The Impact of Digital Cinema on the Movie Industry: Time for a Change?

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I. Abstract

This paper analyzes the movie industry in relation to the emerging digital cinema technology. It looks at the history and evolution of the technology as well as the benefits, drawbacks, and costs of adopting it. The paper further discusses the economic reality of how prepared theaters are for switching from the analog to the digital world and their position in the motion picture value chain. The different stakeholders and how they are influenced by this transition are discussed. Finally, the paper proposes a business perspective on the issue and recommends a strategy for traditional theaters.

II. Introduction

Movies have fascinated the imagination of millions of people around the world for over a hundred years. These moving images provide us something more than just entertainment - they give us the chance to escape from our own sometimes mundane reality and for two hours be immersed in a different world. We can associate with the characters and relive their experiences, whether they would be good or bad, happy or tragic. It is no wonder then that a lot of people call it "the magic of movies." Yet, very few of them really wonder how movies are made and projected, what the technology behind them is, and how they operate. The average viewer would probably not be able to explain the difference between analog and digital projection and production techniques. To those people, cinema is just the "art of presenting motion pictures" (Karagosian, 2006).

The purpose of this paper is to delve into the issue of digital cinema implementation. I will look at the history of digital cinema, how it works and differs from standard analog cinema, the pros and cons, the arising issues and ongoing debates, and the different stakeholders involved in the implementation process. Finally, I will come to a conclusion regarding the future of digital cinema and whether the time has come for the switch from analog to digital.

III. Definition and History

Digital cinema can be defined as "a method whereby the traditional film containing the movie is replaced by an electronic copy contained on a storage device, such as a high-capacity hard drive and server" (BigScreen, 2007). Traditional analog technology utilizes light that passes through the film which is then projected onto the big screen. The problem with that is that every

time the film passes through the projector, the quality deteriorates. Every imperfection is clearly visible on the big screen, whether it would be a scratch, a fluff, or just film blotches (Taylor, 2006). What is more, information is lost during transmission or playing which results in lesser quality of showing number fifty versus the first one. Digital cinema on the other hand eliminates those problems because it utilizes different technologies. It uses bits and bytes, or strings of 1s and 0s, to record, transmit, and replay images. With this approach there is no loss of quality which will be the same regardless of whether it is the first, tenth, or hundredth showing of a movie (Harris, 2008).

The concept of digital or electronic cinema is in fact not new at all. It dates back to the middle of the 20th century and it was even discussed before the introduction of television (Karagosian, 2006). The discussions on the subject picked up speed again in the early nineties when the Hughes/JVC ILA (Image Light Amplifier) projector was introduced to the market. "This was the first electronic projector that could light up a large cinema screen and produce a picture that was worthy of consideration," according to MKPE Consulting (Karagosian, 2006). Nevertheless, the projector had its problems which were mainly in the area of maintenance and alignment issues. Using on a big screen in cinemas only exacerbated its problems and made the picture quality deteriorate.

The solution to the above problems was revealed in 1999 with the introduction of the Digital Light Processing (or DLP) projector for cinema. The DLP projector is "based on MEM technology (Micro-Electro-Mechanical), utilizing approximately one million mirrors that can flip between reflecting light to the projection lens or reflecting light away from the projection lens" (Karagosian, 2006). This allows it to have a wider color range that normal TVs with a pixel array, or resolution, of 1280 x 1024. What is more, it also provided more stable and consistent

quality in the cinema environment, which was a big step up from previous attempts. The DLP technology became the foundation of what we now call digital cinema and without it there would be no discussion. A second and improved version of DLP was shown in 2003. It was able to produce even better contrast ratios and double the pixel ratio of 2048 x 1024 (Karagosian, 2006). Figure 1 shows how the technology works.

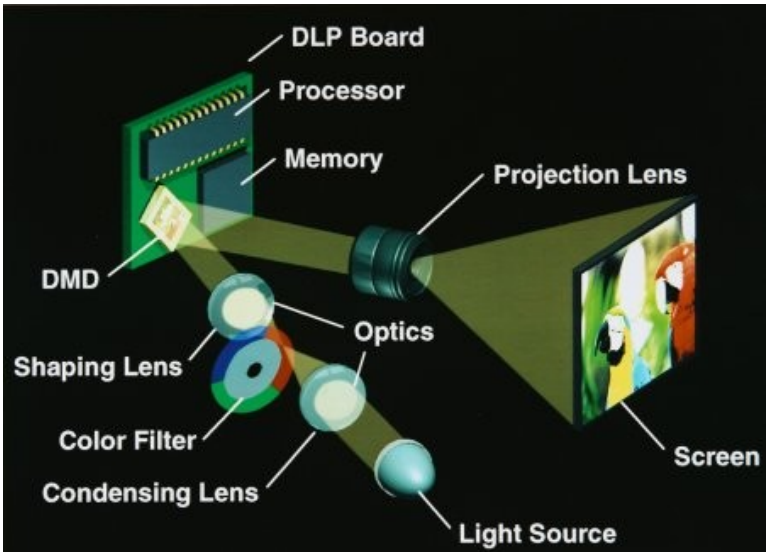

Figure 1: DLP Technology
Source: *PC Tech Guide*, http://www.pctechguide.com/images/57DLP_1chip.jpg

The inv al movie – Star Wars Episode II: The Attack of the Clones. It was the first movie not to use any film in the production stage, although 35mm film copies had to be made for worldwide distribution as most theaters were not equipped with the necessary projectors (BigScreen, 2007). Slowly filmmakers are considering or have already started using digital technologies to assist them in creating their movies. George Lucas started the trend with Star Wars but others such as Robert Rodriguez and Steven Soderbergh have picked up the trend as they saw the benefits that digital offers, discussed later in the paper.

IV. Digital Cinema Process

Implementing a digital cinema system is not a simple change of the projection system. Changes in technology need to happen throughout the entire movie making process. Figure 2 shows the process visually. There are four key elements:

1. Telecine

Nowadays the majority of movies are still shot on original and old fashioned film even though digital effects are often inserted in post-production stages. This means that the movie needs to be digitalized which happens using a telecine. The current telecine process will require some modification in order to be suitable for big screen projections. Most importantly, telecine process needs to be in high-definition in order to guarantee the necessary quality. Also, for best results the telecine equipment needs to be optimized for use with the specific projection technology. This is why if there were two different technologies used, then there would be a need for two different telecine systems (Huske & Vallieres, 2002). This could prove expensive which is why it is vital to set a common standard for the digital cinema. This issue is discussed later in the paper.

2. Preparation

The conversion process for a movie requires some sort of a compression in order to reduce size. If a film is to be digitalized without any compression, the resulting file would be massive, taking approximately 1,000 gigabytes, which is 1 terabyte, for a standard 2-hour movie. When a compression is used, the file is “only” 60-80 gigabytes which is a huge improvement in space requirements. This helps with the storage costs at the cinema level. At the same time transmission should be considered – the larger the file, the harder it is to submit it a file. For example, submitting a full-length, uncompressed movie would take approximately 110 hours

even with using a satellite system. Some commonly used compression technologies include MPEG-2, layered MPEG, and wavelet. The compressed files also need to be encrypted to prevent interception along the way and illegal use. There are a number of possible encryption technologies that could be used. It is very important to encrypt the movie at every stage before reaching its final destination in order to minimize piracy, which is one of the biggest problems in front of digital cinema (Huske & Vallieres, 2002).

3. Distribution

Distribution offers a few options for delivering the digital copy of the movie to the theaters for projection. There is no barrier to using a number of them at the same time, but it would be more efficient to establish a common way of delivery which will bring efficiencies because of consistency. According to the Credit Suisse First Boston report, "From our discussions with industry players, there seemed to be a general consensus that fixed media should be used in the beginning" (Huske & Vallieres, 2002). This means that DVDs or Blu-Ray discs would be used to transfer the movie using the current delivery system. This approach will not cost much because there is essentially no change to the way things are done now. Later on, this system could advance into using fiber optic networks, T1 lines, and so forth. These technologies are already in use but are not as widely available which makes them more expensive. Some time will pass before they become as cost-efficient as the fixed media method above. Finally, the most innovative and ultimate method of digital transmission would be satellites. This can be very useful, especially in emerging markets where T1 lines or fiber optic cables have not been set up yet. One major benefit of this approach as compared to fixed media is that on theory using this infrastructure could allow for live transmission of events and media. This presents an opportunity for revenues from such live events, something participants in the

movie industry should not pass on easily. According to the same report, it would take six to eight hours to submit an entire movie through satellite. Since it is a point-to-point system, distribution costs will be relatively low. A reasonable estimate that is mentioned it a $1,000 per movie which is nothing compared to the thousands of dollars for current major movie distributions. However, this estimate does not account for the cost of the digital cinema projection system.

4. Projection

Movie exhibitors and theaters will have to make significant changes in order to accommodate the change to digital cinema. Disregarding the delivery method, the people at the end of the value chain will have to implement storage and supporting technology. The most important component, naturally, is the projector itself but it does not come cheap. Currently, a traditional, analog 35mm projectors costs around $35,000 but it lasts for a number of years (Huske & Vallieres, 2002). Digital projector systems consist of the projector itself as well as servers in order to store the necessary data. This, along with the need for more powerful lighting, results in significant cost increases. An estimated cost of a digital projector now is $150,000 - $200,000, which comes with the necessary hardware support. Unfortunately, there are almost no prospects for price reductions of these systems. That is because there is fixed number of screens in the world, roughly 108,000, which limits the chance of using economies of scale to produce savings. Put simply, there is not enough demand which will justify producers investing in cost-reduction techniques.

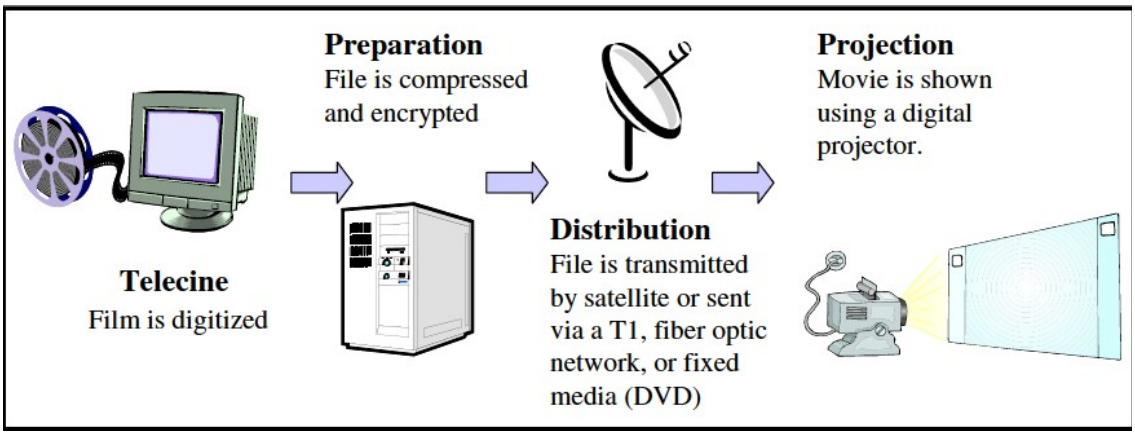

Figure 2: Digital Cinema Process
Source: *Credit Suisse First Boston*, Digital Cinema Report

V. Value Chain

In order to completely understand the impact of digital cinema on the movie industry, it is vital that the general motion picture value chain is discussed. The process of creating a movie and then delivering it to an audience is very fragmented. It is also a complex process that is "based on antitrust rulings that separate distribution from exhibition" (Huske & Vallieres, 2002). Because of some "choke points" along the chain, such as scarce creative resources and high capital requirements, value is not evenly shared among the members. As can be seen in Figure 3, the chain can be divided into the following:

1. Production – this is the group that is responsible for creating and producing the movies. It is closely linked to the distribution part of the chain and sometimes the two are impossible to differentiate, which is the case with Disney for example.

2. Distribution – distributors are the companies that are responsible for the physical delivery of the movie around the world as well as marketing it to the general public and theaters. They also sell the movie to "ancillary markets" which brings them a significant portion of their revenues.

3. Exhibition (or Projection) – these are the entities that show the movies to the general public, more commonly referred to as theaters. They charge admission and collect box office receipts but share their revenues with distributors.

4. Ancillary markets – they are the venues outside of theaters where distributors sell the movies. They can include international venues, pay per view, TV, cable, and so forth.

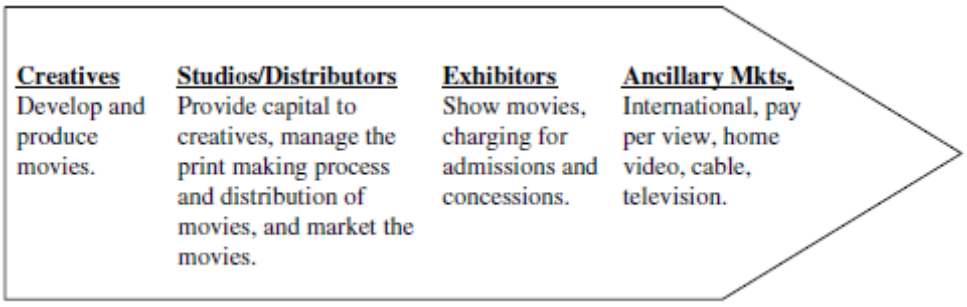

Figure 3: Value Chain in Movie Industry
Source: *Credit Suisse First Boston*, Digital Cinema Report

It is important to explain that power is not equally distributed in this value chain. Because of the large number of exhibitors and ancillary markets, they have limited bargaining power. Distributors in fact are the strongest players in the market. They often collect 50-55% of the box office receipts (Huske & Vallieres, 2002).

VI. Impact on Value Chain

Digital cinema affects roughly three major areas of movie making, all of which are part of the value chain. Those are Production, Distribution, and Projection.

1. Production

Anyone with a digital camera, a computer, and video editing software can create digital movies. The problem is that the resolution will not be sufficient enough to be projected onto a

big screen without loss of quality. Moreover, the movie will not look like a standard theatrical film but rather like cheap news footage. Another major difference is the frame rate that is used. Standard theatrical cameras shoot at 24 frames per second as compared to 30 for TV cameras. This difference gives movies and TV a very different feel which any user can identify almost instantaneously (Harris, 2008). This is why in order to record for digital cinema projections on the big screen, one needs a more professional camera that also costs more. Studios need to invest in cameras equipped to handle digital cinema.

Two other major differences between standard film and digital image are cost and flexibility. Original film is many times more expensive than digital video. The latter is very cheap since there is almost no processing to be done on the movie before the editing stage. A good illustration of this is the example with Star Wars Episode II. Rick McCallum, one of the producers of the movie, said that they "spent $16,000 on 220 hours of digital tape, and they would have spent about $1.8 million on 220 hours of film" (Harris, 2008). These are clearly massive savings.

Digital cinema also makes the whole process of making and editing a movie a lot more flexible. Editors now have to convert the movie from standard film to digital for the post-production editing stage and then back to film for distribution and theatrical release. This is a costly process that takes a lot of time and also sometimes deteriorates the image quality. Once it is fully implemented, digital video would never have to be converted between the two formats. In fact, filmmakers can shoot a scene in the morning and then do post-production work in the afternoon to establish whether they need to re-shoot something. With traditional cinema, that is impossible and it could often happen that a whole day's worth of film was ruined by bad lighting

(Harris, 2008) Thus, digital video cuts costs in terms of making the filming process more efficient.

2. Distribution

Digital cinema's most significant impact is perhaps on the distribution aspect of movie making. Today, production companies spend significant amount of money and resources copying movies to film and then working with distributors to ship the heavy rolls of film around the world. They also need to collect the rolls back for concerns of piracy. Because of the large overhead costs associated with distribution, companies are careful where they play their movies. The big blockbusters can afford to open worldwide because they will cover their own costs but smaller, more independent movies are doomed. Digital movies can change this because they eliminate the need for physical copies. Everything can be transmitted online via high speed connections and then stored on hard drives. Shipping costs are minimal and sending a movie to one or fifty theaters does not make a big difference in terms of price (Harris, 2008).

Individual theaters also have more flexibility with showing a movie. In case on a particular night a movie sells out due to high interest, the management can quickly decide to play it on another screen as well. This is possible because digital movies use the same signal so a movie can be played on a number of screens without a loss of quality or other limitations.

3. Projection

From an audience perspective, the projection system is the most important aspect of the digital cinema. Movie goers simply want to see great quality with amazing special effects. Tradition analog movie projectors deliver really great quality and vibrant colors. Yet, their problem is that movies fade out and scratch with each use which means quality goes down. On the whole, digital projectors at this point are still not superior to traditional ones and do not offer

any improvements in quality. Nevertheless, digital videos look the same regardless of how many times the movie has been shown (Harris, 2008).

There are two major digital cinema projection technologies – micromirror projectors and LCD projectors. Micromirror projectors, such as the already mentioned Texas Instrument Digital Light Processing (DLP) one, use microscopic mirrors to form images. In these systems, a high power light source shines light through a prism that splits the light into red, blue, and green lights. Then each colored beam hits a different Digital Micromirror Device (or DMD), which is small chip with millions of minute mirrors that can quickly switch on and off. The different positions they have and their movement creates different color combinations and images. On the other hand, LCD projectors use a stationary mirror which is covered with a liquid color display. Based on the incoming signal, some of the crystals reflect the light and some do not which again creates different color combinations and forms the image we see (Harris, 2008).

One negative that should be pointed out is that if a pixel breaks in either of these two systems, then it is permanently damaged regardless of the movie copy that is stored on the hard drive. Traditional films have an advantage because a scratched film can easily be replaced.

VII. Pros

The following section discusses the benefits that digital cinema offers. Its impact on the value chain can be significant, especially considering the savings that it can provide to the different participants.

1. Digital cinema eliminates the need for a traditional, print film. According to the Credit Suisse First Boston report, “the annual cost to print film in the United States is roughly $700 million” (Huske & Vallieres, 2002). This price includes the processing as well as the cost of the

film. This is the amount that movie makers and distributors will save annually if they transfer to entirely digital cinema.

2. Traditional movies degrade over time and with use, which results in worse quality with each viewing because of scratches and burnout. This means that traditional movies only have a certain lifetime before they are no longer good for use. Unlike traditional films, digital ones do not degrade over time and remain in the original state on the hard drive they were stored. Moreover, digital movies have more "precise controls" (Huske & Vallieres, 2002).

3. The new digital movie experience will allow theaters to earn revenues in other ways. For example, they can show live events such as concerts or sporting events. Also, we see advertising invading movies more and more today so digital cinema would not be an exception. In fact, digital movies will facilitate targeted and local advertising which will help theaters' bottom lines.

4. Ordering and shipping digital copies of movies will allow for a more accurate estimate of distribution costs. Today, a distributor needs to order prints before they can make estimates of demand which leads to high fixed costs. Digital cinema will effectively make this cost variable because it will more efficient. DVDs will be made as needed and distributors can use one satellite to transfer the movie to multiple theaters.

5. Digital cinema can open the door for smaller, Indie movies to find their way to more consumers. Because of the significant reductions in both production and distribution, movie makers with smaller budgets can afford to make their movies available to wider audiences.

6. It eliminates the need to transfer from film to digital for editing and then back to film for distribution. This transfer, as was described previously, has a lot of costs associated with it and it can also result in inferior quality.

7. Through the use of digital projection technology, theaters can play any sort of input they get on the big screen. According to Steve Knibbs of Vue Cinemas, "[We can screen] a DVD, a clip downloaded from YouTube, gaming from a digital projector with multiple players on the screen at the same time, a live feed from satellite, cable and whatever" (Taylor, 2008). Essentially, theaters have the chance to become true destination points and entertainment places, "providing everything from gambling to gaming, educational lessons to movies they might not have seen for 40 years" (Taylor, 2008). This is an unique opportunity for theaters that should not be passed by easily.

VIII. Cons

1. As described above, digital technology has been around for a while and it has pervaded other aspects of our daily lives – from DVDs, home theater systems, and TV programming to music players, phones, and even our own personal digital cameras. So the question becomes why the movie industry is still using methods similar to those employed fifty to sixty years ago. Most movies today are still shot and distributed on celluloid film, similar to what was done in the turn of the last century. The technology behind it has changed, naturally, but "it is still based on the same basic principles" (Harris, 2008). One possible explanation is that until recently nothing was even close to the image quality that traditional 35mm movies have to offer in optimal conditions. The film resolution is 5K as compared to 2K for digital video. Moreover, color range is significantly higher for traditional film (Huske & Vallieres, 2002).

2. Despite the savings that it offers, digital cinema is still an expensive option which will cost most to the movie theaters to implement. Unless the price of a digital system comes down to less than $50,000, which is roughly how much a traditional projection system costs, then there

will be no net savings (Huske & Vallieres, 2002). The paper will later discuss the different stakeholders and what savings each one has.

3. Despite the advances that have been made towards solving the piracy issues, experience shows that all encryption systems eventually get broken. This could result in significant losses both in the international markets and especially the other ancillary markets (Huske & Vallieres, 2002). According to the Motion Picture Association of America (MPAA), piracy violations cost the US motion picture studios a total of $6.1 billion, 80% of which was a result from piracy overseas and 20% was domestic (Movie Piracy, 2007). Piracy rates are highest in China, Russia, and Thailand with 90%, 79% and 79%, respectively. An interesting demographic fact is that the average pirate age is 16-24 and male.

The music industry provides a vivid example of how not to handle digitalization: “Instead of using technology to facilitate sales and uniformity across all platforms, they introduced DRM-based files which lacked compatibility and transferability standards” (Roussos, 2008). When consumers started using Peer-to-Peer networks and files sharing, the music industry introduced Digital Rights Management (DRM) which restricted and thus alienated consumers. The same could happen with movies as consumers are already used to going online and downloading the newest shows or movies in a matter of minutes. The movie industry should try to listen to its consumers because they are the ones that bring the money in the end. Movie makers and distributors need to embrace technology and find innovative ways to be profitable (Roussos, 2008).

4. There are also fears that digital movies in the cinema will not differ significantly from High-Definition TV (HDTV), especially with the advent and recently more affordable prices of

home theater systems and wide screen TV sets. In fact, HDTV does appear to be slowly picking up so the movie industry needs to find a way to differentiate itself (Huske & Vallieres, 2002).

5. One of the major drawbacks of digital cinema at this point is the implementation and maintenance costs that are associated with it. Figure 4 demonstrates the annual capital requirements that are necessary.

		Film		Digital
Screens		36,764		36,764
Average Projection Systems Cost	$	30,000	$	75,000
Average Life		7		3
Annual Capital Spending	**$**	**157,560,000**	**$**	**919,100,000**

Figure 4: Annual Capital Requirements of Projection Technology
Source: *Credit Suisse First Boston*, Digital Cinema Report

As it becomes apparent from the figure, the estimate is that there were roughly 37,000 screens in the United States in 2001. The average projection system cost according to the Credit Suisse report is $30,000 for film and more than double, $75,000, for digital movies. This cost is further exacerbated by the average life cycle where traditional film "wins" again – 7 years as compared to 3 for digital. The bottom line is that the annual capital spending will be significantly higher for digital cinema which is a major drawback (Huske & Vallieres, 2002).

IX. Technology Standards

In March 2002, seven studios – Disney, Fox, MGM, Paramount, Sony Pictures Entertainment, Universal, and Warner Brothers Studios – formed the Digital Cinema Initiatives (DCI). According to DCI, its primary purpose is to "establish and document voluntary specifications for an open architecture for digital cinema that ensures a uniform and high level of

technical performance, reliability and quality control" (About DCI, 2008). The studios first set quality standards: the resolution of the image had to be a minimum of 2K, or 2048 x 1080 pixels. Moreover, theater systems had to have an option for an easy upgrade to 4K, or double the previous resolution. According to DCI, movies had to produce almost the same range of colors as film does, with the "future potential to include all colors visible to the human eye" (Wintner, 2006). The consortium also specified video compression technology to be used as well as recommended using uncompressed sound. However, they did not recommend a specific projection technology which is where part of the problem of implementing digital cinema comes from. For the time being the industry appears to have settled on DLP by Texas Instruments (Wintner, 2006). DCI has in fact just revised its specifications to version 1.2 which came out on March 7, 2008. This version does not include any major revisions which are worth mentioning.

X. Costs or Economics

Currently, costs associated with the old-fashioned system can be divided into infrastructure costs and distribution costs. In this current distribution process, studios have to be aligned with one of the two major film processors, such as Technicolor and Deluxe. These two companies actually purchase their film from Kodak, Agfa, and Fuji. With a cost per foot of around $0.12, the average movie ends up costing, on average, $1,200 (Huske & Vallieres, 2002). Even after we adjust for discounts they might receive as well the current low position of the dollar, a good estimate would be that the cost is around $1,000 per movie. This means that for a US only release with 2,000-3,000 copies, they would spend $2-$3 million. It should be noted that here that traditional projectors cost around $25,000 - $35,000 and have a life of around 25 years.

Digital cinema, on the other hand, offers significant savings in printing. There are estimates that the global cost of printing savings would be somewhere around $4-5 billion (Huske & Vallieres, 2002). This number does not factor in the big discounts some of the companies receive but nevertheless, it is an impressive figure. These savings, however, are offset by the overhead costs that are associated with going digital. Since there is no clearly set projection standard, most digital theaters today will most not meet requirements when they are finally set. What is more, resolutions will only get better and the now regarded as high 2K may not be as impressive in a few years. The lifecycle of a digital projector is estimated to be around three years, which is significantly less than that of a traditional one. This is mainly because the technology is new and it has not matured enough to bring costs down to a more optimal level. On top of that, $150,000 per screen would be necessary to transform them from analog to digital. This means that to make a complete transition in the US alone would require close to $5.5 billion in capital (Huske & Vallieres, 2002). Some of these costs might be acceptable for larder chains but for smaller cinemas around the country, they are impossibly high.

Finally, movie costs themselves have been increasing. In 2007, the average cost per feature was $70.8 million, which is a $5 million or 7.5% increase over 2006 (Entertainment Industry, 2007). At the same time, marketing expenses have been increasing as well. Overall, it should be noted that companies spent less money on printing the movies, which could partially be explained with digital cinema releases (Entertainment Industry, 2007).

XI. Stakeholders

The main stakeholders in this change process are the production companies, the distributors, the exhibitors, the Writers Guild of America, and finally the consumers. Production

companies stand to gain a lot of benefits from the implementation of digital technology. They will save on film costs as well as on not converting from analog to digital for post-production, and then back to analog again. The whole process will be simplified for them which will make it easier on employees who will not have to worry about converting the movie back and forth. At the same time, a possible negative side is that these studios are already used to making movies in 35mm film. They have been doing that for many, many years and they have achieved savings due to the learning curve associated with it. Implementing digital cinema will require some time before operations run smoothly as they did with traditional cinema. Additionally, there are some costs associated with buying the necessary equipment and support infrastructure for digital production.

Distribution companies will benefit the most out of this transition to the digital world. As was discussed in the previous section, the enormous distribution and shipping costs will be significantly cut down. If the current companies manage to keep afloat during this transition stage and remain the intermediaries, then they will see large reductions in the cost to do business. Nevertheless, with the use of satellite technology to distribute movies from point to point, the need for traditional distribution agents is eliminated. This means these companies will have to find their place in the newly created value chain which is no easy task.

The exhibitors, or the theaters, are the entities that deal with the consumer directly. They are hence the ones that will be “held responsible” from a customer’s stand point for the quality of the digital movies and how they are different from old fashioned film ones. Benefits for the theaters include that this digital technology will allow them to play any content, from movies and music, to YouTube videos, sporting events, and other live content. If they manage the transition properly, they could become the entertainment centers for many. At the same time though, costs

are against them. With the average cost of a projection system close to $150,000 and a lifetime of only a few years, it is economically inefficient and even impossible to justify the costs of switching. There will most likely be no reduction of price for the consumer which means that theaters cannot make some of the capital that way. Unless the big studios back them up with capital investments, the change to the digital world will not happen soon. This is mostly true for the smaller, independent one-screen cinemas in rural parts of the country. The big chains such as Regal Cinemas are already playing around with different digital technologies though they have no switched entirely.

The Writers Guild of America is definitely part of the stakeholder analysis. They are the people that write the movies and the recent long strike proves that they want a bigger share of the enormous profits that the movie industry provides. Going digital to them might be a benefit in the sense that content will circulate more quickly. Hypothetically, production and post-editing time could be cut down which means that writers will be kept busy with generating new ideas in this digital world. Also, since now they receive a higher percentage of ancillary markets, their revenues could go up as result of how quickly digital materials could be transferred for sale in other mediums after the initial movie release. On the other hand, due to the potential increase of piracy the WGA's intellectual property might be hurt. Also, big studios and distributors have always shown their reluctance to share profits with anyone which means that the WGA will have to fight a new battle for the new digital market.

Finally, consumers are the last stakeholders in this discussion. Benefits to them include the quicker turnaround between conceiving a movie and executing it. They could also see the new digital cinema as a place to do more than just watch movies – the idea of an entertainment center which was touched upon previously. Despite the fact that there are huge savings in

distribution and production costs up the supply chain, it is highly unlikely that consumers will get any price reductions. The price of ticket will either remain the same or more realistically go up as a result of the high installation and maintenance costs of the new digital projectors. Also, the picture quality will not be as good as with traditional movies until 4K or 5K is accepted as a common standard for digital movies.

XII. Digital Cinema Today

Digital cinema today is slowly on the rise. In 2007, there are a total of 40,077 screens in the United States. There was a general shift towards larger theaters, with "megaplexes with 16 or more screens grew 4%" (Entertainment Industry, 2007). At the same time, there was a significant increase in digital screens both in the US and worldwide. This means that digital cinema is finally picking up speed and is on the way to establishing itself. Figure 5 below shows details.

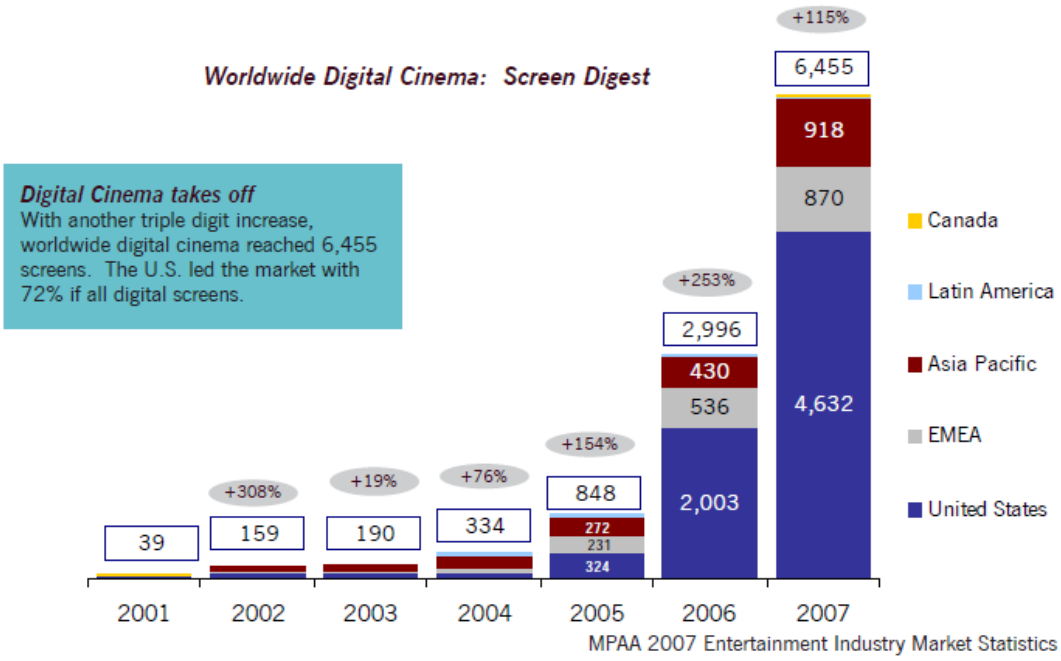

Figure 5 Digital Cinemas Source: *MPAA Entertainment Industry Report*

However, there are a few concerns still remaining. First, a number of people who have been involved with the digital cinema industry from its beginning are getting discouraged that the roll out is not happening as quickly as they had anticipated it (Dager, 2008). According to Dager, editor and publisher of the website DigitalCinemaRepart.com and director of business development for CineMuse, "so much forward motion depends on Digital Cinema Implementation Partners' decision" (Dager, 2008). The company represents nearly half the screen in the US which makes it a significant player in the market.

Second, the US industry is facing talks to recession which is not helping the movie industry. Even the more optimistic experts regarding the future of digital cinema have their reservations about progress in the next couple of years because of the looming recession (Dager, 2008).

The third and final concern is that Hollywood itself is standing in the way of implementing digital cinema. Hollywood "currently refuses to relax the DCI standards in any way and that is critical if a more affordable implementation of digital cinema is ever going to happen" (Dager, 2008). 2K standards are good in terms of picture quality but are very expensive and just not economically feasible, especially for the smaller cinemas around the country. An extension of this problem is that there are no foreseeable reductions in price for 2K which means that another solution needs to be thought of. Many opponents of lowering standards say that 1K does not deliver the necessary picture quality. A counter argument to that is that a lot of the smaller cinemas around the US with old projection systems do not play movies in optimal conditions either, which means that picture quality is most likely comparable (Dager, 2008).

XIII. The Future, Time for a Change?

It is hard to come to a single answer about the future of digital cinema. Much like the introduction of Dolby Surround sound by the original Star Wars in 1977, it will take time for this new technology to catch on. According to Michael Karagosian, a digital cinema consultant to the National Association of Theatre Owners (NATO), "the technology is there […]The return on investment for digital cinema really is not there yet. On a gross level, digital cinema as it exists today would not generate new revenue for an exhibitor" (Niles, 2008). There is an expectation that more and more mainstream cinemas will start buying digital equipment in 2009. Next year could prove to be the turning point for digital cinema even though there are issues that still need to be resolved, such as the security concern and encryption.

It is nevertheless important to remember that despite all the advances in technology, the movie industry is first and foremost about entertainment. We do not go to the movies because of the technology, we go because we expect to see a great story on screen with believable characters and technology just helps us get there. It is all about the acting, directing, cinematography and other factors that rise above technology.

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