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FAREWELL TO FILM?
What is at Stake in Digital Projection?

(Abridged Version)

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FAREWELL TO FILM?
What is at Stake in Digital Projection:
Non-Physical Film Distribution.

Today no professional colloquium or congress goes by without dedicating at least a day to the question of digital projection. Spectacular declarations and stirring future projections are heard on a daily basis. Even if figures show we are still in an experimental phase (just a few hundred theatres and a few dozen films), it seems that an acceleration of the digitalisation process is underway.

The following report makes one assumption: the quality of digital projection is considered beyond dispute; it will not be the subject of discussion.

Consequently, the interrogations put forward are essentially directed at the economic viability and implications of digital projection.

1. / What is Driving the Development of Digital Projection?

The development of digital projection does not result from either technical or political necessity.

The quality gains are real in terms of use. The most important is the stability over time: not only does the risk of scratched prints disappear altogether, exhibitors are also assured of the same projection quality for the entire run of the film. Equally, digital projection offers an obvious quality advantage for cartoons and special-effects films which are post-produced digitally. In addition, it opens perspectives for 3D cinema. These advantages are important for younger age groups, the major audience for such films.

But the most novel advantage for audiences is perhaps the diversification of programming allowed by the "flexibility" of digital technology: widening the spectrum of films on offer (accessing a greater number of films and subtitled versions, including for deaf people and the hard-of-hearing…); and alternative contents (sporting events, shows, audiovisual works).

The quality differential with respect to 35mm remains limited, however. For the time being, the advance of digital projection results from an economic choice on the part of cinema operators.

This choice can result from a simple cost-benefit analysis. From this point of view, the savings anticipated on film prints seem to be the most apparent and the biggest source of profitability. All the more so for films with large print runs. The creation of the DCI (Digital Cinema Initiative) in 2002 by seven large Hollywood studios, the publication of its technical recommendations in July

2005 and the agreements signed with certain companies (Christie-Access IT, followed by Thomson) in the second half of 2005 all demonstrate the key role played by the major distributors in the development process.

In addition, the development of digital projection is a strong positioning factor for a certain number of old and new technological industries (post-production, laboratories, projector and server manufacturers, as well as secure teletransmission industries), which hope to take an important place in the new film distribution channels.

For their part the exhibitors, even those most open to technological innovation, are the ones who must bear the brunt of the required investments. Consequently they are the ones who stand to gain the most from a convincing economic model. In addition, fearing increased dependence through the intrusion of information technology, they are keen to guarantee their liberty, notably as regards programming. Nevertheless they are the focus of equipment producers, and it is likely that some (out of a taste for experimentation or with an eye to gaining audiences) will rapidly equip themselves with digital projectors. The federation of American exhibitors, which has had reservations until now, recently came out in support of digital projection.

Public bodies can also play a considerable role in accelerating this trend. This is the case in the UK, with the initiative launched by the UK Film Council to digitally equip 250 theatres (out of 3300). As we will see, the French regional authorities are also behind providing aid for the digital equipment of theatres. The European Union has also brought to bear certain of its aid mechanisms to support the digitalisation of theatres.

2. / A Simple Technological Change or a Profound Upheaval?

Certain factors prompt one to think that this development may entail profound changes.

What we are facing is a definitive rupture with the material basis of cinema since its origins: film. The psychological shock is great.

But over and above its symbolic value, this change entails a profound redefinition of the entire film distribution chain, from post-production through to projection. Eliminating the physical basis of films not only makes it necessary to rethink the processes of transportation to the cinema (digital hard disks, high-speed networks), security (encryption and keys) and economic viability. It also introduces new terms, on the one hand the territorial regulation of this transportation (nothing prevents films from being sent directly from Los

Angeles, London or Beijing), and on the other hand the relation between officially authorised distributors, physical distributors and exhibitors.

The digitisation of projection also gives rise to soul-searching on the identity of cinemas. The possibilities of programming diversification opened up by digital projection can radically change the theatres' profiles, transforming them into "multi-purpose projection spaces."

The flexibility of the digital format can help exhibitors show a greater diversity of films (arthouse, historically important films); but non-physical distribution can also lead to an increase in the number of screens showing one film and shorten film runs, thus exacerbating concentration and the tendency, criticised by some today, of transforming cinemas into an "advertising window" for other film-related merchandising.

3. / Can We Predict the Time Necessary for Such a Change?

The switch to digital projection is still in its initial phase. Putting together the US and Europe, the number of theatres equipped with a digital projector in June 2006 counted 800 of the existing 66 000, or less than 1.5%. Worldwide, it is estimated at 1500 of the existing 165 000 theatres, or less than 1%. In addition, much of this equipment, notably European, does not conform to norms established after installation.

The publication in 2005 and 2006 of specifications (DCI recommendations, AFNOR norm) aimed at structuring the market around common technical characteristics, and the establishment of re-equipment programmes - whether privately funded (those agreed by the Hollywood studios and Christie AIX and Thomson in the US) or public-funded (such as the UK Film Council initiative) – should help open up the advancement of digital technology.

In the USA, the objective is notably to accelerate the equipment of theatres. Christie has indicated it wants to go from installing 150 projectors per year to 150 projectors per month (a twelve-fold increase). These are only target figures, however, and they are relatively modest in absolute terms (3000 per a year out of 36 000 existing theatres).

Several factors seem to prevent hasty expansion, the most important being the limited production capacity of projectors. The three major manufacturers (Christie, Barco, NEC) are all dependent on one supplier, Texas Instruments. Today, an optimistic estimate puts annual production at around 5000 worldwide, half of which is for the American market.

Thus we can suppose that re-equipment of theatres will proceed progressively, rather than spread rapidly. A period of ten or so years seems reasonable. However, it is probable that the pace of re-equipment will not be homogenous either in time or geographically, and that it will take place in stages and at varying speeds.

This means that for a long time it will be necessary to operate in a world where 35mm and digital co-exist. This transition period is key, notably for the smallest operators. Proper management of this transition period is thus fundamental for preserving the industry's equilibrium and the cultural diversity of cinema as a whole.

4. / Approach and Principles Underlying the Analysis and Recommendations

The approach taken in this study is pragmatic: on the one hand to determine the choices necessary to preserve a cinema which is both diversified and open to the world, and on the other to point the way to a workable "economic model".

Three fundamental principles underlie this approach:

– Firstly, the principle of liberty and transparency: each actor must be free to make his or her own choices, and have ready access to all of the technical means available.

– Secondly, the principle of respect for the cultural identity and diversity of each country. Naturally, the specific nature of France is taken into consideration (market share for national films of almost 50%, a huge diversity of films on offer, specific institutions, notably the Centre national de la cinématographie (CNC)).

– Finally, the principle of solidarity among cinema professions and a respect for every individual trade.

WHAT TECHNOLOGICAL OPTIONS ARE OPEN FOR A JUDICIOUS IMPLEMENTATION OF DIGITAL PROJECTION?
The Idea of Universality.

A. / The "Norm": a Fundamental and Symbolic Question

One of the most widely recognised virtues of 35mm projection is its universality. Will digital projection be able to reproduce this model – which is considered ideal today?

a) The DCI I.0 Recommendation (July 2005)

The DCI recommendation is very detailed: not only does it fix projection quality standards (an image resolution standard of at least 2K, definition of contrast and colorimetric space) and compression norm (Jpeg 2000), it also lays down extremely precise security requirements (with the use of encryption and key systems).

b) The AFNOR NF S-27 100 Norm

This norm was introduced in France by the CST (Commission supérieure technique du cinéma). It is strictly limited to projection quality, and thus corresponds to the first part of the DCI recommendation.

Must All Exhibitors Comply to a Single Norm? The Debate between d.cinema (Digital) and e.cinema (Electronic):

This distinction concerns the alternative between two sorts of digital cinema (or their co-existence): on the one hand d.cinema (digital), which would respect the norms set out above, and on the other hand e.cinema (electronic), for films d'auteur or small theatres, which would not have to comply with these norms.

A number of economic players in the cinema industry – from the creative side, but also among distributors and exhibitors – feel that only a "light" digital approach can safeguard cinema d'auteur. They feel that the costs of 2K digital technology are only justified for large productions.

The fear of investments disproportionate to financial returns are also felt among exhibitors' associations and national representatives, who are interested by the transformation to digital technology, but careful not to unnecessarily over-equip themselves.

Peter Buckingham of the UK Film Council is no doubt the one who has best formulated these considerations.

B. / The Choice of Equipment: a Question that will Determine the Future Shape of the Cinema Network

What is really at stake in choosing among equipment options is the future shape of the cinema network as a whole.

1. / A "Multi-Track" Cinema Network?

This is the risk posed if theatres choose different equipment. On the one hand we would have theatres equipped to show the "majors", whether American or European. On the other hand this entails a network of arthouse theatres, dedicated to cinema d'auteur and new talents. A third group would comprise "multi-purpose projection spaces," with diverse programming including screenings, events and local productions.

This debate – between respecting the norms or positioning oneself outside them, between a universal and an alternative network – also arose within Europa Cinemas, the network of European exhibitors that promotes an ambitious programming of European films. This discussion was all the more natural in that the network's goal is to stand up for a cinema that is often less-frequently programmed, and which is confronted in most European countries with a market share for American films of over 60%. In addition, Europa Cinemas theatres were among the first to invest in digital equipment which, having been purchased before the publication of the norms, had a resolution of less than 2K. Nevertheless, Europa Cinemas has decided to oblige members to equip themselves with 2K resolution – within a transition period – to avoid the marginalisation resulting from a technical incapacity to show major films, which are necessary to their programming balance.

2. / The Fear of "Technological Escalation": the Perspective Presented by 4K and 3D

One of the major reservations for taking the plunge and buying expensive, top-of-the-line equipment stems from the fear that it will be rapidly supplanted by the appearance of new, more powerful equipment. These worries are more than justified – as the experience of the past two years has shown, when many invested in 1.4K projectors which had become obsolete almost before they were first used.

These fears are also fuelled by the statements of some manufacturers and directors, who foresee the imminent necessity of 4K and the advent of 3D. However 4K and 3D remain, for the moment, essentially experimental fields, technologies which have yet to be perfected.

3. / What Options Should be Considered in Choosing Equipment?

The philosophy behind the choice of equipment and technical support for theatres in France has always been that technically, all theatres must have access to all films, including American ones. Will digital technology lead us to turn our backs on this doctrine?

Here, we believe that if exhibitors are to make the correct choice, they must distinguish between two elements of the question that are often thrown together:

– on the one hand there is the projection norm, implying the choice of a certain type of projector,

– and on the other hand there is the compression norm, implying the choice of a certain type of server.

a) The Choice of Projector

The fundamental choice today concerns the projector. As the last link in the chain, it determines the appearance of the film on the screen. Its definition is a definitive constraint which cannot be corrected by additional equipment. It is also the most costly investment.

As far as image quality goes, the 2K projector (1080 pixels vertical resolution, or "number of luminous points per column", and 2048 pixels horizontal resolution, or "number of luminous points per line" – or 2 200 000 pixels in total) and, with the reservations formulated above, even more so the 4K (2160 x 4096, or 8 800 000 pixels) are clearly superior to projectors with a lower definition, including HD.

The advent of HD has led certain people to believe it could be a competitive format to 2K. But HD (1080 x 1920 pixels) is conceived for 16:9, not for the much more elongated cinema formats of 1:1.66, 1:1.85 and cinemascope 1:2.39. And above all, HD can only reproduce 16 million colours, while the 2K system can reproduce 68 billion.

For this reason the 2K projector appears to be that which best displays cinema quality – format, contrast, colorimetric space, luminosity – in a way

comparable to 35mm. It is also the most effective as far as other definitions are concerned, and the most promising for the future:

– A 2K projector can of course project resolutions of less than 2K (in the digital world, if you can do more, you can also do less);

– Nor will it be displaced by the eventual appearance of 4K. The DCI prescriptions have anticipated this evolution, and require that 4K must be playable by 2K projectors;

– It is also compatible with 3D, as the refresh rate of 2K projectors (greater than 48 images/second = 24 images for each eye) is sufficient for 3D.

Finally, it should be borne in mind that the 2K projector will be required by distributors of American films, and that only theatres equipped with 2K projectors will be able to show these films.

Thus the only obstacle to choosing a 2K projector seems to be its cost. Nevertheless, it is not implausible to say that the prices of 2K projectors – certainly for large orders – will fall little by little, gradually approaching those of 35mm projectors.

For this reason it seems preferable to wait for the market to consolidate before investing in 2K technology, rather than going out and buying lower quality material.

<u>Recommendation 1</u>: Financial aid to theatres for the purchase of digital equipment should be strictly limited to the acquisition of 2K (minimum) projectors corresponding to the AFNOR norm.

<u>Recommendation 2</u>: Theatres equipped with projectors of less than 2K definition should not be excluded from other CNC measures, as long as this equipment remains a complement to 35mm.

b) The Choice of Server

One new aspect of digital technology is the need for a server to accompany the projector. An uncompressed digital file is impossible to transport, due to its size.

The job of the server in this chain of operations is to receive the compressed file, to store it and "decode" it for playing.

Storage is thus an important matter, involving two subjects for reflection:

– Storage capacity: most servers currently on the market have a capacity of ten hours, or 4 to 5 films.

– Storage architecture: for complexes with many screens, this is essential for programming flexibility. Today, cinemas are forced to have one server per screen, which is very constricting. But research is underway to develop a storage architecture connecting a central multiplex server to a local server for each screen.

These elements are, of course, of major practical significance for everyday exhibition. But it is probable that the rapid evolution of information technology will make up for these shortcomings within a reasonably short time.

Decoding is, of course, linked to the compression format chosen. Today, two formats exist: Mpeg 2, which tends to be associated with television (it is the encoding format of Terrestrial Digital Video Broadcasting), and Jpeg 2000. The DCI recommendation opted for Jpeg 2000. The AFNOR norm does not explicitly require any compression format, yet only Jpeg 2000 would comply with all the quality demands it laid down. In addition, as opposed to Mpeg 2, Jpeg 2000 is an open, non-proprietary codec.

Finally, it seems clear that only servers able to decode from Jpeg 2000 will be able to project American films.

The choice of server is thus much less significant than the choice of projector. The cost is far lower (25% that of the projector), and should decrease spectacularly in a rapid space of time. In addition, as we have seen, and as opposed to the projector, the choice of server will not restrict further use. On the one hand, it is likely that most servers will very soon be multiformat. On the other hand, this equipment is highly adaptable. Adding a card in one server or adding an additional server will enable exhibitors to correct initial choices.

Recommendation 3: Financial aid systems should not recommend one compression format, but should encourage server versatility.

Recommendation 4: Financial aid systems should consider incorporating support for diversification in theatres.

4. / Compatibility and Interoperability: Free Choice of Suppliers and Technical Independence

Another consideration in the choice of equipment is that servers should be technically compatible with projectors. Furthermore, a Jpeg 2000 or Mpeg 2 server put out by one company should ideally not have any particular constraints compared with the equivalent server of another company (sometimes they do not accept the same file format). A film encoded in Jpeg 2000 at Kodak should

be playable on a Doremi server, and an XDC server should have no problems with a film encoded in Mpeg 2 at any laboratory whatsoever.

Previous experience has shown, however, that interoperability cannot always be taken for granted. Several European exhibitors, pioneers of digital technology, have made that painful discovery.

It is true that in most cases, these experiences date from before the publication of the DCI recommendations and the AFNOR norm. It is to be expected that fewer problems will be encountered in future. The DCI has just entrusted (June 2006) the Frauenhofer Institute with the role of establishing verification modes to test whether new equipment conforms with recommendation 1.0. The principle is that films encoded anywhere must be playable anywhere else.

Checking equipment as it comes from the factory is a fundamental guarantee of its operational value. Yet with every installation in a particular theatre, it must also be verified that the equipment selected corresponds to the criteria of compatibility and interoperability that guarantee the liberty of exhibitors and distributors.

Recommendation 5: The French CST should be asked to check digital re-equipment projects for the compatibility of their projected installations.

WHAT ARE THE STRATEGIC CHOICES TO BE MADE TO REGULATE NON-PHYSICAL FILM DISTRIBUTION? Protecting Transparency and Diversity.

Eliminating the physical basis of film distribution would seem to open up new methods for exhibiting and disseminating films. But it also makes territorial control of distribution nigh impossible. The internet, high-speed networks and satellites do not have national boundaries, thus facilitating worldwide release of films. By any count, disembodying films is bound to affect the relationship between authorised distributors and exhibitors.

In terms of independence and diversity, a great deal is at stake, and a certain number of strategic choices with respect to the architecture of this new network need to be urgently addressed if the process is to be regulated.

A. / The Organisation of the New Network for Physical Distribution of Films – a Gamble for the Industry.

1. / From Mastering to Projection

Digital projection is dependent on the existence of films in a suitable digital format and their transferral to the place of projection.

a) Mastering

This process comprises three stages:

- First, the creation of a Digital Source Master (DSM) of the film, an uncompressed

reference which forms the basis for all future steps in the reproduction process. It is comparable to the 35mm interpositive.

This master can be the end product of native digital post-production (in the 4K, 2K, HD, DV formats) or the result of transferring a film after post-production on 35mm.

This step is costly, as it can involve up to a threefold increase in the amount of labour, as opposed to post-production on 35mm.

– Secondly, the creation of a so-called Digital Cinema Distribution Master, or DCDM. This marries the picture with the relevant soundtracks and other information such as subtitles. It is comparable to the 35mm internegative.

– Thirdly, the creation of a Digital Cinema Package, or DCP, encoded in the compression format of choice, which combines in one single, indivisible package, all the files necessary for cinema projection. Copies of the DCP are distributed directly to theatres. It is thus comparable to the 35mm print.

The combined cost of these last 2 processes is relatively modest, comparable to that of a 35mm internegative (roughly between 5000 and 15000 euros).

b) Transport:

The most cost effective means of transport for the DCP today would seem to be the removable hard disk.

The factory reproduction costs of a DCP are virtually zero. After transportation, we can estimate that the real costs of each DCP – according to

the number of copies involved – range from a third to a fifth of those for the creation and transportation of a 35mm print (between 200 and 500 euros for a DCP, as opposed to 1000 to 1500 euros for a print).

2. / Security Concerns:

In addition to the above elements of a non-encrypted distribution network, the process should also incorporate the DCI's recommendations 1.0 on security issues.

a) The Principal Security Procedures Put Forward by the DCI

– Encryption of the film. This takes place on creation of the final DCP of the film, parallel to the encoding. The process itself incurs no further costs. The encrypted files are associated with a "**primary key**", which allows this film to be decrypted.

– The generation of a key, specific to each theatre, allowing the film to be read. This key, known as the Key Delivery Message or KDM, is a file composed partially of code drawn from the film's primary key, as well as elements identifying the equipment installed in the theatre (server and/or projector) called "**public keys**" or "**certificates**".

This key – which is linked to the film's files on the DCP – allows the reading of this film on this server and this projector in this specific theatre, guaranteeing that the files cannot be used to project the film on another screen.

In addition, this KDM can incorporate a time limit corresponding to the contract signed between the distributor and exhibitor, allowing this film to be played only in this theatre over this specific time period (not before, not after).

– **Transportation of the KDM separately to the DCP.** The Key Delivery Message may be sent on a USB stick or as a file sent via e-mail. In France, both methods are current.

b) Management of the Keys (KDM)

As the reader will surmise, the generation and management of these security keys is a strategically significant operation, as it involves not only the technical processes of distribution, but also the commercial relations between authorised distributors and exhibitors.

In the United States, it was agreed that the generation and management of KDMs would be entrusted to a third party, known as the "trusted third parties".

Two types of companies have now taken on this role. Each already has one of the two elements necessary to generate the KDMs.

– On the one hand, there are the post-production houses which generate the primary keys for films during encryption. This is the most widespread type of trusted party.

– On the other hand, there are the providers of cinema projection equipment, which often retain ownership of the cinema servers, if not of the projectors etc. as well. They thus have the necessary certificates for the theatres they equip.

Occasionally, the same firm will handle both post-production on the film and provide projection equipment to theatres. In that case, they control both the elements involved in key generation.

3. / Non-Physical Film, Industry Shifts and Globalisation

As this dramatic shift in the technical apparatus of the film industry gathers pace, for the first time we see certain companies trying to bring all elements of the distribution chain under one single umbrella, from post-production to the installation of projection equipment in theatres.

This new ambition is not really a product of industrial logic, since the various stages in the process call on very different areas of expertise. It is driven much more by commercial logic, which seeks to offer a bundle of services to clients, be they distributors or exhibitors. In the face of rapid technological change, they prefer to limit the number of companies they have to deal with when they adapt, opting wherever possible for turnkey solutions.

For the companies offering these all-encompassing packages, the aim is to fit out enough theatres as rapidly as possible so as to reach a critical threshold, making them a major force which will have to be consulted in decision-making. Potential customers are tempted with arguments that the level of quality offered will guarantee that industry standards are met. But the approach also gives companies leverage in negotiations with distributors, particularly Hollywood studios.

The issue boils down to the nature and strength of the ties binding each theatre to the network. The relationship can be one founded on a number of choices made from a range of offers. But it can equally consist of a package of obligations – perhaps freely accepted – which limit some or all of the exhibitor's independence.

The guarantee of technical compatibility between the various equipment, as mentioned above, is an important concern, but serves only to facilitate technical transparency. This transparency is necessary. But clearly, it should not come at the price of other constraints – be they commercial, legal or financial – that put the exhibitor in a dependent relationship in matters of equipment or programming.

The first such deal signed in Europe – between Thompson and the Kinepolis group, in July 2006 – is interesting in this regard. It dictates that (according to the conditions agreed on) "Thompson will guarantee the installation, maintenance and regulation of all installed digital cinema systems, including the licensed TDC system (Technicolor Digital Cinema), for the running of cinemas." This first European deal of its kind shows the risks of vertical integration.

B. / The Urgency of Choosing an Architecture for Digital Distribution: An Issue with Implications for the Freedom of Distributors and Exhibitors and the Diversity of Cinema.

Recent deals show the rush on the part of certain economic players to secure their advantage.

The formation of networks of screens whose distribution is linked on a global level to large, vertically-integrated conglomerates, and who have signed framework deals with the major distributors, harbours real dangers for the freedom of exhibitors and distributors alike.

In the longer term, there is the danger that exhibitors or distributors who remain outside this system of alliances will be marginalised or even eradicated. Again, it would sensible to introduce a two-track system, with an alternative network counterbalancing these integrated networks. This analysis does not just hold for France but, we believe, for the whole of Europe.

We believe a certain number of measures need to be taken urgently at both the national and European levels to preserve the transparency of the technical distribution chain, the freedom of economic players and, at the end of the day, the diversity of cinema.

1. / The Rapid Development of Digital Filmmaking: A Vital Precondition

Digital projection only makes sense if the films are there to be shown. This self-evident proposition describes in a nutshell the main obstacle faced by

pioneers of digital exhibition to date – the lack of films available in a digital format, especially of non-American productions.

a) An Essential Objective for the Circulation of Films: Increasing the Number of French and European Films on Digital Formats.

When a not insignificant number of French and European screens have ventured the change to digital projection – and especially, when more single-screen theatres have done so – we believe it is vital that all French, and even European films should be made available for distribution digitally.

This should also allow the films to be shown not just in their "premiere version", but also open up the full range of possibilities inherent in digital formatting: foreign-language films in dubbed or subtitled versions, variations for the deaf or hard-of-hearing. The dissemination of European films in Europe and worldwide is dependent on expanding this capacity to distribute various versions through digital post-production. As far as its film industry is concerned, surely one of Europe's prime goals has to be encouraging the distribution and export of its films.

b) Responsibility for Digital Masters

We believe it should be the producers' responsibility to provide the Digital Source Master (DSM – comparable to the 35mm interpositive) and Digital Cinema Distribution Masters (DCDM – comparable to the internegative) for each of their films as quickly as possible.

On both the technical and creative fronts, the ideal situation is for the Digital Source Master to be the end product of digital post-production (given that the film was shot in a digital format, or that the 35mm rushes were transferred directly to digital formats before post-production). Digital image manipulation and finishing give the creative personnel a wealth of fresh possibilities and guarantee high image quality. But as we have seen, these processes are costly, and many producers do not have the means at their disposal. Nevertheless, it is essential to push in this direction: today, post-production on 90% of American films is completely digital (rushes are digitised, then edited and finished on computer); this is true of only 40% of French films.

<u>Recommendation 6:</u> Producers should be obliged to ensure that, by 2009-2010, all French films are available for cinema distribution in digital format.

This should be a Europe-wide goal, on two levels. Not only should it be the vision of all European theatres, but also of the European authorities, such as the Commission and the MEDIA Programme. Given what is at stake, it is vital they take this on board.

Recommendation 7: The European Commission must be convinced to take steps to further the digital post-production of European films.

2. / One Nodal Point that Must be Addressed Without Delay: Clear Rules Need to be Drawn Up Governing Security.

This is without doubt the most pressing issue. Security is the keystone of the new techno-economic edifices currently being erected. If all aspects of security for digital cinema projection are allowed to fall into the same hands, this will create focii of economic power, jeopardising the free choice of parties in the industry. What use is it to guarantee the compatibility of equipment if projection remains a purely technical possibility, contradicted by the "proprietal economic systems" of vertically-integrated companies? At the end of the day, the diversity of cinema is at stake.

As we have seen, the generation of the keys necessary to exhibit films occurs at the confluence of two aspects of the distribution process: the technical production of the necessary elements (the mixing of the two objective components, the primary key to a film, held by the laboratories, and the public keys, or certificates, held by the exhibitor or supplier); and the commercial and legal relations that govern them (the contract between distributor and exhibitor). In effect, this process is a "technological padlock" placed at the strategic intersection of the physical, artistic and commercial aspects of a film's distribution.

It would seem crucial for this intersection to be a perfectly neutral place – almost "notarial" – if the system is to remain fluid and transparent. The very process implies that all necessary data converge there, yet no party involved should be allowed to use the data to his or her own gain or use them for leverage. This risk is particularly high for the "certificates" granted for equipment by suppliers. In other words, the bodies that generate and manage the keys must be as impartial as a notary.

The notion of "trusted third parties" would seem an a priori response to this need for neutrality at this strategic intersection, the generation and management of key codes. But in the American understanding of the term, only those parties are excluded who are directly implicated in the commercial relationship "authorised distributor/exhibitor". Thus, it has been quite possible

for companies which produce masters or the suppliers of cinema equipment to take on the role of "trusted third parties".

In the light of our observations above on the phenomenon of vertical integration, this would not seem to be an adequate response. It does not sufficiently guarantee the freedom of distributors and exhibitors. We believe that the notion of "trusted third parties" for the generation and management of keys should also exclude all firms involved in the technical distribution process, whether encoder of masters or supplier of cinema equipment. The third parties must be independent of every link in the chain.

Hence, two fundamental conditions must urgently be set down for the generation and management of key codes:

– A third party must be employed, by outside regulators, which is independent of all other firms in the process, and which will operate transactions with respect for the liberty of those at both ends of the chain;
– This third party must be given proper access to the relevant data for the key codes, in particular to the public keys or certificates for the equipment.

<u>Recommendation 8:</u> A catalogue needs to be drawn up as rapidly as possible of the public keys or certificates for digital equipment installed in theatres. This needs to be kept by a neutral technical body.

<u>Recommendation 9:</u> A study needs to be made of the conditions for appointing, by tender, of an independent technical provider who will generate and manage keys for the projection of films, on behalf and under the authority of the CNC.

Operating under a strict code of practice, this independent technical body would receive orders to draw up keys from distributors according to their release plans. The body would then receive the film's primary key from the laboratory and proceed to collect – from the catalogue kept by the relevant neutral authority – the certificates for the equipment of each exhibitor who will show the film.

This proposition would guarantee the liberty of each agent involved in the distribution chain:

– Distributors could produce copies of their film with whichever company they desired, without it having an effect on their release plans;
– Exhibitors could choose freely who supplied their projection equipment without being excluded from the release plans of certain distributors;

– Laboratories and suppliers of cinema equipment would again face a certain amount of competition, as it would be impossible to offer a completely integrated vertical solution that ruled out rival offers.

Each party in the process would have its freedom of choice restored.

In addition, without any consequences for the editorial choices of distributors and exhibitors, this model would also allow nationwide (indeed, Europe-wide) monitoring of distribution and the creation of a transparent database of film screenings accessible to all.

It would not block companies or groups from offering both laboratory and cinema equipment services. Rather, it would again place them in a system of open competition by ruling out the misuse of key generation and management as a "technological padlock". They could not use this as a factor to exert pressure on distributors or exhibitors.

WHICH ECONOMIC CHOICES ARE NECESSARY TO FOSTER LONG-TERM DIGITAL DISTRIBUTION?
The Benefits of Solidarity

To date, very few economic models have been established. Each has consequences for the shape of cinema networks and can also affect programming choices. Some models reinforce tendencies towards vertical integration we highlighted above in our discussion of the non-physical distribution network.

A. / The Costs and Rewards of Digitising Distribution: Decisive Factors which are Difficult to Estimate.

The entire economic discussion on the establishing of digital distribution and projection makes sense only if it is founded on reliable figures for outlay and income. Yet it appears that many parameters remain uncertain, even if our appraisals are improving. In the following hypotheses, we will try to make a few estimates.

1. / Outlay Linked to Equipment

This comprises investment costs and running costs.

a) Investment Costs

Estimated costs vary extremely widely.

In part, this uncertainty is due to the difficulty in assessing the real mass production prices charged by suppliers in a market which, to date, has been dealing largely with prototypes. Nevertheless, it is true to say that costs vary with the same supplier depending on the size of the order.

But variations in estimates also stem from the variations in what is included in the price quoted. Often estimates come for setups which are simply not comparable – projector and server are usually included, but sometimes also anamorphic lenses, sometimes even installation work in the booth. In comparing estimates, careful attention needs to be paid to whether the package on offer is identical.

Today, no company will make an estimate in the order of 100 000 euros (for projector and server), which just six months ago was considered a realistic basis. Now, figures are closer to 75 000 or 80 000 euros. If Christie and Doremi are to be believed, the "projector plus server" package offered in the United States – albeit on the basis of equipping 4000 theatres – is in the order of 60 000 dollars (or 50 000 euros)!

Prices in both equipment categories seem to be heading downwards.

Naturally, such economic developments are difficult to predict. In the past, the market for cinema projectors has been characterised by inflexibility. But it does not seem too far-fetched to predict that the price for the "projector plus server" package will – for larger-scale orders, at least – move to within 20 or 30% of the price for 35mm projectors in the next 3 or 4 years. This bears little relation to the double or even threefold price level which was considered normal just months ago.

b) Running Costs

Costs associated with the purchase of the material clearly depend on its price, the kind of financing involved (own funds, hire-purchase, rental, grants etc.). Depreciation occurs as set levels. It is quite possible that the projector and server will have to be written off at different rates. But if we do presume the same levels, based on an 8-year period to write off a purchase price of 75 000 euros, we can assume that per year, 10 000 euros can be written off.

Running costs depend on the contracts offered by the suppliers, which vary widely. They can be tied to the conditions of sale or hire for the equipment.

Experience has shown that the maintenance costs are noticeably lower when the system is hooked to a NOC (Network Operating Centre), a monitoring and diagnostic centre which oversees the maintenance of various pieces of equipment. It allows problems to be anticipated and identified remotely. For a service of this kind (for a projector plus server package), a number of operators quote a fee of around 200 euros per month (140 dollars per month per screen for the projector and 80 dollars per month for the server).

This is also the sum charged by XDC for maintenance contracts. Other suppliers charge significantly more: for example, 8% of the equipment's price per year. For 80 000 euros worth of equipment, this comes to a monthly charge of around 500 euros.

So offers vary widely, from 2400 to 6000 euros per year.

2. / Predicted Benefits

The predicted financial benefits take two forms: new income and potential savings.

a) The Income from Exhibition

Increased income from exhibition is a significant factor. The increase may be due to a rise in the number of tickets sold, as people are drawn in by the new projection technology either from rival cinemas or from other entertainment. Income may also be boosted by a rise in ticket prices to accompany the new technology. The potential here is, as yet, difficult to predict. Besides an overall increase in ticket sales, the flexibility in digital projection also allows theatres to draw on more niche audiences by targeting specific screenings at them. Examples include linguistic minorities, the deaf and hard-of-hearing and special-interest film-goers. At the risk of more fragmented programming, these screenings offer a valuable opportunity to improve takings.

b) The Benefits of Diversification

In the US, the network of cinemas fitted out by Christie/Access IT after October 2005 programmed 57 Hollywood films and 257 alternative items, known as ODS, or Other Digital Stuff. A ratio of 1:5 in favour of ODS!

Nevertheless, there is not yet enough significant data to determine a reliable trend in this direction.

c) Advertising Income

Some people nurtured hopes that the perspective of increased advertising income from digital projection would lead advertising agencies to re-equip all theatres. This is clearly not the direction the two leading cinema advertising agencies, Screenvision and Médiavision, wanted to head in. Their studies of the effects of digitisation in theatres come to similar, highly nuanced conclusions (tougher competition, fragmentation of the market by concentrating demand on certain screenings etc).

The two agencies were counselled prudence. Now they are waiting for exhibitors to move ahead with the installation of digital equipment before they switch platform.

Their decision appears all the wiser in the light of the overall evolution of the advertising market. The income to be had from cinemas is shrinking in proportion to the rest of the market. It is now just 0.3 or 0.4% of the total, though its absolute value is stable.

Some may still claim that but for the cautious advertising agencies, boundless wealth would flow from advertising. Nevertheless, it is now such promises that seem illusory.

d) Savings Made on the Price of Prints

For the time being, this is the most immediately visible financial gain of switching to digital distribution. The savings potential was certainly decisive in bringing Hollywood studios around to promoting digital projection.

The cost of a 35mm print varies according to the number of prints being ordered. What's more, the laboratory cost of a print is not the same as that of a print which is then transported to an exhibitor. The total cost of a 35mm print, delivered to the exhibitor, can be put at between 1000 and 1500 euros.

Clearly, the production cost of a digital copy is virtually zero. Transportation, however, does still play a role (whether it be by satellite, broadband transmission or physical courier). Assuming transportation on a removable hard disk, the cost of a Digital Cinema Package can be put at a third to a fifth of that of a 35mm print (again, depending on the number of copies), or between 200 and 500 euros.

Given a run of 700 copies/prints, the order of the projected saving is in the region of 500 000 euros. The savings involved in a worldwide release are truly enormous. Clearly, this is a major factor for the big studios and for large European distributors, and one which pays off relatively quickly.

3. / Is it Possible to Balance the Books?

As can be seen from the data above, a watertight projection of the sums is nigh impossible, especially for the long term. Hypotheses and rough estimates are our only way of grasping the relations between costs and benefits.

A first hypothesis projects that income from distribution, diversification and advertising could just cover the maintenance and running costs of the equipment. Given the size of the sums shelled out in advance, this is not an absurd idea.

That would leave the outlay directly linked to acquisition of the equipment.

In this macro-economic model, we could venture an estimate of the total cost of installing digital projection in all theatres in France (5300 screens). Assuming an average cost per "projector plus server" package of 75 000 euros – although that sum could be hoped to come down – that would give a total cost of 400 million euros in necessary investment. Stretched over 10 years, that makes 40 million euros in investment per annum.

Given this estimated outlay, the projected savings made by not having to strike film prints can be calculated as follows. Currently, 75 000 prints are struck every year in France (a total turnover of 75 million euros). If we assume a saving of 500 euros per digital copy – which is modest given the expectations – we arrive at a total saving per year of 37.5 million euros.

Even from these few approximations, we can see that the equation "investment costs = savings on the cost of film prints" is more or less balanced.

B. / Existing Economic Models: Towards Domination of the American Model "Third-Party Investor"?

Essentially, there are very few existing models for this process. The most dynamic and appealing would appear to be the US model, which has been driven by two forces, the technological industry and the Hollywood studios. Their relationship was formalised in deals signed in the autumn of 2005. The model

has also been strengthened by the widespread re-equipping already undertaken in the US.

1. / The Scarcity of European Models

a) The Hire/Purchase Model Proposed by XDC

This model is currently being re-evaluated by the operator.

b) The United Kingdom's Financial Assistance Model

To the surprise of some observers, the British government pioneered the state intervention model with the Digital Screen Network, largely financed by the UK Film Council.

The principle behind this model was to equip a select number of screens (initially put at 250) using funds from the National Lottery. The theatres were selected from applications on the basis of how many "special-interest" films they programmed. The UKFC determines what these special-interest films are – subtitled films, documentaries, historically significant works or British or American films dubbed "difficult" (by way of their subject matter or their innovative form). The theatres which were accepted into the Network had to undertake to increase the number of special-interest films in their programmes.

In effect, the UKFC selected theatres not only according to their programming activities, but also according to their geographical spread. Those awarded include independent cinemas and multiplexes. 298 theatres (with 350 screens) applied; 211 (with 240 screens) were selected. They represent a total of 10 million admissions per year; it's hoped to increase that number to 14 million (a rise of 40%).

The task of equipping screens was given to a single firm, Arts Alliance Media, following a public tender. They take care of installing equipment, training staff and maintenance. Choice of equipment model was left to up to the exhibitors, as long as the projector was a 2K unit and the server Jpeg 2000-compatible.

The exhibitor contributes a yearly sum (around 5000 euros) towards the cost of the equipment and maintenance. The theatre picks up the installation costs and is obliged to follow through on its programming commitments. Currently, around 30 screens are up and running; by the end of 2007, that should be 200.

As part of the programme, Arts Alliance Media has also given distributors price guarantees for encoding and encrypting their films.

The aim of this initiative is to make "difficult" films more accessible in a wide range of locations across the country. It is clearly directed at increasing the number of admissions to special-interest films.

In itself, it is difficult to attach the label of "economic model" to a programme of grants aimed at a limited number of screens and a limited number of films. Rather, this is a voluntary aid policy, directed at difficult films in the hope that rapid access to new projection technologies will help them find a larger audience. It also offers benefits in terms of regional development. But it leaves aside the majority of screens (a remaining 3100), which have to find other models for modernisation.

c) European Aid for Cinemas

By the same accord, the European Union's MEDIA Programme has decided to contribute and help the 1560 screens of the Europa Cinemas network re-equip for digital projection. A grant of 15 to 20 euros is given per digital screening, with a maximum ceiling of 7500 euros per screen or complex.

Europa Cinemas theatres programme a total of 34% films from European countries other than their own. The system can also be opened up to theatres outside the network if they make commitments to show European films. It can be opened to include programming of European films in general, without the specific commitment to films from other countries.

This is a "diluted" version of the British model, again targeting a limited number of theatres in exchange for programming commitments. The aim – as in the UK – is to give European film a greater footing in a certain number of cinemas.

As in the UK, this system has the disadvantage of not representing a truly universal "model", instead targeting a limited network capable of offering "alternative" programming.

2. / The American Model: Third-Party Investors and VPF (Virtual Print Fee)

The basic principle of the US "model" is to establish a direct link between the outlay incurred by exhibitors and the savings made by distributors. Part of these savings is used to compensate the exhibitors for their installation costs. As such, it is economically simple.

One single idea is at its heart: the Virtual Print Fee (VPF). This consists of a fee – equivalent not to the cost of a digital copy, but roughly that of a 35mm print – which distributors agree to pay for a certain period. It goes towards redeeming the exhibitor's costs for the digital equipment.

Since this fee cannot be paid directly from distributor to exhibitor, it goes through an intermediary, a third-party investor, who fulfils three functions:

– The investor makes sure that the sums necessary for the investment are provided to the exhibitor, either directly or through affiliated financers. The financial package offered to exhibitors can vary from case to case;

– The investor must guarantee the distributor that the exhibitor's equipment conforms to standards of quality and security; the investor guarantees exhibitors that the distributors he or she represents will deliver Digital Cinema Packages of the films;

– The investor collects the VPF for each film on release, crediting it to the exhibitor's account to help pay back the investment.

This system was regulated in the deals signed by Hollywood studios and two third-party investors, Christie/AIX on one hand, Thomson on the other. These deals run for a sufficient period to allow reliable projections for the recoupment of investments.

Some European companies hope to benefit from a similar type of agreement, allowing them to offer exhibitors equipment packages comparable to Thomson's. Even if the US studios showed interest, there are no guarantees that they would be willing to go along with setting up a VPF system along American lines in Europe.

The US "model" has in its favour simplicity and realism. It is the only one which has, to date, allowed thousands of screens to be re-equipped, instead of hundreds.

On the other hand, it has shown itself to be a starter motor, firing up the movement, but not necessarily geared towards maintaining its momentum. It also inherently risks aggravating the phenomenon of vertical integration highlighted above and could – if applied to Europe – have definite effects on theatre programming:

– By relying so heavily on third parties – who are often key players in the vertical integration system – it further increases their power by making them treasurers of the VPF, on behalf of exhibitors they were involved in supplying;

– In addition, the drive to maximise VPF income can lead third-party investors to encourage exhibitors equipped by their allies to allocate more screen space to films of distributors with whom they have ties.

C. / Economic Choices Which Can Further Long-Term Digital Projection: the Need for Solidarity between Aspects of the Industry

The suggestions we would like to make here are offered as food for thought, sketches for possible solutions.

They attempt to draw on the positive aspects of existing models while taking into account the particularities of French and European identities, espousing the freedom of choice of each party involved and fostering solidarity between aspects of the industry.

1. / A Demand of Realism: Balancing Investment and Savings

After a survey of the sums involved, it would seem impossible for the public purse to pick up the costs, unless we accept a marginal network of digital screens.

The only principle which can provide the initial boost necessary for exhibitors to re-equip theatres is to balance their projected investment (or at least their projected additional investment) against the only immediate financial gain: the savings made by distributors who do not have to invest in prints. The basis of the US model would appear sound.

The magic formula, though, still has to be found. The deals signed in the US have set a precedent, but they clearly have major disadvantages – in terms of limiting choice, limiting programming and limiting the territorial control of cinema networks.

2. / A Vital Tool in the Balancing of Exhibitors' Outlay against Distributors' Savings: the Extra Key Fee

The Virtual Print Fee is the fundamental tool establishing the relationship in the American model between the exhibitors' investment and the distributors' savings. It has two drawbacks:

– On the one hand, it is founded on a notion which will soon be part of the past – the film print;

– On the other, as we have seen, it calls for the intervention of a third-party investor as a link in the distribution chain, whose power is only increased further by the handling of the Virtual Print Fees.

To redress this, we believe that the idea of a security key to read films is preferable to that of a Virtual Print Fee. Following on from considerations above, we would argue for an Extra Key Fee, instead of a VPF.

A study of this text reveals that the only solid barrier in the non-physical distribution chain is the Key Delivery Message, or KDM. Without the KDM, the digital file that contains the film is inaccessible. Changing theatre (or even screen), changing the projected version or the period of projection all call for a new key. The KDM – more so even than the digital files of the film – is closest to the actual moving image.

<u>Recommendation 11:</u> Channels need to be rapidly put in place for the payment by distributors of an Extra Key Fee through the body responsible for the generation and management of keys.

This latter body will be authorised to collect, on behalf of the CNC, a supplemental cost agreed on by all parties above and beyond the operating fees laid down in its remit. This supplemental charge will be passed on to the various exhibitors or their suppliers depending on their activities.

This mechanism seems sure to win the support of distributors: it is simple, neutral and carries the guarantee of impartiality in CNC approval.

A system of this kind could only be put in place by an agreement signed between the CNC and all distributors (including the US majors) on behalf of all exhibitors; this agreement would establish:

– formal consent to the payment of additional fees for decryption keys;

– the amount of fees to be paid;

– the authority of the CNC to collect and redistribute these funds through the body charged with the generation of keys;

– the guarantees given by the CNC with regard to technical projection standards, transaction security and investment aid.

Even if attempts failed to put in place a mechanism of this kind on a universal level, nothing would prevent the CNC negotiating a similar deal with distributors on behalf of exhibitors who refused to go along with the idea of industry integration.

<u>3. / Which Investor would be Best Suited to Independent Theatres?</u>

We believe it would be useful to look into the feasibility of creating a pool of investors – backed by a reliable institution such as the IFCIC (the Institute for

the Financing of Cinema and Cultural Industries) – which would help independent exhibitors make the switch to digital technology. This pool could also negotiate prices with the suppliers based on the combined demand of the theatres it represented.

Recommendation 12 : There needs to be a feasibility study for creating a pool of investors – backed by an institution such as the IFCIC – which would help independent exhibitors make the switch to digital technology.

4. / Correcting Imbalances During the Transition Period

At several points in this report we have highlighted the particularly vulnerable phases some exhibitors or distributors will have to go through during the transition to digital distribution:

– Exhibitors with only one or two screens are particularly liable to suffer;

– Small and medium-sized distributors will have to deal with releases on both formats during the transition period, which could entail much greater costs.

These are just the two most obvious cases in point. But the notion of vulnerability can also be understood in a much broader sense, in terms of the balance between professions or the pace at which digital projection will spread.

Government intervention would seem appropriate to redress the imbalances which can occur and ensure that vulnerable theatres or distributors – vital for the diversity of the cinema landscape – are not sunk in the process. Subsidies would seem the best tool to address this problem. They could be awarded in the form of bonus support or targeted additional aid.

Recommendation 13: We must look into the possibility of additional support or targeted additional funds for high-risk theatres, particularly those with only one screen.

Recommendation 14: We must look into the possibility of additional support or targeted additional funds for the most vulnerable distributors, particularly those which will be releasing smaller-scale films on both the digital and 35mm formats.

Clearly, the criteria and thresholds for these subsidies still need to be established.