

A large, white, stylized number '5' is centered on a dark blue background. The background features a fine grid pattern and a faint, high-contrast image of a person's hand holding a pen, suggesting a technical or engineering context. The overall aesthetic is modern and professional.

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## **JEFF UBOIS**

Jeff Ubois is een van de projectmanagers binnen Presto Centre, het nieuwe Europese Competence Centre voor digitalisering en digitale conservering van audiovisuele content. Hij werkt tevens als consultant voor archieven, bibliotheken en musea die betrokken zijn bij massadigitalisering en het conserveren van beeld en geluid. Ubois is eerste voorzitter van de conferentiereeks die wordt georganiseerd door het Internet Archive in San Francisco. In de Basetti Foundation in Milaan, een organisatie voor het promoten van verantwoorde innovatie, vertegenwoordigt hij de staat California. Voor het Internetarchief heeft Ubois gewerkt aan het managen van orphan works, waarbij het behoud van archivale integriteit centraal stond. Hij was tevens verantwoordelijk voor het beheer van de collectie gebruiksgegevens van dit archief. Jeff Ubois heeft meerdere publicaties op zijn naam staan en schreef voor o.a. ACM Interactions, D-Lib, The Journal of Digital Information en Computerworld.

## HANS WESTERHOF

Hans Westerhof is adjunct-directeur van het Nederlands Instituut voor Beeld en Geluid. Hij is daar tevens verantwoordelijk voor Beelden voor de Toekomst, het grote digitaliseringsproject van een aantal Nederlandse collectiehouders. In dit project dat zeven jaar in beslag neemt, levert Beeld en Geluid een aandeel van € 85 mln en verzorgt het instituut de digitale conservering van 98.000 uur audio, 88.000 uur video, 19.000 uur film en 1.2 miljoen foto's. Daarnaast wordt in dit project de toegang tot de gedigitaliseerde collecties verbeterd door het ontwikkelen van online-services voor omroep professionals, het educatieve domein en het algemeen publiek. Door de inzet van innovatieve technologieën als spraak- en beeldherkenning en semantische technologie worden de collecties beter vindbaar en doorzoekbaar. Voorafgaand aan zijn functie bij Beeld en Geluid was Westerhof werkzaam als directeur van de denktank Nederland Kennisland, als organisatieadviseur bij adviesbureau Andersson Elffers Felix en als wethoudersassistent in Amsterdam. Westerhof studeerde politieke wetenschappen aan de Universiteit van Amsterdam en is alumnus van de Harvard Business School, waar hij een postgraduate opleiding heeft gevolgd.

The background is a dark blue color with a fine, light blue grid pattern. Faint, dark silhouettes of people are visible, appearing to be in a meeting or discussion. One person is on the left, and another is on the right, both looking towards the center. The overall mood is professional and digital.

THE DIGITIZATION OF  
ARCHIVES HAS A VERY  
FUNDAMENTAL IMPACT  
ON THINKING ABOUT  
ARCHIVAL COLLECTIONS  
PER SE...

# MASS DIGITISATION: LESSONS FROM A MANAGERIAL PERSPECTIVE<sup>1</sup>

*Hans Westerhof, Jeff Ubois*

The Netherlands Institute for Sound and Vision is halfway through a seven-year, € 115 million project, Images for the Future, to digitise nearly 200,000 hours of audiovisual materials, and many lessons from the project are now becoming quite clear.

Some of those lessons concern technologies such as codecs, formats, carriers, and processes; others have to do with the performance of particular products, vendors, and service providers; still others have to do with the specific operations of Sound and Vision. Over the next four years, there will undoubtedly be much more uncovered.

But already, and despite the rapid evolution in the technologies associated with mass digitisation of audiovisual material, it is evident that some management issues will remain important for the foreseeable future, in our archive, as well as others. This paper looks at enduring issues associated with mass digitisation that managers must learn to deal with successfully: 1) people, 2) learning, 3) specifications, 4) workflows and 5) finance. It concludes with a number of suggestions about future research directions and collaborative projects.

## **BACKGROUND**

The Netherlands Institute for Sound and Vision collects and digitises audiovisual heritage from the Netherlands and makes it available to media professionals, students and teachers and the public at large. For example, Sound

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<sup>1</sup> Dit artikel is een bewerking van een presentatie gegeven op 17 oktober 2010 tijdens de FIAT-IFTA conferentie, Dublin, Ierland.

## THE DIGITAL ARCHIVE

<b>Born digital: Dutch television &amp; radio</b>	<b>Large digitisation project</b>
- yearly	- 2007 - 2014
- 8.000 hours video	- 91.000 hours video
- 25.000 hours radio	- 17.500 hours film
- >1 petabyte per year	- 98.000 hours audio
	- 1.200.000 photo's

Figure 1 - A summary of operations at the Netherlands Institute for Sound and Vision, and its Images for the Future project.

and Vision has a large news reel collection, a collection of important documentaries, government commissioned films, 'old' amateur film, shot on 'real' film, but also 'new' amateur film, mainly found on the Internet video websites. Sound and Vision annually ingests 8,000 hours of video and 25,000 hours of radio from more than 20 public broadcasters. This material is all born digital, and ingested as nearly as possible to the time of actual production and broadcast. Preserving this material, and making it available to broadcasters on demand, is one of the key functions for Sound and Vision.

But this is only a part of what flows into Sound and Vision's digital systems each year. Older, analog material is being ingested via Images for the Future (see figure 1), which is currently digitising almost one petabyte per year. By the final year of the project, we anticipate that this number will grow to nearly 1,5 petabyte per year, as film scanning processes come fully online.

These digital projects are changing the look of Sound and Vision's archive from something like (Figure 2) to something more like (Figure 3). As of late 2010, Sound and Vision has more than 3.5 petabytes of data in its archive, and that is growing at a fast and steep rate to an expected 13 petabytes by 2014.

Images for the Future began in 2007. It required Sound and Vision to hire 100 new staff, and to issue over ten European tenders. So far, the project has digitised 130,000 hours of all kinds of media, and there is a nice analog to



Figure 2 - The vaults and shelves at Sound and Vision.

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Moore's Law here – usage of this material doubles every 2 years. This kind of exponential growth is very good news; it proves that as soon as material is digital, it gets reused. Managers at Sound and Vision hope it continues at this rate, though it also poses a lot of problems. Still, it's the kind of problem that archives should like to have - an archive can never have too much usage from our perspective.

Much of the material digitised by Images for the Future was at risk up until quite recently. In 2004, the PrestoSpace Annual Report on Preservation Issues for European Audiovisual Collections, which covers film, audio, and videotape, noted that "at current rates of preservation work, and with audio and video material beginning to degrade after 20 years at 5% per year, 40 % of existing material will simply disappear by 2045. This is a best case figure ... At worst ...70% of existing material will simply disappear (by 2025)."

*[reference: PrestoSpace (2004) Annual Report on Preservation Issues for European Audiovisual Collections (2004) [http://www.prestospace.org/project/deliverables/D22-4\\_Report\\_on\\_Preservation\\_Issues\\_2004.pdf](http://www.prestospace.org/project/deliverables/D22-4_Report_on_Preservation_Issues_2004.pdf).]*

Ensuring that material is preserved is one side of Sound and Vision's operations. But in addition to safeguarding Dutch audiovisual cultural heritage, Sound and Vision's systems are production environments that are critical for the media professionals. Material from the archive is downloaded for incorporation into new programs countless times every day by reporters, editors,





Large scale digital storage: exterior taperobot

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and others in the Dutch public broadcasting system. If systems go down, which does happen for a few hours per year, someone somewhere - usually in a news department - immediately finds him or herself in a tight spot: “we’re about to go live in one hour!”. The phone rings immediately: typically, it is necessary to deliver files within a few minutes to the professionals that use these services.

It’s in this environment, and in response to these needs, that Sound and Vision’s approach to management has evolved.

## PEOPLE

It seems obvious to state that people are important, that they need to be competent, that managers must hire carefully and also that managers should be hired carefully. But this is much harder than it sounds. We found that it took a lot of time to get the teams that we needed, to find the people that had the right skills and the right outlook on the project. Recruiting is a major task for any new, large scale, digitisation project.

Determining what kind of people were needed was not immediately obvious. Clearly knowledge of the analogue collections is needed if one wants to digitise them. But setting up smooth high quality workflows in the digital domain proved to be another task altogether. In short: we needed more people



with IT background and some consultancy experience. Finding them was not always easy, sometimes paychecks outside Sound and Vision can be higher for people with the right skill sets. We ended up with a mixture of hiring and longer term consulting. All in all a lot of new people entered the organisation and had to work with staff that knew everything about the collections, but had less experience in setting up a large project like this. Both groups needed each other, but very often spoke different languages.

Given skilled people, they must also have the right responsibilities, and we were not always immediately successful in determining that. Again it might seem obvious, but the most technically competent people are not always the best project managers or team leaders. So it also took time to match responsibilities of people who evidently brought very useful knowledge and skills to the project with their capabilities. And it doesn't stop there: setting up projects and work flows is only half of the story. There is not enough smart thinking in the world to combat poor execution. The teams that do the day to day work are where it all comes together. They were usually made up of younger people. It is in the teams that are responsible for projects for years that true ownership resides. Because it is not execution pure and simple that is needed, it is comprehension, thinking about work processes, signalling problems and anomalies, reflection on limited, poor, or plainly wrong instructions, that generates much needed feedback and the possibility for continuous improvement. We found we needed people in our teams who were maybe less experienced, but really smart. It took us two years before we were happy. We had the teams up and running, and also the teams independent, interacting with each other and interacting successfully.

Building the right team cuts across every aspect of our operation, and new approaches to solving problems can cause people to become more involved, or to leave. For example, one of the most difficult areas we have at Sound and Vision is metadata-related (we still have a lot of information residing in different databases, sometimes pertaining to the same object). We identified it as one of our most important issues early on, and decided on some general approaches to metadata we would use in all the individual projects that deal with particular carriers. This meant that individual project requirements sometimes had to be bypassed. This approach did not sit well with everyone, some individuals were unhappy with the changes, and that is sometimes hard: the 100 people that we hired is not the same 100 people that started. There has been a lot of change in that group.

## LEARNING

Which brings us to the second theme, and that is learning. When an organisation begins a new mass digitisation project, it is hard for managers to ask the right questions because they don't really understand what they are up against. They've probably written a project plan, and others have read it, and estimated production numbers and associated costs. But what it really takes to get it done is very hard to comprehend before starting. It's possible to go around and talk to people at other organisations, and managers at Sound and Vision did that. And there is relevant literature to read, and we did that too. But since it's so hard to ask the right questions, how is it possible to get relevant answers? Problems seem idiosyncratic, particular to one situation, so it's difficult to find help from other people.

It is for this reason that it is best to start with a project that is well scoped and understood. For us, it was the encoding of digibeta tapes. We learned a lot in debugging that first workflow. Digibetas were a good place to start partly because the data on the tapes was already digital. But we still had issues, such as tracking the flow of physical materials through the system. Tape labels were sometimes missing. What was supposed to be in the tape case wasn't always there. Timecodes were missing. Some tapes didn't play back, and we needed to develop an exception handling capability for that. It turned out that prepping the material was critical to ensuring that the rest of the workflow pipeline remained full. We had to learn to work differently with our vendors. There were questions about what parts of the quality control process could be automated, and which could not. What were the objective quality control criteria? And we learned by looking at the variation between what we had planned and what had actually occurred. Subsequent workflows were more complex -- more exceptions, poorer metadata, more decisions about format conversions. But we were able to build on what we learned.

Specific operational tasks can offer the most fruitful environment for learning. Designing the first production workflow will give lessons about others. For most archives, workflow design is one of the hardest things to learn, but it is possible to identify the issues by closely specifying what is needed.

## SPECIFICATIONS, OUTSOURCING AND VENDOR RELATIONS

Whether insourcing or outsourcing digitisation, close specifications of the final results that are required are critical. This need for defining results up-

front, and for operationalising tasks, is the reason for the recommendation: outsource only what you understand yourself.

Understanding is reflected - or proven - in the specifications. If materials are sent vendor, but without adequate specifications, the vendor might send nice files back. They might even play back nicely, but still, there might be a lot of artifacts inside. You've just outsourced your curatorial task. Going in small steps allows an organization to apply what it learns as it goes forward. Each standards document that we published was more specific and more objective - for example, describing in quality control measurement, metadata, work-flows, or in describing information interfaces and levels of automation.

This brings us to the vendor processes. It is crucial to understand the vendors' processes. An archive doesn't need to be able to do everything internally, but to outsource effectively, it must have a thorough understanding of what the vendor is doing. If managers do not know that while scanning, a frame is projected on the imaging processor, then it's nice to talk about full 2K scanning, but the vendor will probably not deliver exactly that. The vendor will probably send back something that is framed wider than the frame on the film, so the film can move over the scanner with a little movement and not be interrupted and production processes can continue. It is, in itself, not very bad, but if managers do not know that this happens, then they cannot write a specification very precisely.

Over time, we got a lot of reports and results back from vendors. Some were helpful, others not. We found out that the reports of automatic file-based quality control of video files were, in fact, completely useless because we checked them against reality. And what is reality? Reality is your own eyes. We checked them against the files and we saw that a lot of artifacts were not reported. It took us one month and a complete team of people in real time watching files and calibrating the software to get results that we could trust.

In another project automatically generated production numbers turned out to be completely false. Reality was less of half of what was predicted, and less than half of what was reported. Luckily we found out after three months. But getting performance numbers back is critical to closing the loop on the specifications process.

One requirement in our concept tender documents read as follows: "The transfer of acetate sound to polyester sound film should not bring with it too much wow or flutter." That is not really specific. So, we started measuring, what is a nice quality, and what can you find out about nice quality? We



Bad hair! Not on the performers though, but in the red circle.

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worked with good examples that we had in our archive, and we found out that it turns out to be six decibels, so we specified “too much wow or flutter” as “not more than six decibels” in the tender document.

To have a good relationship with a vendor, it’s necessary need to build trust. We found that if we could specify clearly what we expected, communication got better and service providers were better able to deliver what we wanted.

You can measure more than you think.

For example, with photo scanning, Sound and Vision categorized problems in hair and dust problems. Before we published our tender document we did a few tests and found we needed to deal with hair and dust problems. We defined four categories each. ‘Hair, one, two, three, four’, and ‘dust, one, two, three, four’. We defined acceptable levels of hair and dust per batch of 1,800 scans, and it objectified our quality criteria and again helped us a lot in our relation with our service provider. Discussions - arguments - with vendors about quality are minimized this way. Here is an example. In reality, it’s worse.

And as one can see, this particular cultural treasure (Figure 4) is marred by a hair.

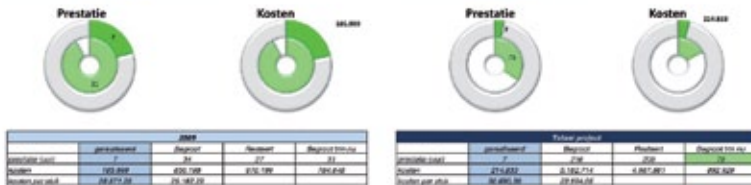
It is also good to measure production in financial terms. What is shown in Figure 5 are monthly reports about production targets and financial targets.

11. Prestaties Beelden Voor de Toekomst: Grafieken

A1 Film  
Conservering Acetaat Film



A1 Film  
Conservering Nitraatfilm



A1 Film  
Conservering Perif. acetaat

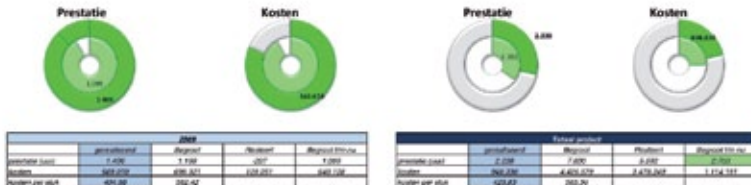


Figure 5 - Production reports from Images for the Future, showing progress (or lack of it) towards production goals, as well as expenses.

WORKING METHOD REQUIREMENTS

Requirement	Agreement? Confirm with 'yes'	Provision of requested information or reference to source in tender or appendix
MR01		
MR02		Please provide a timeline and brief explanation.
MR03		
... <SNIP>	... <SNIP>	... <SNIP>
MR24		Please elaborate on how material with physical problems are handled.

The contract document, above, allows only one correct answer (yes), while the specifications on DPX leave nothing to chance.

We get about 20 pages of these reports every month. All our project managers have to deliver production data and financial data every month. It allows us to track progress and deviation. And it's easier this way to take remedial action when it is clear what needs doing.

In our tendering procedures we choose by default to contract on lowest cost. The only exception so far was on a software development contract. The relationship between a tendering system that requires accepting the lowest bid and writing tight specifications is worth emphasizing. Institutions that must contract out based on the lowest cost rather than a diversity of other criteria, will have a headache in the beginning. Least cost approaches force (or should force) managers to specify exactly what they want in tender documents, and to think very carefully about the project before starting.

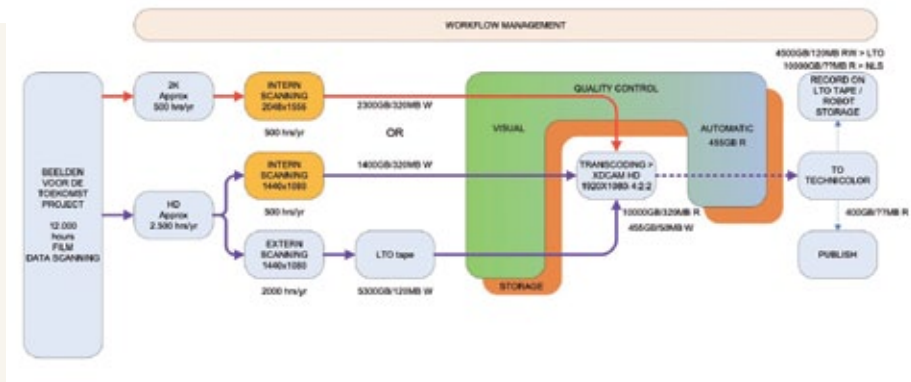
So tender documents from Sound and Vision rely on lots yes/no check boxes, and as a vendor, there is only one acceptable answer (see Figure 6).

#### **2.6.6. DPX REQUIREMENTS**

- Digitisation of film images must conform to SMPTE 268M-2003; SMPTE Standard for File Format for Digital Moving-Picture Exchange (DPX), Version 2.0.
- References made in these requirements to "DPX" entail the complete DPX sequence consisting of multiple DPX files, one per film frame digitised.
- In almost all cases (see details of films in paragraph 2.4) the framerate of the film scanned is 25fps. DPX header data must contain the framerate.
- The DPX image must be in focus for the whole image area. Focus will be judged based on film grain sharpness. (Digital) Sharpness enhancements are not allowed.
- The DPX must contain the full image area of the film without overscan. Image area corners will be used for checking.
- Stability of the DPX image with respect to framing must be guaranteed.
- The image captured in the DPX should have no perceptible levels of added noise or artifacts.
- Cropping and upsampling shall not be used for providing the right framing related to the spatial resolution. Downsampling may be used only as a standard feature of the scanner (in case it samples at a higher resolution). Postprocessing afterwards is not accepted.
- The spatial resolution of the DPX must be 1440 pixels horizontal and 1080 pixels vertical. Necessary adaptations shall be done using a variable optical system of the scanner instead of electronic or digital scaling. This is based on the 4:3 aspect ratio of the films. The reason for the 1440 pixel width is to

- preserve storage space needed for the DPX. During subsequent transcoding by Sound and Vision pillar bars will be added to create the 1920\*1080 XDCAM HD422 access format.
- The DPX must use a RGB colour space to store colour information.
  - In case of black & white source material the DPX must contain only one (luminance) channel. This will save storage space because about 50% of the film material is B/W.
  - Preferably the scanner also registers infrared information in case of colour source material to support possible future digital scratch reduction. This information must be stored as efficient as possible (e.g. 2-bit alpha channel) without compromising standards and future usage. Supplier to elaborate on the solution..
  - The RGB colourspace is based on the scanner primaries. These primaries must be registered in the DPX header and in the XML for future reference. The native scanner primaries chosen must ensure that all colour information on the film will be captured.
  - During setup of the work process the supplier has to provide a LUT with which Sound and Vision can transform the native scanner colourspace to the Rec. 709 colourspace for XDCAM HD422.
  - The DPX must be provided using a logarithmic transfer curve. The transfer function, profiles and curves used must be optimised for the film stock at hand. For Film Oud II and the rest of TV- film material no default profiles and curves exist (no Key Codes). Therefore during setup of the work process the supplier must create - in close cooperation with Sound and Vision - a set of profiles and curves that support the assortment of film stock within Sound and Vision's TV film collection.
  - The bit depth of the DPX must be 10 bit and the full range of 10 bit values should be used, i.e. not to use the head/foot room that would be used when transmitting the signal like a video signal over HD-SDI links. The scanner internally should capture the image at a higher bit depth (12 - 16 bits) to ensure the optimum output quality.
  - Black and white clipping must not happen and quality control mechanisms shall be installed to make sure the actual maximum and minimum values that occur in each frame do not exceed the limits.
  - Timecode information must be added to the DPX header. Standard timecode start (e.g. 00:02:00:00 on first image) will be determined during setup of the workprocess.
  - The DPX (TAR) per film package must be named according to the identifier (GUCI) in the batch order XML. Extension must be ".tar".
  - All possible metadata fields mentioned in SMPTE 168M-2003 should be filled with correct and meaningful information for each frame (in the infor-





For film scanning, Sound and Vision split the work between an outside contractor and inside staff.

- mation headers). like scan date, GUCI project file name, scanner brand & serial number.
- Supplier must calibrate the digitization equipment frequently, according to operations manual / best practice.

Vendors need to tick each box yes because if they tick the box no, they do not fulfill the requirements. Sound and Vision has pages and pages of these lists of requirements in each tender document. It is a lot of headache to write those out, but it ensures we get what we need. And there's good news, also, which is vendors will return really sharp proposals that way. And if, after careful work and after production starts, it turns out that a spec is missing, and that something more needs to be added, most vendors will do so happily at extra cost. But that is no problem because the tight specifications for everything else have saved so much money in the first place.

## WORKFLOWS

Mass digitization is all about workflows. To build them effectively, break them down into simple pieces because that gives the most control, and engineers can better adjust without complete system interventions. Breaking down the process into discrete steps also makes it possible to standardize, and this allows production to go up much more efficiently.

To design a workflow is hard, so take time to set it up, to do test runs, and to iron out all issues. There will be surprises - inconsistent condition of material, inconsistent metadata, quality control issues, bottlenecks in different places. Do not expect to effectively solve large production problems during

production, when the workflow is supposed to be operational. On occasion, it may be necessary to do so; but solving problems after production has started will most likely also complicate relations with outside vendors, cost extra money, and create problems for the future. It is preferable to slow down production, communicate with the service provider and solve problems before production is scaled up again.

Once a tender is accepted, we usually take three months before we go to production. In our photo tender, we took six months. It was a new procedure, it involved multiple scans at one time, and it was about a lot of files, not large files, but many of them. Initially, we went more slowly and took a lot of time for our preparation. Debugging the workflow in advance is critical. Now, we are scanning 50,000 negatives per month, which means 200,000 files (each image has a positive and a negative, a JPEG and a thumbnail), and we look at a happy team taking great pride in the incredible amount of work they are getting done.

Information management has proven to be a deep issue at Sound and Vision because we have a lot of information stored in different databases. Information pertaining to the same object sometimes, conflicting information, missing information, etc. We are forcing ourselves to have correct metadata before we start production - metadata that are needed for production workflows, not so much descriptive metadata that can be added later. It allows for these happy, efficient flows afterwards. It means a lot of preparation of material in advance, almost every film can has to be opened before we send it away. All our metadata have to be correct before we start production. And the less manual handling of metadata is needed, the better it is. Sending out XML schemas, and defining the schemas that should be returned, is preferable to relying on manual entry and making changes in Excel spreadsheets.

The opposite of a happy workflow is no production, or allowing a backlog to come into being. If faces with this choice, go with the first one: no production. If a project runs into deep trouble, it is best to just stop production. There will be problems with the vendor because he will be expecting production to continue, and expecting the workflow to proceed. Talk to the vendor, but don't continue production. Backlogs have a tendency to never, ever go away; or rather, they are so expensive to clear they can quickly overrun the budgets for time and costs.

## FINANCE, SCALING AND MARGINAL COSTS

Enormous economies of scale are possible in mass digitisation projects. We're not talking about 10 percent or 20 percent here, not at all. Real large scale brings enormous price drops. The difference between 1 hour of film scanning, 100 hours or 10.000 hours is enormous and brings price drops in the range of 80-90%. The same is true for large scale audio or video digitisation.

It helps us remedy financial problems that we have in other areas. It also proves that there is a lot to win in collaboration between archives, to create these economies of scale.

It is important to think about marginal costs. Organisations with large infrastructures can calculate a marginal cost for activities beyond the initial plan. For example, Sound & Vision has a large storage infrastructure. The costs of that are covered already, and because we have that, the marginal cost of digital film preservation as DPX files, full 2K scanning, uncompressed, is really an attractive option because we have to calculate it only against marginal costs.

Finally, our projects must prove their financial value to the public. As archivists, we believe in the intrinsic value of the material we are saving, but since we are working with public funds, it is important for us to provide evidence, to demonstrate the potential to provide value to the public, now and in the future. We want to do this not only to ensure continued public support, and to create a better relationship with the public, but because we believe audio-visual archives can help bring accountability and transparency to the social processes, improve public discourse about important and controversial social issues, and serve the needs of educational systems that are now in transition. This reflects a lesson from the funding of "Images For The Future."

## FINAL LESSON AND FUTURE AGENDA

Images for the Future started as a preservation project. Important national cultural heritage institutions saw their collections slowly but surely deteriorating and called out for help: "Our cultural heritage is disappearing!" However true this might be, archivists have not been very successful in raising funds for preserving their collections. And although there are a lot of projects around these days, they are not nearly large enough. A recent estimate of the Comité des Sages is that €100 billion will be needed to preserve and digitise Europe's cultural heritage. Discussions of this staggering number are usually

accompanied with remarks that this is minor compared to the defense industry. However true that might be, that comparison has never helped anyone in getting funded.

In the Netherlands we were forced to argue our case in more detail, and more persuasively, and that proved a blessing in disguise. Funding for Images for the Future was not possible within the limits of most budgets for culture. We were forced to look for alternatives. We found one: a national infrastructure fund under auspices of the Ministry of Economic Affairs that funds highways and bridges. We applied, but to be able to be considered seriously, we had to offer a positive cost-benefit analysis. This forced us to think differently about our project. Yes, of course everyone believed AV preservation was important, but could we prove it in an economic way? What was the value of the project to the Netherlands as a whole, expressed in Euros? The only way to show value was to think of use and turn use by some means into value expressed in money. And to be able to do that, we had to think of users and their potential needs. We had to think of services that would help them. We had to give them access.

This focus on access has since become a key aspect of the project. We do not think in terms of preservation only. We always think about preservation and access. Access is a topic that we did not really touch upon in this article, but it has been central to Images for the Future. We have developed many services for different user groups, some successful, others not so, but it has been and will be a central concern already when we start thinking about digital preservation. And it should be a central concern to all cultural heritage organisations.

Another topic that we only shortly touched on is organisational change. Organisational change takes place on different levels. First and foremost within the organisation: staff changes. Competencies change. New people bring dramatically different views and skills to traditional archivists. Different cultures come together and it is not always easy to get the best of both worlds.

And this leads to another important issue: the digitisation of archives that is the root cause for these organisational changes and potential problems has also a very fundamental impact on thinking about archival collections per se. Instead of film cans, stored in very specific circumstances and always handled with care, we now have to deal with 'invisible' assets: files. Do we have as much control about our digital assets as we have over our analogue tapes? Are our concerns in the analogue domain properly mirrored in the digital domain? If we care - which most of us luckily do - do we feel the same confi-

dence as we had in the analogue domain? We found that we needed to fundamentally rethink our strategy of curating in the digital domain, a process that has not stopped yet.

It seems to us that collaboration on a deep level is more easily attained in the digital domain. Sharing of knowledge and expertise seems more easy when we are dealing with common features of files - as opposed to the differences between video and newspapers. The differences between traditional collections becomes blurred in the digital domain. Productions involve more multimedia. We all share a need for digital storage infrastructures, so new opportunities for collaboration are coming up: the large storage infrastructures needed for audiovisual collections can be leveraged for other digital collections. Combining needs of different institutions allows (again) for cost efficiencies to be realised.

One step further is sharing infrastructure. Larger institutions can leverage their infrastructure for the benefit of smaller ones. To attain this we need to think differently about organisational autonomy and independence: sharing infrastructure and building common platforms whilst at the same time recognising the need for organisational responsibility and accountability.

For cultural heritage institutions fortunate enough to be involved in mass digitisation, the future ahead is filled with promising opportunities. While some of the challenges facing us are immense, it's clear that we're well into the transition to a digital world, and on our way to a level of access to audiovisual heritage scarcely imaginable two decades ago.