in favor of this technology.

## Publics' Perception of Digital TV Converter Boxes

Figure 13: DTV Converter Box VS. New TV

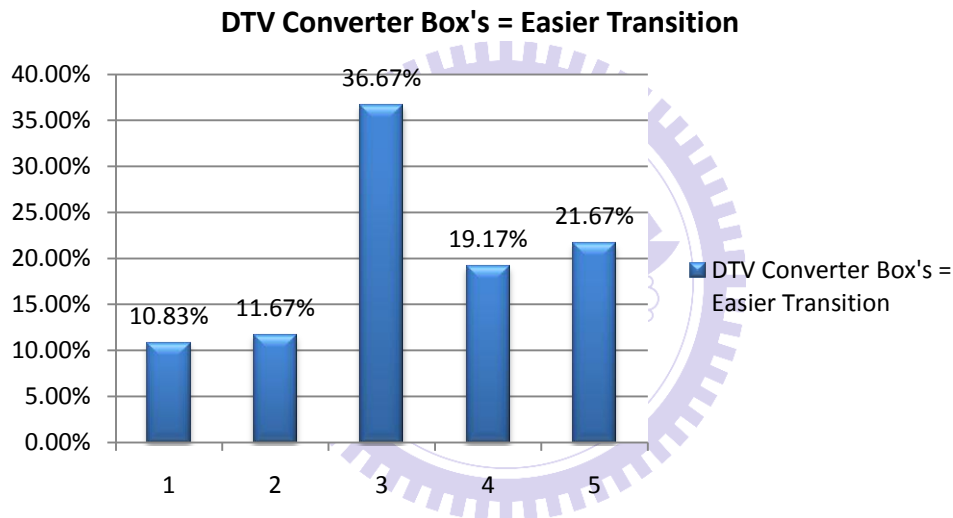


Apparently 30.83% of the population surveyed would rather purchase a new television set capable of receiving digital TV signals as opposed to purchasing a digital TV

converter box. Although the majority of the surveyed answered in this manner it, this response does not reflect their actual behavior. We must also take into consideration other factors such as price and ease of purchase. It would result less costly to simply buy a complementary piece of equipment for their current TV rather than replacing it all together. Therefore although the majority of the surveyed would ideally prefer a new television over conserving their old one, this does not represent the actual end decision they will make. This statement will be later supported by the other findings related to Digital TV converter boxes.

### Digital TV Converter Box's Contribution to an Easier Transition from Analog to Digital TV

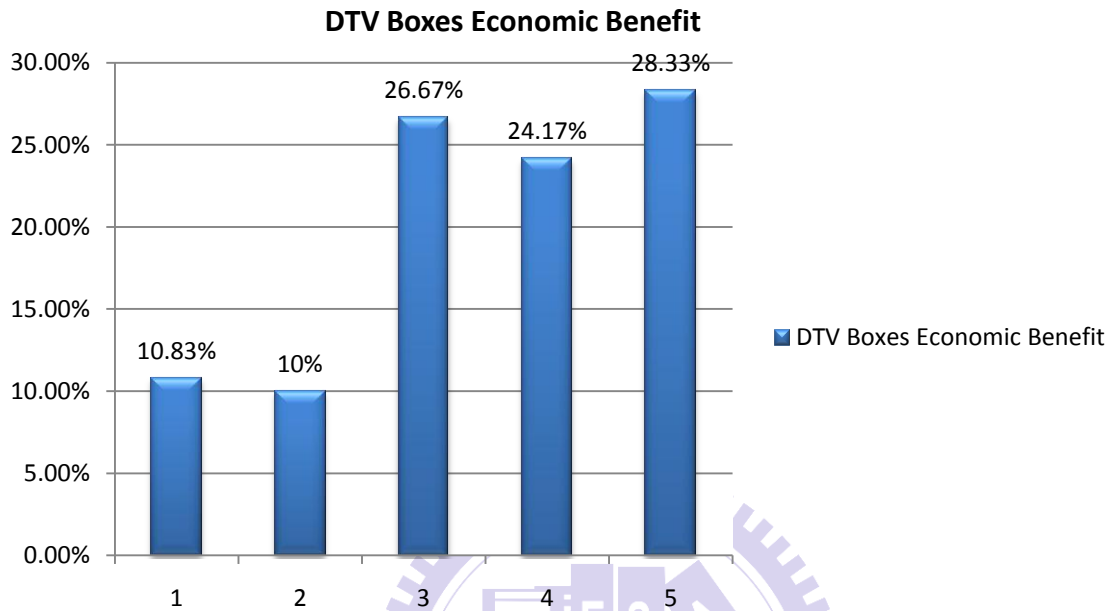
Figure 14: DTV Converter Box = Easier Transition



Although the majority of the population was unable to either confirm or deny that the purchase of a digital converter box would facilitate the transition into digital TV, these results give us the first hint as to how people's behavior will lead to the purchase of digital converter boxes. 21.67% (26) completely agreed that a digital converter box would facilitate this transition. Although the majority of those surveyed previously stated that they would prefer to purchase a new TV over buying a converter box, this response is not supported in the current analysis were a significant amount of the population either are unable to deny the importance of this equipment or strongly agree that it is the better option.

## Perceived Economic Benefit from Purchasing DTV Converter Boxes

Figure 15: DTV Converter Box Economic Benefit

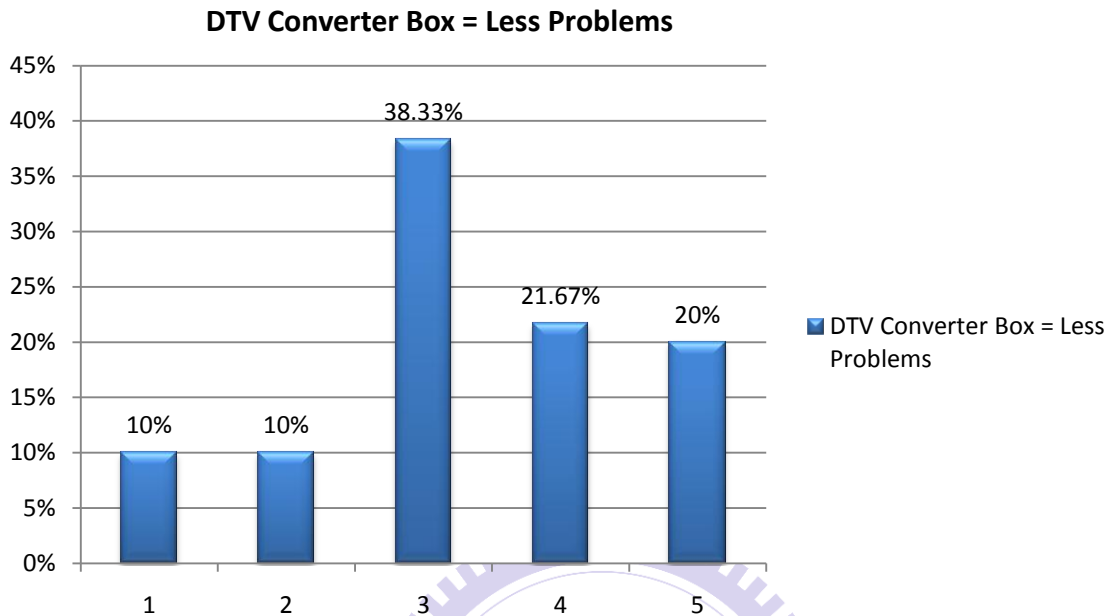


This is a clear indicator that shows that in the public's mind, DTV converter boxes are the more economic alternative to enter into the DTV era. 28.33% (34) completely agreed that DTV converter boxes would pose less economic strain on them when switching from analog to digital, 24.17% (29) agreed that it would cost less to keep their old TV and simply acquire this complementary equipment. Therefore we can conclude that the majority of the population which is price sensitive will obviously opt for the purchase of a DTV converter box over purchasing a new TV.



## DTV Converter Boxes Contribution to Problem Reduction

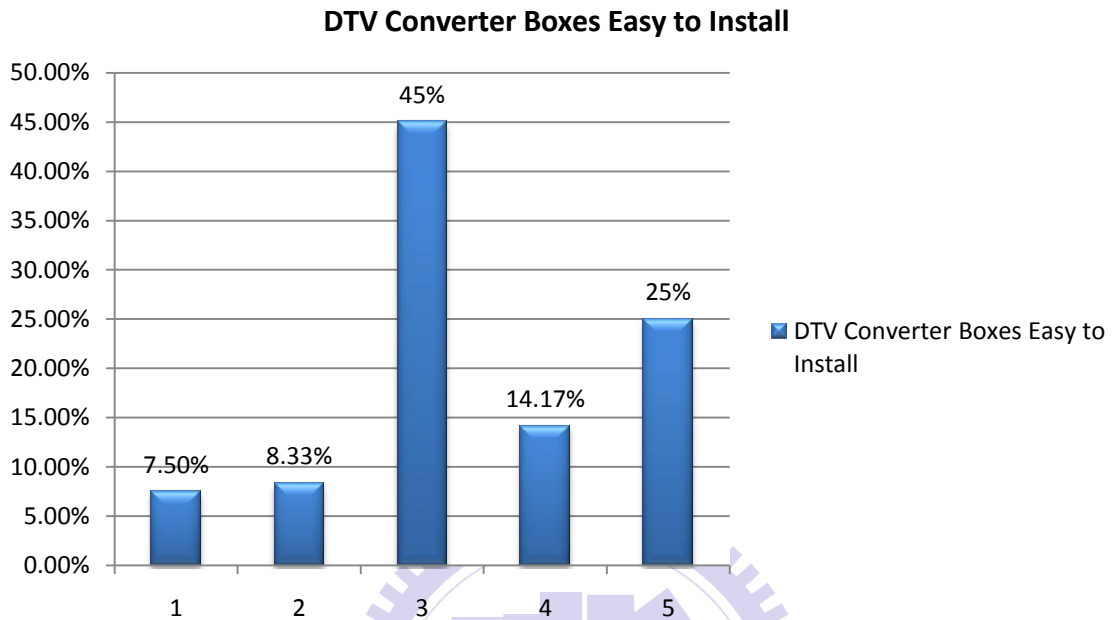
Figure 16: DTV Converter Box = Less Problems



The majority of the population in this case was unable to decide whether they believe that DTV converter boxes will ease the rising problems that the switch from analog to digital TV broadcasting could bring, however a higher percentage of them decided that this alternative would be a feasible way of avoiding the potential problems already mentioned as opposed to those who did not agree with the statement, to be exact 21.67% (26) agreed with this statement and 20% (24) strongly agreed.

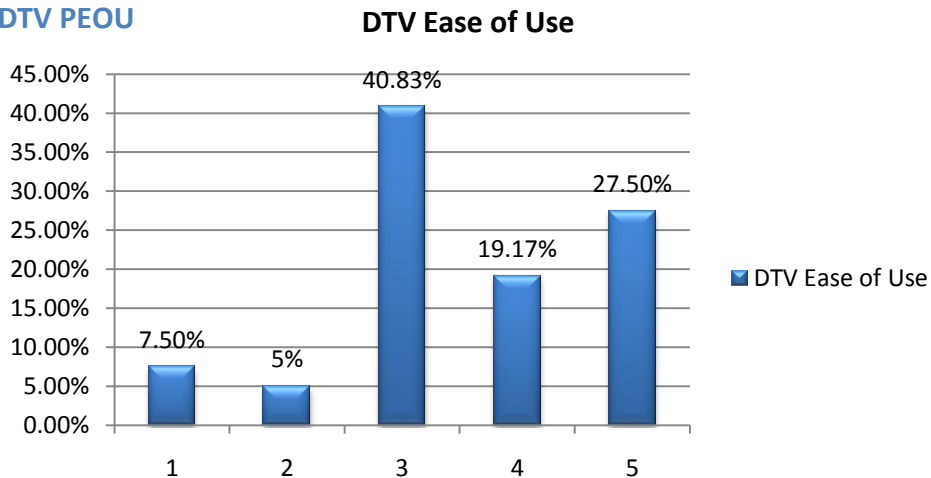
## Perceived Ease of Use of DTV Converter Boxes

Figure 17: DTV Converter Box = Easy to install



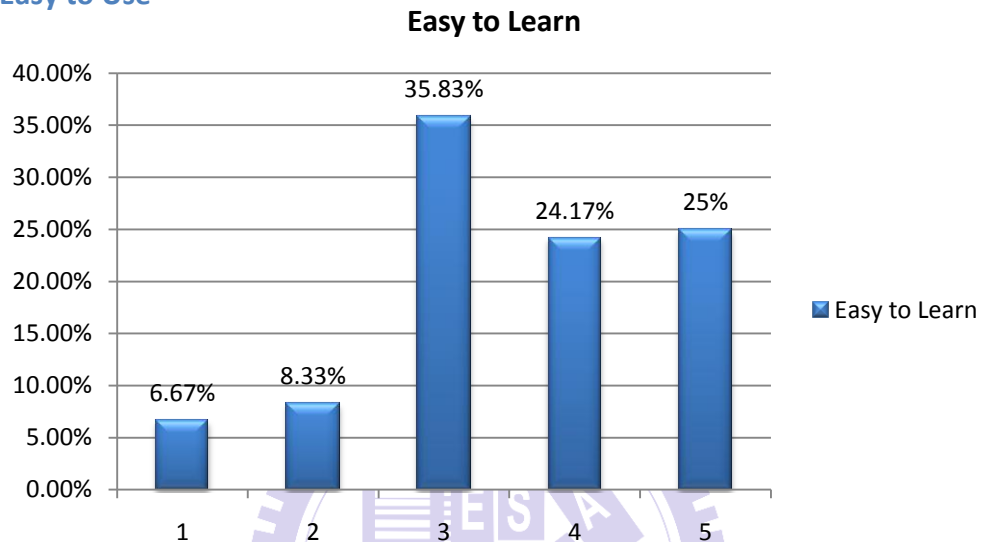
The highest concentration of the population interviewed did not either confirm or deny the ease with which they believe they could install a DTV converter box. However a significant amount of the surveyed, 25% (30), did confirm that they believe that installing a DTV converter box would be easy. Therefore we can infer that the perceived ease of use by the public will be high for DTV converter boxes. This is further confirmed by the following results.

Figure 18: DTV PEOU



27.5% (33) of those surveyed admitted to thinking that using a DTV converter box would be easy, only 7.5% (9) of the surveyed believed the contrary. Therefore there is strong evidence pointing to a high perceived ease of use amongst the population, although 40.83% (49) were still uncertain about this statement.

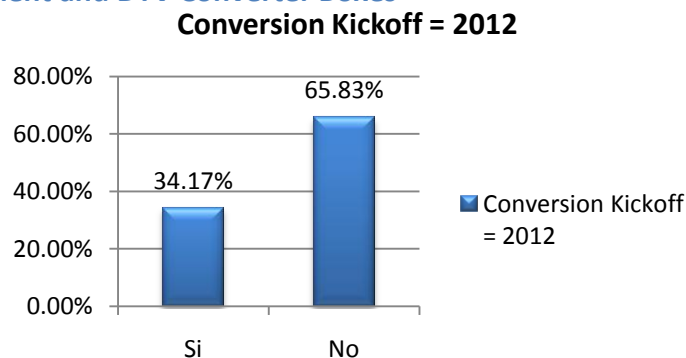
**Figure 19: Easy to Use**



25% (30) of the participants in this surveyed strongly agreed with the statement that learning to use a DTV converter box would be easy. Therefore we can infer that even those participants who stated that they were unfamiliar with this technology, many of them may believe that it might prove relatively easy to learn about this technology and later adopt it.

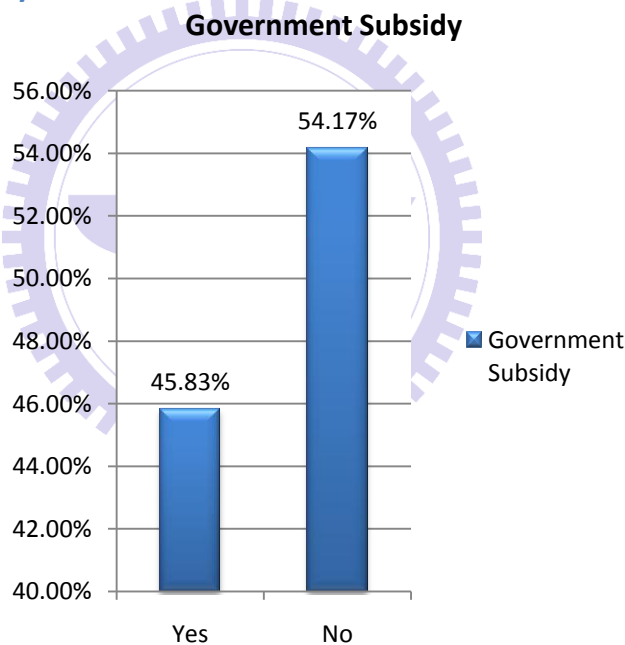
**Government and DTV Converter Boxes**

**Figure 20: Government and DTV Converter Boxes**



The majority of those surveyed had no knowledge of the kickoff date set by the Bolivian government to commence the transition from analog to digital TV broadcasting. Although this deadline is right around the corner most of the participants remained unaware of this which allows us to believe that further and more effective communication as to this government lead operation will be handled. If most of the people remain ignorant to the fact that their TV broadcasting system will be altered in such a way that they may not be able to utilize their current equipment to enjoy the service they currently have access to, then this could bring about several unnecessary complications that will prolong and disrupt this process.

**Figure 21: Government Subsidy**



The majority of the surveyed 54.17% (65) have expressed that they believe the government should not subsidize part of the cost of the DTV converter boxes, while 45.83% (55) were in favor of this. This means that most of the population expects some form of government aid in the acquisition of this equipment.

**Table 8: Factor Analysis**

Item	PU	PEOU	AWA
PU1 Q11. I would rather buy a converter box for my old TV than purchasing a new TV.	0.784		
PU2 Q.12 Purchasing a digital converter would facilitate my access to digital TV.	0.821		
PU3 Q.13 The acquisition of a converter box would be an affordable entrance to digital TV.	0.778		
PU4 Q.14 Buying a converter box would reduce the hassle related to switching from analogue to digital TV.	0.737		
PEOU1 Q.15 Installing the digital converter box will not take much effort.		0.882	
PEOU2 Q.16 Using the digital converter box will be simple.		0.894	
PEOU3 Q.17 Learning how to use a		0.794	

digital converter box will not take much time.			
AWA1 Q.7 The conversion from analogue broadcasting to digital broadcasting is a necessary transition.			0.805
AWA2 Q.9 Digital TV would improve my television viewing experience.			0.764
AWA3 Q.10 I understand that I will need a TV capable of receiving digital signals or a converter box for my old TV in order to continue to receive television broadcasts once the transition from analogue to digital has been completed.			0.741
AWA4 Q. 6 I am fully aware of the transition from analogue broadcasting to digital broadcasting.			0.649
Eigenvalue	4.15	2.22	1.16
Variance explained (%)	37.27	20.14	10.55

This factor analysis constitutes statistical proof that the questions designed and implemented in this questionnaire effectively test the constructs that they were individually intended to test given the research context. Each of the questions show the highest loading on the item it is bound to test. The questions correspond respectively either to perceived usefulness, perceived ease of use or awareness. This analysis also exhibits the Eigenvalues, which will prove to be significant if they are greater than 1. In this case all of the values are greater than 1 and therefore the data can be considered to be reliable. The variance explained percentage is comparable to the traditional  $R^2$ . In this case the sum of the percentage of total variance is greater than 68% (0.6841) which indicates the quality of the regression and the distribution of the independent variable.

### **Regression Analysis**

In order to measure and validate the interaction between the independent variables, dependent variables and the moderators a binary logistic regression was run using the SPSS software. The following are the results explaining the relevance of the hypotheses in connection to each research question.

#### Research question 1

- What is the influence of perceived usefulness on behavioral intention?
  - ❖ Is the influence moderated by age so that the effect is stronger for the younger generation?

#### Hypothesis 1

- The influence of perceived usefulness on behavioral intention will be moderated by age so that the effect is stronger for the younger generation.

Table 9: Hypothesis 1-2

Coefficient(a)						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig
		B	Stand. Err	Beta		
1	<b>(Constant)</b>	1.362	.524		2.600	.011
	<b>PU</b>	.253	.174	.249	1.455	.148
	<b>Age</b>	.052	.239	.063	.218	.828
	<b>PU*Age</b>	-.060	.080	-.241	-.752	.453
a Dependent Var : BI						

When performing the hypothesis test the significance level is the standard used for rejecting the null hypothesis. Traditionally, experimenters use 0.05 as the level of significance. First the difference between the results of the experiment and those of the null hypothesis were determined. Then it was assumed that the null hypothesis was true, after which the probability of a difference that large or larger was computed. This probability was compared to the significance level of 0.05. The results from this analysis concluded that age does not have any effect on behavioral intention, since the significance level in this case was 0.828 larger than 0.05. This analysis also concluded that no interaction between PU and age exists since the significance level was 0.453, again larger than 0.05. In conclusion H1 cannot be statistically supported.

- ❖ Is the influence moderated by gender so that the effect is stronger for females?

Hypothesis 2

- The influence of perceived usefulness on behavioral intention will be moderated by gender so that the effect is stronger for females.



Table 10: Hypothesis 3

Coefficient(a)						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig
		B	Stand. Err	Beta		
1	(Constant)	1.964	.344		5.716	.000
	PU	-.031	.115	-.031	-.272	.786
	Sex	-1.401	.568	-.646	-2.469	.015
	PU*Sex	.478	.189	.686	2.526	.013
a Dependent Var : BI						

From this test it was concluded that gender does have a direct negative effect on BI, with a regression correlation coefficient of -1.401, which is significantly supported by a significance level of 0.015 lower than 0.05. Gender and PU possess an interaction effect on BI, with a significance level of 0.013 lower than 0.05, meaning that gender plays a role of moderation. Furthermore, the data shows that the coefficient for males is -0.031, while the coefficient for females is 0.447(-0.031+0.478). Therefore we can conclude that the effect is stronger for females, supporting H2.

Research Question 2.

- What is the influence of perceived ease of use on behavioral intention?
  - ❖ Is the influence moderated by awareness so that the effect is stronger for those users who are more familiar with this technology?

Hypothesis 3

- The influence of perceived ease of use on behavioral intention will be moderated by awareness so that the effect is stronger for those users who are more familiar with this technology.

Table 11: [Hypothesis 4](#)

Coefficient(a)						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Stand. Err	Beta		
1	<b>(Constant)</b>	.898	.483		1.858	.066
	<b>PEOU</b>	-.237	.169	-.235	-1.405	.163
	<b>AWA</b>	.260	.216	.223	1.204	.231
	<b>PEOU*AWA</b>	.154	.068	.619	2.28	.024
a Dependent Var : BI						

PEOU and AWA do not have a positive effect on BI as is proven by their significance levels of 0.163 and 0.231, respectively which are both higher than 0.05. As for interaction, PEOU and AWA possess an interaction effect on BI evident by the lower significance level of  $0.024 < 0.05$ , which signifies that AWA does play a role of moderation. Therefore the higher the AWA in the individual the higher the positive effect on the relationship between PEOU and BI, which statistically supports H3.

Research question 3

- Is there a strong positive correlation between perceived ease of use and perceived usefulness on behavioral intention?

Hypothesis 4

- There is a strong positive correlation between perceived ease of use and perceived usefulness on behavioral intention.

Table 12: [Hypothesis 5](#)

Coefficient(a)						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Stand. Err	Beta		
1	<b>(Constant)</b>	3.040	.361		8.416	.000
	<b>PU</b>	-.006	.101	-.006	-.058	.954
	<b>PEOU</b>	.320	.100	.318	3.195	.002
a Dependent Var : BI						

PEOU will positively influence BI as it is statistically supported by a significance level of 0.002. As to PU, some of the possible factors that can determine the perceived usefulness of DTV converter boxes (in terms of a sharper image, better sound and easier access to DTV) derive from knowledge (awareness and actual knowledge), uses and gratifications. When discussing entertainment products we must understand that awareness over the functionality and capability of the technology product in question is crucial to increasing or decreasing the users' perceived usefulness over the product. In the present case we see that perceived usefulness does not influence behavioral intention when measured independently, this may well be due to the amount of unfamiliarity with the DTV converter boxes already previously described. Another factor contributing to this result could be that the majority of the participants in the survey, 44.17% (53), expressed that they found the transition from analog to digital TV broadcasting unnecessary. Therefore the empirical findings of this study would suggest that since the majority of the participants found this transition from analog to digital TV unnecessary, they would

hold the same regard for any complementary technology, again due to unawareness rather than an informed opinion.



## Chapter 5 Conclusions, Assumptions and Limitations

### Assumptions and Limitations

The present study has been conducted over the basis of the TAM research methodology which was developed by Davis in 1989. The TAM is perhaps one of the mostly utilized methodologies for examining and exploring the acceptance, perceived ease of use, perceived usefulness and actual usage of different technologies. This methodology has been modified and extended according to the purpose of each study in which it was utilized. This study was conducted under the following assumptions: (1) all of the respondents answered the questionnaire in a completely honest manner, providing accurate information; (2) the participants of the survey utilized in the development of this research have access to television broadcasting on regular basis and therefore will be affected by the switch from analog to digital TV broadcasting; (3) the results obtained from this study will serve as a useful and informative insight in regards to the acceptance of digital converter boxes in the Bolivian market for those companies involved in the manufacturing and distribution of this technology.

The limitations of this study include (1) the fact that the researcher was located in Taiwan while the population subjects of this research are the Bolivian citizens. Although this was overcome through the use of technology, specifically the use of an internet based survey; the distance between both parties limited the research to some measure. (2) A second limitation to this study is precisely the fact that it was restricted to the use of an internet based survey, which meant that the population that participated in the survey was limited to those who had access to a computer with internet connectivity. (3) Because the survey was conducted over the internet and the population therefore was limited to those with access to an internet connection, unfortunately this thesis was also restricted to a young range group which belong to a middle class economy since this the major group with access to the internet in Bolivia. Future studies should consider the previous situations and perhaps expand the range of the population surveyed by performing a physical survey that those not require access to an internet connection and

therefore include a more representative population.

## Conclusions

This study addressed the lack of empirical information regarding the acceptance of the transition from analogue television broadcasting to digital television broadcasting and the need for DTV converter boxes in the Bolivian market. The acceptance of this technology in the public's perception was measured through the use of a modified TAM model, which was effective based on the correlation coefficient analysis. The purpose of this study was to determine under which conditions this technology could be successfully introduced and adopted by the Bolivian society. It also set out to determine what significant elements should be taken into consideration by the Bolivian government and those manufacturing companies dedicated to the fabrication of DTV converter boxes when initiating an entry into the Bolivian market.

Several research questions were generated in order to obtain the necessary information to determine the factors previously discussed. Some of the most significant conclusions were for instance the fact that 31.67% (38), had not been previously informed of the change in technology programmed to occur in the coming year. This is significant information since it reflects the unawareness of the population in regards to DTV or its complementary products, which could generate unnecessary delays in the acceptance of this technology. Of equal significance is the fact that 30.83% of the population surveyed would rather purchase a new television set capable of receiving digital TV signals as opposed to purchasing a digital TV converter box, this may be due to the lack of information available in Bolivia in regards to DTV converter boxes.

Three of the four hypothesis determined in this study proved to be statistically supported when the correspondent analysis was performed. The first hypothesis, "The influence of perceived usefulness on behavioral intention will be moderated by age so that the effect is stronger for the younger generation", could not be statistically supported, therefore age does not have any effect on behavioral intention; this analysis also concluded that no interaction between PU and age exists. We can say then that age should not be a factor to consider when implementing marketing strategies for the commercialization of DTV converter boxes in Bolivia. The second hypothesis, "The influence of perceived

usefulness on behavioral intention will be moderated by gender so that the effect is stronger for females”, was statistically supported. The analysis concluded that gender does have a direct negative effect on BI; this effect is stronger for females, supporting H2. In other words perceived usefulness is of more importance to women than men when deciding to purchase a product of this nature.

The third hypothesis, “The influence of perceived ease of use on behavioral intention will be moderated by awareness so that the effect is stronger for those users who are more familiar with this technology”, was also statistically supported. It was concluded that awareness does play a role of moderation. Therefore the higher the awareness in the individual the higher the positive effect on the relationship between PEOU and BI, which statistically supports H3. Those members of the society with a higher sense of awareness related to DTV converter box technology who have a high PEOU would tend to adopt this technology at a higher rate than those who remain unaware, proving once more the importance of “awareness” for the acceptance of DTV converter boxes. Finally the fourth hypothesis, “There is a strong positive correlation between perceived ease of use and perceived usefulness on behavioral intention”, was also statistically supported, Perceived usefulness (PU) was not a significant factor in determining the intention to adopt DTV converter boxes, on the other hand PEOU was found to positively influence BI. This suggests that the ease of use of the technology is imperative in predicting the potential behavioral intent.

The great potential for business of digital signal converters is clearly high due to the mandatory nature of the transition from analogue to digital which will force all of those members of the public who do not possess a television capable of receiving digital signals to either purchase a new television or acquire a digital converter box. However those looking to get involved must take into consideration the results obtained by this study, which seem to point out a significant amount of unawareness amongst the Bolivian population in terms of DTV or DTV converter boxes. This is important since there is seems to be accordance as to the benefits of DTV; however many of the surveyed seemed uninformed as to the benefits of a DTV converter box. It is also

necessary to point out that the majority of the population that participated in the survey found the transition from analog to digital to be necessary however their sentiment towards the need for DTV converter boxes was not the same. Most of the surveyed were impartial towards the need for this equipment and even suggested they would prefer to acquire a new TV over purchasing one of these DTV converter boxes.

Based on the economical information of this country, which is unfortunately ranked as number 99 in the world, it may seem irrational that the majority of the surveyed would opt for the more expensive solution rather than picking the one with more economic benefit. As to pricing for this equipment the majority of the population surveyed agreed that the price for a DTV converter box should be between 21 USD and 36 USD. They were also consulted if they believed the government should cover part of this cost, the majority (65.83%) was against any subsidy from the government, only 34.17% were in favor of government aid for the purchase of the DTV converter boxes. This data should be taken into consideration when determining the companies pricing strategy.

It is this researcher's modest opinion that the population should be widely educated in the different aspects of DTV as well as the implications of the transition from analog to digital TV broadcasting, through a conjunct campaign of both government and the private companies interested in selling their converter boxes in Bolivia. It must be made clear what this change will mean to the average citizen and how they can prepare themselves for it. DTV converter box companies looking to enter this market will clearly need to deploy a significant amount of resources in marketing and education programs to allow the population to familiarize itself with this technology in order to successfully enter this market.



## Bibliography

1. Abramson Albert (2003). The history of television 1942 to 2000, Jefferson, NC, and London, McFarland.
2. Abramson, Albert. (1995), Zworykin: Pioneer of Television. University of Illinois Press, pp. 51-52.
3. Atkin, J.A., Neuendorf, K., Jeffers, L.W. & Skalski, P. (2003). Predictors of audience interest in adopting Digital television.
4. Barbirato, W.; Morassutto, L.; Temporelli, M. (2008). Fracarro, from the disk of Nipkow to the digital convergence. History of telecommunications conference, 2008.
5. Barker, Dennis. (2008). Digital TV set-top box sales break 100M barrier, says Strategy Analytics. EE Times news & analysis.
6. Chan-Olmstead, S.M., Chang, B. (2006). Audience knowledge, perceptions and factors affecting the adoption intent of terrestrial digital television.
7. Choi, Hun; Choi, Minseok; Kim, Jinwoo and Yu, Hyoshik. (2002). Extending the TAM for a t-commerce.
8. Dasari S. Jayant. (2009). Set-Top Boxes: Outlook, Parks Associates.
9. Davis, F.D. (1989, September). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 318-340.
10. Dhir, Amit. (2004). The digital consumer technology handbook: a comprehensive guide to devices, standards, future directions, and programmable logic solutions.
11. DigiTAG - The Digital Terrestrial Television Action Group (2008). Analogue switch-off learning from experiences in Europe.
12. DTV delay act. United States Law No: 111-4 (introduced 1/29/2009).

13. Farnsworth, Russell. (2002). Philo T. Farnsworth: The Life of Television's Forgotten Inventor.
14. Federal Communications Commission (December 24, 1996). *Fourth Report and Order in MM Docket No. 87-268, FCC 96-493*
15. Franquet, Rosa. Larrègola, Gemma (1999). Comunicar en la era digital.
16. Galperin, Hernan (2004). New television, old politics: the transition to digital TV in the United States and Great Britain. Chapter 8, p. 186.
17. Grimme, Katharina. (2002). Digital television standardization and strategies.
18. Hart, Jeffery A. (2004). Technology, television, and competition: the politics of digital TV. Chapter 7, p. 137.
19. Hopkins, R. (1994). Digital terrestrial HDTV for North America: the grand alliance HDTV system.
20. Lundström, Lars-Ingemar (2006). Understanding Digital Television. An introduction to DVB systems with satellite, cable, broadband and terrestrial TV distribution.
21. Mesa de José, Gisbert Teresa, Mesa D. G. Carlos. (2007). Historia de Bolivia.
22. Moller N. Alane, Pletson E. Charles (2008). Telecommunications and media issues.
23. National Television System Committee Reports (1951–1993), Library of Congress Online Catalog.
24. OECD Communications Outlook (2007). Organization for Economic Co-operation and Development.
25. R. W. Burns (1998). Television: An International History of the Formative Years, IET, p. 98.

26. Sapio, B., Turk, T., Cornacchia, M., Papa, F., Nicolò, E., Livi, S. (2002). Analogue to digital switch over: Human aspects of adoption, A scoping study for the Digital Television Project.
27. Sapio, B., Turk, T., Cornacchia, M., Papa, F., Nicolò, E., Livi, S. (2008). Microsimulating the Adoption of Digital Television and T-Government Services. Proceedings of the Workshop "Digital Television Revisited: Linking Users, Markets and Policies".
28. Sapio, B., Turk, T., Cornacchia, M., Papa, F., Nicolò, E., Livi, S. (2009). Building scenarios of digital television adoption: a pilot study. Submitted to Journal of Technology Analysis & Strategic Management.
29. Scott, J., & Marshall, G (2005). *A Dictionary of Sociology*. New York: Oxford University Press.
30. Venkatesh, V.; Morris; Davis; Davis (2003), "User Acceptance of Information Technology: Toward a Unified View", *MIS Quarterly*, 27, pp. 425–478.
31. Viswanath Venkatesh, Fred D. Davis. (2000). A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies.
32. Wu, Y.; Hirakawa, S.; Reimers, U.H.; Whitaker, J. (2006). Overview of digital television development worldwide.
33. Yu, Jieun; Ha, Imsook; Choi, Munkee and Rho, Jaejeung. (2004). An empirical study on the adoption of information appliances with a focus on interactive DTV.

## Appendix A

### **Market Study of Digital Converters in Bolivia Survey**

The following survey serves the purpose of collecting the participant's views and opinions related to the current situation of television broadcasting in Bolivia and specifically the switchover from analogue broadcasting to digital broadcasting that is set to commence in this country as of this year. We appreciate you taking a couple minutes of your time to fill out this survey and we assure you that this information will contribute in bettering our countries situation over this matter.

Luis Daniel Cusicanqui,  
National Chiao Tung University GMBA  
Thesis Supervisor: Professor Yingchan Edwin Tang

#### **A. Consumption behavior of analog TV**

**\*\*Please mark the answer you consider best.**

**1. How many television sets does your household posses?**

- 0
- 1
- 2
- 3 or more

**2. Are you subscribed to a cable television service?**

- Yes
- No

**3. Are you subscribed to a satellite television service?**

- Yes
- No

**4. You watch television on average for:**

- 8 hours or above per day
- 6-7 hours per day
- 4-5 hours per day
- 2-3 hours per day
- Less than one hour per day

**5. Are you pleased with the current image and sound quality of the television channels?**

- Completely
- Mostly
- Somewhat
- Not at all

**B. Consumption behavior of digital TV**

**\*\*Please rate the degree of your agreement for the statements below**

Strongly Agree	Agree	Don't Know	Disagree	Strongly Disagree
----------------	-------	------------	----------	-------------------

6. I am fully aware of the transition from analogue broadcasting to digital broadcasting.
- 5                      4                      3                      2                      1
- 
7. The conversion from analogue broadcasting to digital broadcasting is a necessary transition.
- 5                      4                      3                      2                      1
- 
8. I intend to use digital TV when available.
- 5                      4                      3                      2                      1
- 
9. Digital TV would improve my television viewing experience.
- 5                      4                      3                      2                      1
- 
10. I understand that I will need a TV capable of receiving digital signals or a converter box for my old TV in order to continue to receive television broadcasts once the transition from analogue to digital has been completed.
- 5                      4                      3                      2                      1
- 
11. I would rather buy a converter box for my old TV than purchasing a new TV.
- 5                      4                      3                      2                      1
- 
12. Purchasing a digital converter would facilitate my access to digital TV.
- 5                      4                      3                      2                      1
- 
13. The acquisition of a converter box would be an affordable entrance to digital TV.
- 5                      4                      3                      2                      1
- 
14. Buying a converter box would reduce the hassle related to switching from analogue to digital TV.
- 5                      4                      3                      2                      1
-

15. Installing the digital converter box will not take much effort.

- 5       4       3       2       1

16. Using the digital converter box will be simple.

- 5       4       3       2       1

17. Learning how to use a digital converter box will not take much time.

- 5       4       3       2       1

18. Do you believe the government should bear some of the cost of the new equipment?

- Yes     No

### C. Demographics

**\*\*Please select the answer that best suits you.**

19. Are you Male or Female?

- Male     Female

20. What is your age?

- 18-25       26-30       31-40  
 41-50       51-60       61 or over

21. What is the highest degree or level of school you have completed?

- No schooling completed  
 Elementary school to 8th grade  
 9th, 10th or 11th grade  
 12th grade, no diploma  
 High school graduate - high school diploma or the equivalent  
 Some college credit, but less than 1 year  
 Bachelor's degree  
 Master's degree  
 Doctorate degree (for example: PhD, EdD)

22. What is your total household income, including all earners in your household?

- \$10,000 to \$19,999
- \$20,000 to \$29,999
- \$30,000 to \$39,999
- \$40,000 to \$49,999
- \$50,000 to \$59,999
- \$60,000 to \$69,999

- \$70,000 to \$79,999
- \$80,000 to \$89,999
- \$90,000 to \$99,999
- \$100,000 to \$149,999
- \$150,000 or more

**23. What is your current marital status?**

- Single, Never Married
- Married
- Separated
- Divorced
- Widowed

**24. Is your television set capable of receiving digital broadcasting?**

- Yes
- No

**25. Are you aware that the government has agreed to begin replacing analog television broadcasting with digital television broadcasting by the year 2012?**

- Yes
- No

**26. What would you consider to a reasonable cost for a digital converter? (U.S. Dollars)**

- Above 75
- 50-75
- 30-49
- 25-29
- Below 25

