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Further information on ERPANET and access to its other products is available at [Hhttp://www.erpanet.org](http://www.erpanet.org).

A great deal of additional information on the European Union is available on the Internet. It can be accessed through the Europa server ([Hhttp://europa.eu.int](http://europa.eu.int)).

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Executive Summary

The Nederlandse Aardolie Maatschappij (NAM) is an upstream petroleum company, the largest gas producer in the Netherlands and a 'centre of excellence' of one of the biggest petroleum companies in the world - Shell Exploration and Production (EP). A petroleum production well must be carefully documented throughout its life-time and may span numerous decades, starting from the initial exploration of a possible source, the construction and operation of the well, until its dismantling. This information is recorded in a 'well file', which is integral for operating the well and which also bears reuse value for the NAM. Well files consist of a myriad of data types, including office documents and scientific data.

It was not until the late 1990s that the NAM started to use digital information extensively. Before that time office documents were managed in paper form, and consequently the NAM does not have long-term experience in the preservation of digital documents. However, as they have stored scientific data in digital databases for several decades already, they have already had to conduct several database migrations. Not least due to these experiences, staff at the NAM are aware of some of the challenges posed by digital preservation.

For the preservation of their information assets, the NAM largely relies on the backwards compatibility of software and data formats. However, they have not yet approached digital preservation comprehensively. Staff time is currently completely occupied with internal reorganisations and the overhaul of their information management infrastructure. Once this overhaul is finalised, the NAM's information management staff will approach digital preservation.

Despite the lack of a comprehensive approach, plans for future information management have already begun to embrace features that are conducive to digital preservation. The core of these plans, for example, is a 'publishing process' designed to ensure the completeness and the quality of the NAM's information.

In addition to this, the NAM's business environment may also facilitate digital preservation programmes because the upstream petroleum sector has a culture of outsourcing and – as a prerequisite for outsourcing – standardisation. From a long term perspective, this may lead to cooperative action towards digital preservation.

Chapter 1: The ERPANET Project

The European Commission and Swiss Confederation funded ERPANET Project¹ (Electronic Resource Preservation and Access Network) works to enhance the preservation of cultural and scientific digital objects through raising awareness, providing access to experience, sharing policies and strategies, and improving practices. To achieve these goals ERPANET is building an active community of members and actors, bringing together memory organisations (museums, libraries and archives), ICT and software industry, research institutions, government organisations, entertainment and creative industries, and commercial sectors. ERPANET constructs authoritative information resources on state-of-the-art developments in digital preservation, promotes training, and provides advice and tools.

ERPANET consists of four partners and is directed by a management committee, namely Seamus Ross (HATII, University of Glasgow; principal director), Niklaus Bütikofer (Schweizerisches Bundesarchiv), Hans Hofman (Nationaal Archief/National Archives of the Netherlands), and Maria Guercio (ISTBAL, University of Urbino). At each of these nodes a content editor supports their work, and Peter McKinney serves as a co-coordinator to the project. An Advisory Committee with experts from various organisations, institutions, and companies from all over Europe give advice and support to ERPANET.

¹ ERPANET is a European Commission funded project (IST-2001-32706). See www.erpanet.org for more details and available products.

Chapter 2: Scope of the Case Studies

While theoretical discussions on best practice call for urgent action to ensure the survival of digital information, it is organisations and institutions that are leading the drive to establish effective digital preservation strategies. In order to understand the processes these organisations are undertaking, ERPANET is conducting a series of case studies in the area of digital preservation. In total, sixty case studies, each of varying size, will investigate awareness, strategies, and technologies used in an array of organisations. The resulting corpus should make a substantial contribution to our knowledge of practice in digital preservation, and form the foundation for theory building and the development of methodological tools. The value of these case studies will come not only from the breadth of companies and institutions included, but also through the depth at which they will explore the issues.

ERPANET is deliberately and systematically approaching disparate companies and institutions from industry and business to facilitate discussion in areas that have traditionally been unconnected. With these case studies ERPANET will broaden the scope and understanding of digital preservation through research and discussion. The case studies will be published to improve the approaches and solutions being developed and to reduce the redundancy of effort. The interviews are identifying current practice not only in-depth within specific sectors, but also cross-sectorally: what can the publishing sector learn from the aeronautical sector? Eventually we aim to use this comparative data to produce intra-sectoral overviews.

This cross-sectoral fertilisation is a main focus of ERPANET as laid out in its Digital Preservation Charter.² It is of primary importance that disparate groups are given a mechanism through which to come together as best practices for digital preservation are established in each sector.

Aims

The principal aims of the study are to:

- build a picture of methods and match against context to produce best practices;
- accumulate and make accessible information about practices;
- identify issues for further research;
- enable cross-sectoral practice comparisons;
- enable the development of assessment tools;
- create material for training seminars and workshops; and,
- develop contacts.

Potential sectors have been selected to represent a wide scope of information production and digital preservation activity. Each sector may present a unique perspective on digital preservation. Organisational and sectoral requirements, awareness of digital preservation, resources available, and the nature of the digital

² The Charter is ERPANET's statement on the principles of digital preservation. It has been drafted in order to achieve a concerted and co-ordinated effort in the area of digital preservation by all organisations and individuals that have an interest and share these concerns.
<http://www.erpanet.org/charter.php>.

object created place unique and specific demands on organisations. Each of the case studies is being balanced to ensure a range of institutional types, sizes, and locations.

The main areas of investigation included:

- perception and awareness of risk associated with information loss;
- understanding how digital preservation affects the organisation;
- identifying what actions have been taken to prevent data loss;
- the process of monitoring actions; and,
- mechanisms for determining future requirements.

Within each section, the questions were designed to bring organisational perceptions and practices into focus. Questions were aimed at understanding impressions held on digital preservation and the impact that it has had on the respective organisation, exploring the awareness in the sector of the issues and the importance that it was accorded, and how it affected organisational thinking. The participants were asked to describe, what in their views, were the main problems associated with digital preservation and what value information actually had in the sector. Through this the reasons for preserving information as well as the risks associated with not preserving it became clear.

The core of the questionnaire focused on the actions taken at corporate level and sectoral levels in order to uncover policies, strategies, and standards currently employed to tackle digital preservation concerns, including selection, preservation techniques, storage, access, and costs. Questions allowed participants to explore the future commitment from their organisation and sector to digital preservation activities, and where possible to relate their existing or planned activities to those being conducted in other organisations with which they might be familiar.

Three people within each organisation are targeted for each study. In reality this proved to be problematic. Even when organisations are identified and interviews timetabled, targets often withdrew just before we began the interview process. Some withdrew after seeing the data collection instrument, due in part to the time/effort involved, and others (we suspect) dropped out because they realised that the expertise was not available within their organisation to answer the questions. The perception of risks that might arise through contributing to these studies worried some organisations, particularly those from sectors where competitive advantage is imperative, or liability and litigation issues especially worrying. Non-disclosure agreements that stipulated that we would neither name an organisation nor disclose any information that would enable readers to identify them were used to reduce risks associated with contributing to this study. In some cases the risk was still deemed too great and organisations withdrew.

Chapter 3: Method of Working

Initial desk-based sectoral analysis provides ERPANET researchers with essential background knowledge. They then conduct the primary research by interview. In developing the interview instrument, the project directors and editors reviewed other projects that had used interviews to accumulate evidence on issues related to digital preservation. Among these the methodologies used in the Pittsburgh Project and InterPARES I for target selection and data collection were given special attention. The Pittsburgh approach was considered too narrow a focus and provided insufficient breadth to enable full sectoral comparisons. On the other hand, the InterPARES I data collection methodology proved much too detailed and lengthy, which we felt might become an obstacle at the point of interpretation of the data. Moreover, it focused closely on recordkeeping systems within organisations.

The ERPANET interview instrument takes account of the strengths and weaknesses from both, developing a more focused questionnaire designed to be targeted at a range of strategic points in the organisations under examination. The instrument³ was created to explore three main areas of enquiry within an organisation: awareness of digital preservation and the issues surrounding it; digital preservation strategies (both in planning and in practice); and future requirements within the organisation for this field. Within these three themes, distinct layers of questions elicit a detailed discovery of the state of the entire digital preservation process within participants' institutions. Drawing on the experience that the partners of ERPANET have in this method of research, another important detail has been introduced. Within organisations, three categories of employee were identified for interview: an Information Systems or Technology Manager, Business Manager, and Archivist / Records Manager. In practice, this usually involved two members of staff with knowledge of the organisation's digital preservation activities, and a high level manager who provided an overview of business and organisational issues. This methodology has allowed us to discover the extent of knowledge and practice in organisations, to understand the roles of responsibility and problem ownership, and to appreciate where the drive towards digital preservation is initiated within organisations.

The task of selecting the sectors for the case studies and of identifying the respective companies to be studied is incumbent upon the management board. They compiled a first list of sectors at the very beginning of the project. But sector and company selection is an ongoing process, and the list is regularly updated and complemented. The Directors are assisted in this task by an advisory committee.⁴

³ See <http://www.erpanet.org/studies/index.php>. We have posted the questionnaire to encourage comment and in the hope that other groups conducting similar research can use the ideas contained within it to foster comparability between different studies.

⁴ See www.erpanet.org for the composition of this committee.

Chapter 4: The Upstream Petroleum Industry

Literally translated from Latin, the word 'petr-oleum' signifies 'mineral oil'. Nowadays, the term is used more inclusively, referring to all sorts of fossil fuels including natural gases as well as crude oils. The industry exploring, producing, and transporting oil and gas is called the 'upstream' industry. The 'downstream' industry refines the natural substances and sells the final products as energy sources such as car fuel, or for residential use in heating.

Oil and gas companies are mostly hugely international. The top five companies on the market are BP, ExxonMobil, TotalFinaElf, Royal Dutch/Shell, and ChevronTexaco. The estimated net asset value of Royal Dutch/Shell exceeds thirty-six billion US Dollars in 2002.⁵ Shell's expenditures amount to more than twenty-two billion US Dollars in 2002, with the exploration of new sources taking more than half of those overall expenditures.⁶

The exploration of possible petroleum deposits is a complex process full of uncertainty, despite the development and application of advanced technology since the 1980s. Today, exploration is a scientific process composed of geological surveys, seismic exploration, as well as data collection regarding variances in the Earth's magnetic and gravitational fields. This information, produced long before a well is dug to exploit the source, is of great value. The same can be said for the other information accrued during the lifetime of a well, which may span numerous decades and continue for up to a century. All of the information documenting the exploration, construction, and operation of a well up to its dismantlement is recorded in a 'well file'. Well files are highly structured compendia that contain various kinds of information, including reports and notes, pictures, and videos, as well as seismic data. While such a 'well file' is still composed of an amalgam of paper and digital information in most companies, there is a clear drive within the sector towards a purely electronic well file with all information available in digital form.

Technological advances in information and communication technology together with changes in business thinking led to large-scale organisational restructuring. Around the 1980's, the huge monolithic oil companies started to split up into a number of rather detached parts. Moreover, companies started to outsource many of the processes such as seismic research, well digging, maintenance and building, to a variety of third parties. Consequently, rather young companies such as the Nederlandse Aardolie Maatschappij (NAM) tend to focus more on coordinating services by other companies rather than conducting them themselves. All in all the sector is slowly coming to terms with these restructuring processes, and increasing exploitation of information and communication technologies has had a positive influence on the global business process.

⁵ Royal Dutch/Shell Group of Companies: Financial and Operational Information 1998-2002. (website viewed November 2003.) <http://www.shell.com/html/investor-en/reports2002/fao/html/site.html>.

⁶ OPEC: Annual Statistical Bulletin 2002; see References.

Chapter 5: the Nederlandse Aardolie Maatschappij

The NAM was established in 1947 after the discovery of the oil field Schoonebeek (Northern Netherlands), with the mission to explore and produce natural resources in the Netherlands. Today the NAM accounts for just under half of the oil produced in the Netherlands. NAM's focus, however, has shifted from oil towards natural gas. With the discovery of one of the world's largest gas fields in Slochteren (Northern Netherlands), the NAM was the first company in Western Europe to drill for gas in the North Sea in 1961. It currently holds 75 percent of the overall gas production in the Netherlands, the Netherlands being among the top twenty countries in gas production world-wide⁷, and employs about 2,700 staff.

As natural resources in general remain publicly owned by the source country, the NAM is cooperating closely with the Dutch government.⁸ The NAM is a partner with the government-owned company EBN (Energie Beheer Nederland)⁹ in gas production, and its products are transported and sold by other companies held by the Dutch government.¹⁰

The NAM was founded as a cooperative of the petroleum companies Shell and Esso but operated solely by Shell. Both still hold an equal share of the company, but today NAM is an independent entity in tight cooperation with Shell EP (Exploration and Production). The NAM is regarded as a centre of excellence within the Shell Corporation; as such they are a standard setting branch and involved in all discussions at Shell. Integration with Shell was further strengthened through the formation of a European unit of Shell EP in January 2004.¹¹ As a result, the NAM has become one of three centres of Shell's EP activities in the whole of Europe. This important move has entailed major organisational restructuring activities, which were in the course of being implemented at the time of this case study.

The history of digital information for document-like resources is relatively young at the NAM. Only in the late 1990's was a comprehensive digital information management system installed.¹² Since then the NAM has moved swiftly towards digital processes. This effort is not limited to the NAM; in fact, it has taken a lead role in implementing a global information management system in Shell EP. The NAM's efforts in shaping information management and the effect this has on digital preservation will be discussed in the following chapters.

⁷ In a 2001 estimation of the CIA World Factbook the Netherlands take position 16 in gas production, only second in Europe after Norway;
<http://www.cia.gov/cia/publications/factbook/geos/nl.html>.

⁸ Tweede Kamer der Staten-Generaal: Aardgasbaten. Den Haag, 1999. 26 811, nrs. 1–2; KST40431; ISSN 0921-7371. Sdu Uitgevers.
http://www.rekenkamer.nl/9282000/d/tk26811_2.pdf.

⁹ EBN - Energie Beheer Nederland B.V.; <http://www.ebn.nl>.

¹⁰ The 'Nederlandse Gasunie' (<http://www.gasunie.nl>) is responsible for trade and supply, and 'Gastransport Services' (<http://www.gastransportservices.nl>) is in charge of all the network activities.

¹¹ Press release 03/04/2003: NAM centre of gas operations in Shells European EP organisation. Available via the NAM website at <http://www.nam.nl/> (viewed January 2004)
http://www.shell.com/home/Framework?siteId=nam-en&FC1=&FC2=&FC3=%2Fnam-en%2Fhtml%2Fwgen%2Fnieuws%2Fpersberichten%2F2003%2Fnam_persbericht_03042003.html&FC4=&FC5=.

¹² This is described in more detail in the Chapter *Preservation* Activity below.

Chapter 6: Details and circumstances of the interviews

The interviews for this case study took place in November 2003 in short succession and were conducted on the telephone. Interviewees came from a range of backgrounds, which provided a broad perspective of the situation at the NAM: Theo Bontje, field engineering skill pool manager; Joke Nanninga, Information Advisor; and Peter Kemper, head of Information Management/Tools and Standards. We are particularly happy that the major reorganisation taking place at NAM did not prevent them from participating in this case study.

Chapter 7: Analysis

This section presents an analysis of the data collected during the case study. It is organised to mirror the sequence of topics in the questionnaire.

- Perception and Awareness of Digital Preservation
- Preservation Activity
- Compliance Monitoring
- Digital Preservation Costs
- Future Outlook

We will, in the following, focus on the preservation of information related to petroleum wells, as it is the most particular type of information in upstream petroleum industry and also the information with the most long-term value.

Perception and Awareness of Digital Preservation

The value of well files is based mainly on economical and environmental factors. The importance of well files for NAM is obvious to its staff and they unanimously subscribe to the necessity of preserving this information. At the same time, staff are not aware of the actions taken towards long-term preservation that are beyond their area of responsibility. Corporate training programs on a variety of issues, including the adequate creation and management of documents, are in place at NAM and the overall Shell company. Interviewees indicated that staff may also be informed about digital preservation in the future and trained on the necessary actions once they have been identified.

The main problems

Two of a well file's outstanding features that encumber preservation considerably are the diversity of formats it holds and the fact that the file is growing continually over the whole lifetime of a well, which may be numerous decades. The dynamic organisational environment also puts a strain on the development of a preservation approach. The sector has changed considerably in recent decades and is in many ways still inexperienced: there are in fact various reorganisations taking place just now within the sector as a whole, as well as within Shell and also within the NAM. Specifically, the formation of a Shell Exploration and Production (Shell EP) unit for Europe entails many changes for the NAM. This dynamic organisational environment in tandem with exacting requirements on the information and communication infrastructure results in the current situation where the NAM and similar companies are still fundamentally shaping their information management.

Asset value and risk exposure

The long-term value of well files is particularly striking in the following situations:

a) In particular circumstances a source may be dormant for a long period of time. It is, in fact, not rare that a well is only established a decade after a source is discovered. The technology to extract petroleum may be insufficient for given environmental condition, for example, the source may be too deep down. Economic circumstances such as the current petroleum price strongly influence whether or not a well is developed at the time. And, of course, the political situation in the country where the well is located also influences its timely production.

b) As already outlined, the organisational environment in the petroleum sector is relatively dynamic. The ownership of a well may change during its lifetime perhaps multiple times. This may be related to a merger, or the owner company decides to trade the well to another company. Such a “swap” may be a reasonable move due to infrastructure reasons, for instance, if an existing pipeline of another company is closer to a particular well than the transport routes of the owner. Complete documentation of a well’s history is, of course, essential in a swap when the well file is transferred from one company to the other.

c) Experiences gained during the lifetime of a well may inform the construction and operation of other wells where the environmental conditions and the position specific circumstances are similar. Such a knowledge transfer may occur on a global level within a company or between partnering organisations, as long as the relevant antitrust and competition laws are respected. Shell hopes to reuse their existing knowledge even better in the future by improving their information management. In tandem with Shell’s restructuring towards a Shell EP Europe, which is being done for creating synergies and improving information management, an integrated information management system for Shell EP as a whole is planned to be implemented. Interviewees underlined that information must always be available to any member of staff at any place in the world – an indispensable prerequisite in a global business company.

Regulatory environment

Many legal situations are conceivable where a record of the well’s history is essential. For example, the well file may be examined in context of environmental legislation, or the decisions taken in the past and the reasons why they have been taken must be known in the case of a disaster. This is especially relevant for gas wells, as gas production routinely causes earth shocks and the gas in its natural form is highly poisonous¹³. Regulations¹⁴ the NAM is subject to focus primarily on organisational and safety issues, and not as much on the information the NAM creates and maintains.

Apart from this the government as a partner in the production process has influence on the relevant information and its preservation. In the tight cooperation between the Dutch government and the NAM, the relevant governmental parties demand diligent stewardship of the information without imposing stark regulations. For example, an exact retention period of well-related information is not put down in stark regulations, but the public bodies expect the well file to be available on request.

Preservation Activity

Policies and Strategies

Long-term preservation of digital information has not been approached by the NAM up to this point in time. It is, however, moving towards a new information management infrastructure with a number of features that may support preservation actions in the future. This entirely new approach will be implemented across the whole Shell EP. The NAM information department is taking a lead role in its design, cooperating closely with

¹³ Our awareness of the danger level of gas wells was elicited recently, when just around Christmas 2003 a burst gas well in Chongqing, China, released toxic gases changing an area of 25 square kilometres to a death zone. See BBC News 25/12/2003: Mass exodus after China gas blast. <http://news.bbc.co.uk/1/hi/world/asia-pacific/3348429.stm>.

¹⁴ Mijnbouwwet, per 1 januari 2003. http://www.minez.nl/beleid/home_ond/olieengas/oliegas.htm.

the overall Shell Corporation. This overhaul of information management currently absorbs all available staff time and is expected to take few years longer. Digital preservation will be addressed in a calculated manner just after this is completed.

The main component of the future information system will be a 'publishing process system'. The idea is to formally define a set of generic business processes. These business processes are generic building blocks of a well, such as subsurface exploration or the acquisition of necessary legal admissions before a well can be established. Each of these processes requires a number of specific documents to be added to the well file, which are identified in a 'template' or checklist. This allows the whole organisation to better oversee the progress of undertakings, and at the same time it gives the information management department more control by means of a 'traffic light system' that indicates if specific documents are still missing from a collection. This improved control over documents through the 'publishing' system is designed to ensure the quality and completeness of information in the future. This will give information management staff a clearer role and authority and will also be conducive to digital preservation. In addition to that the system may support other preservation actions to be taken in the future.

The level of standardisation and interoperability within the sector may also affect digital preservation positively. As outlined above, numerous parties are adding information to a well file during a well's lifetime, from the government and the operators themselves to providers of specific services. Standards for information interchange are thus a core requirement in the petroleum sector, and all companies including the NAM push jointly in that direction. There are two primary levels for standardisation. From a national perspective, Governmental agencies set national standards. For example, the American Petroleum Institute¹⁵ is quite influential in the whole sector, and specifically relevant to the NAM is the Dutch ministry of economic affairs. On an international level the Petroleum Standards Committee (POSC)¹⁶ is a powerful player. The POSC is an international not-for-profit membership corporation that promotes cooperation in the upstream petroleum sector by providing open specifications and tools for electronic information management and interoperability.

Selection

Shell EP has clear selection guidelines on what information needs to be included in well files. This information is in a myriad of different data types, a great part of which is in digital form. 3D subsurface seismic data as well as construction plans and drawings are almost completely in digital form. Office documents on the other hand including letters and reports have a higher percentage of paper documents, which results in a hybrid file. The ultimate goal is to attain an 'electronic well file' with all information available in digital form. To achieve this the NAM is pushing towards digital processes such that paper is avoided in all business processes in the first place. Also, scanning is in progress for transforming the information that is still on paper. It is not yet clear whether paper documents may be destroyed once scanned and the NAM currently stockpiles them in a depot. While scanning has been ongoing for a couple of years, the effort will be ongoing for several years longer.

A well file is essential during the whole lifetime of a well. Due to its relatively young age, the NAM has not often been confronted with the question of whether or not a well file should be disposed of after a well has been dismantled. At the same time the cost

¹⁵ The American Petroleum Institute (API) of the United States: <http://www.api.org/>.

¹⁶ Petroleum Standards Committee, POSC: <http://www.posc.org/>.

of keeping information is relatively cheap, so the NAM did not address disposition of well-related information at this point of time.

Preservation

The history of digital information for document-like resources is relatively young at the NAM. Before 1995 NAM depended primarily on paper for document-like resources. After an interim period in which the NAM used a local system, an information management system was installed across the whole Shell EP. This system called LiveLink¹⁷ was customised for Shell's needs and installed at NAM in 1998. LiveLink can store any kind of information or reference to physical storage using about a dozen fields of descriptive metadata.

In the relatively short time period that the NAM uses digital information for document-like resources, they did not have a drive to invest in digital preservation as they have not yet been faced with the situation where complex preservation action was necessary. For office documents NAM relies on Microsoft formats and builds on the downward compatibility of future versions. Staff at NAM are, however, aware that there are certain problematic formats including drawings in AutoCAD¹⁸ or other proprietary data formats. The NAM therefore employs only TIFF and PDF formats for their documents of long-term value rather than formats where the specification is not openly available. If it is not possible to resort to published standards, NAM prefers prevalent industry standards. For seismic data, for example, the companies Landmark and Schlumberger are the largest system providers, and their data formats represent de facto industry standards.

Unlike documents, scientific data has been created in digital form and stored in databases¹⁹ since the 1980's. Database migrations have thus been conducted in the past. These were huge efforts, logistically complex, and involved many person months of work by external experts. In these migrations staff found that the real work is not so much the actual transfer of the data from the old to the new system, which can largely be conducted automatically; validating the accuracy of this transfer proved far more time-consuming.

Access

Across the Shell Corporation, 100 million documents are expected to be available digitally by the year 2008. All of these documents already exist, but often only in paper form. They are now being scanned and accessioned into Shell's LiveLink system. Intelligent retrieval mechanisms are necessary for this enormous amount of information, so that the user does not drown in information.

Old information is planned to be kept separately from the current information stocks. The system designers believe that searching archives involves special knowledge understanding the past from an organisational as well as a technological perspective. This special knowledge is needed to find, access, and correctly interpret relevant documents in the archives. For this reason specially trained experts will be in charge of

¹⁷ LiveLink content management software is supplied by OpenText - <http://www.opentext.com/livelink/>.

¹⁸ AutoCAD is a 2D and 3D design software by Autodesk - <http://www.autodesk.com/>.

¹⁹ NAM employs since 1987 constantly Oracle databases (<http://www.oracle.com/>), building on existing migration paths from one Oracle version to the subsequent. Before 1987 NAM utilised other databases including Adabas supplied by Software AG (<http://www.softwareag.com/>) and DB2 by IBM (<http://www.ibm.com/>).

administering and searching the archives. Staff can approach these experts for any of their information needs.

The active information in the Shell LiveLink system can be accessed from any part of the organisation by using SmartCards for identification. Suitable access restrictions and security mechanisms are installed. This part of the system is already well equipped for the future and for worldwide accessibility of information resources.

Compliance Monitoring

As digital preservation and information management in general is still in its infancy, mechanisms for compliance monitoring have not yet been established. The future 'publishing system' (described above) is geared at allowing better control over existing information and its quality. This, together with ongoing training for staff and future monitoring mechanisms, is planned to ensure the adequacy of information management.

Digital Preservation Costs

Compared with the investment of creating seismic data and other well-related information, the cost of digital preservation is expected to be comparably low. Interviewees were confident that the organisation would assign the budget necessary for preservation actions once they are identified. At the moment, however, the further shaping of the overall information management landscape has higher priority and investments for digital preservation cannot be identified. To get an idea of the possible scale of investments, the current operational costs of systems at Shell EP including the scanning of paper documents absorb multiple millions Euro a year.

Future Outlook

The ongoing overhaul of information management is absorbing all staff time. During these fundamental changes preservation is more of a side topic. The information management department is well aware of the importance of preservation, and interviewees allude to the necessity of establishing a technical approach that may be a combination of migration and the use of standard formats, as well as necessary organisational amendments such as adequate training for staff and archival experts. At this point of time, however, other major tasks including the reorganisation and the introduction of the publishing process system take a higher priority. As soon as the organisation finds the staff resources and the necessary focus to address preservation, they plan to do so.

Chapter 8: Conclusions

Previous erpaStudies have already shown that rapid technological development is not the only factor in digital preservation and that organisational dynamics may encumber preservation activities as well.²⁰ The situation at the NAM underlines this perception. Moreover, organisational and technological transformation may affect each other: advances in technology make it possible that globalised organisations work as tightly integrated organisms; conversely organisational change may necessitate adaptations in the information infrastructure.

Comprehensive approaches to digital preservation and indeed any information management approach that is designed for the longer term must therefore not only allow for technological change, but must also consider possible organisational change. The NAM is confronted with exactly that challenge when currently designing their future information management. If this system prescribes business processes too rigidly, it may be outdated even before the current reorganisation is completed. The NAM is thus moving towards a modular and flexible approach.

While the NAM does not explicitly dub this planned feature of their future information management as a digital preservation design criterion, this feature is conducive to digital preservation. Similarly, the NAM displays a long-term perspective in other aspects as well, as exemplified in their plan to employ experts to assist information retrieval by brokering archived information at request. These experts are supposed to know about the context the information was created in, and they thereby facilitate reuse of information. Of course, these experts need to be trained with comprehensive background information. Such information describing the history of the organisation and the context of the information may be considered an vital component of a preservation solution.

A digital preservation policy at the NAM is of great importance, recognising that the active time of a well file is already way beyond the time horizon of how long many organisations in other sectors need to preserve their information assets. Indeed, if a migration approach is chosen for preservation and the information in the well file is to be regularly transferred to new formats before it becomes obsolete, several migration cycles will be required during the lifetime of a well. Without a systematic approach to this, the NAM is in danger of losing information. However, the NAM information management staff are well aware of this and will address digital preservation as soon as possible. Also their plans for active information management will continue to be influenced by their long-term thinking. In fact, the ongoing reorganisation and the overhaul of information management open a window of opportunity for implementing tools and procedures for digital preservation in one go.²¹ The NAM would certainly be in a position to accomplish more in the way of digital preservation now, were it not for the limited time resources of its staff.

Furthermore, the NAM's business context appears opportune in this respect. There appears to be consent in the upstream petroleum sector that competition in the companies' primary business should not span to auxiliary functions. The out-sourcing of activities on all fronts and services within the sector points to this, as does the cooperation in the definition of sector-wide standards in the way of data formats and

²⁰ Cf the erpaStudy on the "Office of Metropolitan Architecture", or other case studies available on the ERPANET website at <http://www.erpanet.org/studies/>.

²¹ The World Intellectual Property Organization (WIPO) is currently at a similar crossroads, which was outlined in the respective erpaStudy available on the ERPANET website at <http://www.erpanet.org/studies/>.

information management. In anticipating the future, it may indeed be possible that information management services and digital preservation are out-sourced to service providers that host the information for a number of upstream petroleum companies. The synergies and possible cost savings of such an approach may be significant.

Appendix 1: References

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