The features and impact of the paperless office, with specific reference to the City of Johannesburg

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1 Introduction

Major changes are taking place in the global workplace. The European Foundation reveals that work is becoming more intensive, more than 50% of workers are working at high speed or tight deadlines most of the time, the nature of the work is driven by customer demands and the number of people working with computers has increased to 41% in 2000. The strain on the employee is ultimately reflected in the work-related health issue of muscular pains in the neck and shoulders reported by a quarter of the workforce (European Foundation, 2000). Closer to home, statistics support this trend by indicating that the number of Internet users in Africa has increased by nearly 100%, from 2.5 million in 2000 to nearly 5 million in 2001, with South Africa having two-thirds of Africa's internet population (Dudley 2001).

Not only does the Information Age take its toll on people, but on the environment too. The availability of computers, printers and information sources (e.g. the Internet), as well as access to new technologies such as digital cameras, has improved the ability and increased the capacity of the end-user to produce paper output. In South Africa paper printing is increasing annually at a rate of 20% (Maynard 2001). In South Africa an estimated three trillion pages were printed at homes and offices during 1999, which was 5% of the total number of 60 trillion pages printed world-wide, with a figure of eight trillion estimated for 2010 (Jovanovic 2000). Environmentalists are reacting to such environmental threats by launching initiatives that promote business practices and technologies that support and

improve environmental protection and sustainability (Global e-Sustainability Initiative - GeSI 2001).

Despite pressures to be more competitive and the large investments that have been made in technology to improve the ability to create, process, update and distribute data, many of us, including local government, are still drowning in a sea of paper that is becoming more difficult to control. Document and information control processes have not kept pace with the volumes of paper that we are creating. During the 1980s concerns were expressed that the growth of paperwork exceeded the corresponding growth in business (Knox 1980) and attempts were made to introduce digital documentation in order to create the paperless office, but they were never realized (Keary 2000). Since then new technological developments like the Internet, with sharing and collaboration capabilities, have been introduced. If the City of Johannesburg's vision is to become a world-class city that operates efficiently, is people centred and environmentally sensitive, should the attempts to create a paperless working environment be revived in the twenty first century? In this research the following research problem was investigated:

What are the features and impact of the paperless office, with specific reference to the City of Johannesburg?

The sub-problems that were addressed are:

- What is a paperless office?
- What are the paperless office's functionality and advantages to paper?
- How does one go about implementing a paperless office in the City of Johannesburg?

The research method followed was a combination of a literature study and a case study to demonstrate the digitizing of amendment schemes and promulgations used at the Planning Information Counter of the Midrand Administration: City of Johannesburg.

2 Definitions

The *Chambers Thesaurus* (Seaton *et al*. 1990:453) proposes alternative words for paper as 'certificate, document, file, gazette, journal, newspaper, letter, record, script, thesis, etc.' These terms all refer to products containing information. Lund (1994:24) makes the distinction between *desktop publishing* and *electronic publishing* where the final product of the former refers to a typeset document (hard copy) and the latter to a document on the screen (soft copy). Keary (2000:1) refers to the compound *document* that combines text, digital, video and digital audio to create the virtual document. An electronic document would thus be synonymous with any form of digital document, file or folder.

During the 1980s the paperless office simply meant that all forms of paper (documentation) within an organization should be converted to digital format. Since then the introduction of Internet technologies has changed the definition of an organization to move beyond traditional, locality bound clusters to include distributed (globally spread) branches and supply chains. Currently an *office* would therefore refer to a virtual working environment.

For purposes of this article an updated definition of the *paperless office* refers to a working environment where the creation, modification, storage and retrieval of documents (electronic, graphical and virtual) happen electronically. It supports the business/work processes-oriented management of documents. It entails a move from paper to electronic medium where employees work with electronic (e) documents, e-forms, and documents

distributed via e-workflow and e-distribution. The aim is to discharge paper documents as the carrier of information and work only with electronic documents (Lund 1994). Alternative terms for the paperless office are the paper-free or digital office.

3 Functionality of the paperless office

The information era concepts of electronic document management, work-process automation (workflow), optical character recognition and imaging are essential elements of the paperless office (Keary 2000).

3.1 Document management

Document management software allows the user to store electronic documents in a database for subsequent retrieval and sharing, and it can assign viewing and editing privileges to users. It helps manage the creation, distribution maintenance, organizing and storage of documents. It often includes scanning (converting paper documents to electronic format) and high performance storage. Keary (2000:2) points out that 'the weakest links in electronic document management are indexing, searching and retrieving'. This underpins that, although the selection of software is important in this regard, the application of appropriate expertise during the indexing phase is critical for finding electronic documents at a later stage. Several document management packages now provide full-text indexing and searching (Falk 1999). The addition of metadata (data about data) to documents is becoming important to enable the user to verify the general quality of the document, for example the reliability, accuracy and currency.

3.2 Workflow

Complex business processes typically include several operations, different levels of authority and documents or folders of information (Brunwin 1994). Workflow software provides tools to automate the electronic workflow of documents and business procedures. It ensures that the correct document enters the database, routes each document to the appropriate person and ensures that approval is obtained at the right stages within the business process, monitoring each step of the process. Electronic workflow automates process control because it co-ordinates activities, role players, data/information and monitoring. Tracking and tracing of dynamic content and feedback are possible at any point in a document's life cycle. When applied correctly, and not just automating inherently inefficient paper procedures, workflow is a catalyst for business process improvement (re-engineering), defining new business rules (FHC 2000).

3.3 Intranet

Within an organization an intranet creates a Web-enabled digital environment for the entire organization, providing services such as electronic mail, GroupWare and search engines. Via a standard Web browser the intranet enables cross-platform information access, sharing and communication across traditional organizational boundaries (Ives 2001). According to Auditore (2001:33), the enterprise information portal (EIP) is the next natural step in the evolution of the organizational intranet. It acts as a single point of access to internal and external information, enabling users to access disparate information sources throughout the organization. In larger organizations with distributed offices (e.g. the City of Johannesburg), an EIP can function as a unified corporate desktop that provides a personalized view of organizational information. The ultimate EIP integrates structured information (databases) and unstructured information (documents, items) with knowledge into a single, personalized

environment. For purposes of this article, the EIP is acknowledged as an exciting development that provides an organizational platform to facilitate the paperless office, but is not detailed any further.

3.4 Enabling technologies

Documents have to be put into a computer-readable format before they can be stored electronically. Enabling technologies that assist in the electronic management of documents include *scanners* that use image technology. Information in paper medium is converted to digital information and can be stored in multiple media such as microfilm, tape, disk, etc. Flat platen (bed) scanners are usually used for smaller documents (up to A3), while drum scanners are used for large (A0) sized documents. Multiple feed scanners are useful when working with multiple page documents and large volumes.

The *digital camera* is another image-entry alternative especially useful for capturing images in fragile bound materials, although it is less effective for large volumes.

Optical Character Recognition (OCR) technology electronically recognizes characters or text automatically and can be used to convert scanned documents (images) to full text documents. It is particularly useful because it enables full-text indexing and searching. OCR and neural network *recognology* systems are particularly interesting developments because they develop their own rules and can learn and relearn to provide solutions in the areas of data analysis, pattern recognition, data processing and electronic imaging. The integration of recognologies and electronic document management systems (EDMS) are predicted to include all the technology functions related to scanning, indexing, modifying, processing, storing and retrieving of documents (Keary 2000).

Distributed printing is facilitated by high volume network fax solutions, network printers, network PCs or network printer devices (Tarsus Technologies 2001). Unnecessary printing (desktop publishing) of documents is thus avoided and happens only when and where you need it, on demand (print-on-demand) and closer to the ultimate user (Jovanovic 2000). This reflects a move from a 'print and distribute' to a 'distribute and print' scenario of the Internet and intranet environment.

Multi-channel delivery or transmission (Internet, wireless, mobile and e-mail) furthermore extends digital communication beyond the organization's boundaries (FHC 2000).

Other technologies providing digital office solutions worth mentioning are digital copiers, multi-functional units (printer, copier and fax), automated electronic faxing facilities (digital senders), e-mail or GroupWare, voice-recording systems, videoconferencing and raster image processing (RIP) technologies.

4 Benefits of the paperless office

The paperless office has several advantages to that of paper, of which 'saving the trees' is only one.

4.1 Environment friendly

The paperless office reduces the amount of paper produced and used, saving money for the organization as well as making a tangible contribution towards protecting the environment. Large storage rooms filled with files can be eliminated, provided legal obligations are

adhered to.

4.2 Process efficiency

Converting to an electronic system provides the opportunity of analysing and identifying flaws in manual processes in order to implement improved electronic business processes and new business rules (Sharma 2000).

4.3 Process management

Electronic workflow has built-in control mechanisms like the triggering of activities, automated notifications and escalation as well as an audit trail to measure processing time and the quality of process output. The automated process allows tracking against predefined rules. The control over document updating and circulation ensures more accurate information, as employees will be using the most up-to-date version available. This culminates in improved efficiency and better quality (Baines 1997).

4.4 Resource efficiency

Automated workflow sends the work to the employees and efficiency is achieved by assigning tasks according to, for example, workload. Electronic templates furthermore eliminate repetitive administrative tasks, improving productivity by allowing the employee to concentrate on the more intellectual tasks at hand. Increases in productivity and efficiency culminate in profitability and cost savings, while managing an increased workload (Uthmann and Speck 1998).

4.5 Standardization

Consolidated electronic forms, working documents, templates and procedures ensure standardization.

4.6 Sharing and collaboration

A central database or repository of documents and information on the network, such as provided by intranets or extranets ensures the sharing of information from distributed locations, which encourages collaborative business processes and functional integration (process chains).

4.7 Market efficiency

A single customer service representative can access all the different areas of the (distributed) organization and has immediate access to the most current electronic information. This allows for quicker response times to customer inquiries. The automated procedures furthermore enable transparent communication with customers (uniform interface), the prediction of delivery times and adherence to deadlines. Automated acknowledgement letters, for instance, demonstrate a customer focus. Better service delivery improves customer's perceptions of the organization and provides a competitive advantage.

4.8 Information delivery

Electronic documents can be stored and delivered in various forms and formats, and delivered as a package to the user as, when and how required.

4.9 Unlocking information

Information sources previously 'locked' away and unknown might become available to the end-user in electronic format. Examples are fragile documents or those of which only a single copy exists. Provided the information professional has applied his/her expertise in identifying and organizing (indexing) documents or records, better retrieval results will be obtained.

5 Case study: Digitizing of amendment schemes and promulgations

5.1 Overview

Although a local government is a non-profit, service-rendering organization, it operates in the same dynamic, competitive environment as any other enterprise. It should apply its information resources and capabilities to its advantage in attracting investment and achieving its obligation to be an efficient, frontline development agency, constantly seeking the best way of delivering services to all its residents and to put 'people first' in the way it runs its administration. Furthermore, the ratepayer is a customer to various other organizations or institutions, for example, a bank where he/she is exposed to state-of-the-art technological facilities and customer care services. Although the implementation of these facilities and services is the result of competition between profit-oriented enterprises, they set the norm and the ratepayer measures the local government against these standards. Because of its relatively restricted budget, the local government is obliged to make wise judgements and investments in information technology and to provide computing tools to meet customer expectations and increase employee productivity.

Problem

The paper-based file storage system at the Town Planning Information Counter of the Midrand Administration is slow, cumbersome and error-prone. Furthermore it does not support the principles of local government for efficient service delivery or the vision of the City of Johannesburg to be a customer-oriented, world-class city.

Solution

As a first phase the amendment schemes and relevant *Provincial Gazette* promulgations were electronically captured and archived using Alchemy software (distributed by the Information Management Research Company).

Benefit

The captured records can be accessed from the desktop at the information counter, improving retrieval times, accuracy and customer service. It supports the organization's vision.

5.2 Background

The orderly development of towns is the responsibility of local government and, more particularly, that of the town planning department. A mechanism to control development is the town planning scheme, which provides the 'rules' according to which properties may be developed. Criteria include aspects such as zoning, building line restrictions and coverage. Any deviation from these predefined rules must be applied for by means of a development application. Applications for rezoning, township establishment, subdivision and consolidation of erven are examples. Each contains a set of diagrams and annexes

stipulating the details of the application. Once the applications have been evaluated and commented on by all the service departments (e.g. town planning, engineering, electricity, water, and sewer) the comments are combined, evaluated and considered for approval. On approval a publication notice is sent to the *Provincial Gazette* for promulgation of the conditions under which the amendment has been approved. On publication the amendment is legally valid.

One type of inquiry at the town planning information counter is that customers wish to know what the zoning and site information is on a specific property. This question is often raised by potential developers who want to develop a site for a business or by developers who want to establish a new township. The counter personnel then need to know whether the specific stand or stands are still zoned according to the original town planning scheme or whether an amendment scheme has been submitted and/or approved for deviation. They then need to determine the current specifications. Both the amendment scheme documentation and the promulgation are required for this purpose.

The previous manual process required the counter personnel to leave the customer at the counter while they went to the registry file room where they had to trace the specific erf's file. Often the file would be misfiled or in use by another department, which meant that they had to walk around the building, trying to find the file. If they eventually did get hold of the file, they had to page through all the correspondence in the file to see if it contained relevant documentation. It could happen that the amendment scheme was found but not the promulgation. Without the promulgation they would not be able to provide a specific answer as to the legality of the application. After having left the customer unattended at the counter for all this time, they probably were not able to provide the customer with a definite answer and would therefore not be able to issue a zoning certificate as requested. Over and above the effect this state of affairs had on customers, it placed unnecessary stress on the counter personnel.

This situation, together with the changes in demarcation, that now included Midrand into the City of Johannesburg, set the scene for major changes. The paper files were moved to Johannesburg, as the town planning function had now been centralized. For survival, the urgency of applying electronic technology was realized and planning started immediately.

5.3 Software solution

The Midrand Administration was in the fortunate position to have purchased the Alchemy information management software, which was at that stage utilized by the engineering department to retrieve engineering drawings. After preliminary investigation, it was realized that the capturing of the plans had been outsourced and that no knowledge of the software existed in-house except for viewing and retrieval purposes. The Alchemy manuals and the Information Management Resource Web site (www.imr.com) provided the necessary background to be able to evaluate the software as suitable for the purpose. Special attention was paid to the following criteria:

Unstructured data

The software was required to handle unstructured data, which were typically made up of many different types of files and formats, for example, paper, scanned images (TIFF files), Adobe Acrobat files (PDF files), ASCII files, text files and Microsoft Office documents. For future purposes it was useful to know that it could cater for AutoCAD files, video, audio and other binary files too. The current development of an XML-based portal server would furthermore extend the architecture to manage the Internet data types (e-mail with attachments and HTML files).

Entering items

Compatibility with the existing scanning device was required. Because of the volume of documents to be scanned and because amendment schemes consisted of several pages, it was important to be able to scan multiple page documents by a multiple page feed scanner.

Storing documents

Alchemy stores data in multiple databases, which can be set up for specific user groups. This was found to be a definite advantage as it limits risk by separating the databases while still maintaining centralized control. Security and views could thus be set up for the development application database and users. Within the database a hierarchy of folders could be set up, ideal for combining the various documents per application. Documents could be dragged and dropped within and between folders, new items could be added easily and items could be re-scanned if required.

Indexing and retrieval

Having the counter's searching requirements in mind, it was important to make provision for the quick retrieval of relevant documents. Although Alchemy provides full-text indexing, the nature of the documents (images) and user preference dictated the option of manual indexing. (OCR was not considered as an option.) Manual indexing allowed setting up a custom profile for each document or image according to user-defined fields. This was particularly important as searches were mostly done according to property descriptions (suburb, erf and portion). A 'comment' field was provided for notes and metadata. Each field was indexed and searchable according to a specific method, for example, full text, date range or numeric. Boolean searches were not provided for, which was not a problem as searches according to the various fields provided an alternative solution.

Database back-up and recovery

An efficient database back-up and recovery strategy was possible because of the straightforward file structure and file storage methods of the database.

Output

Screen outputs (views) were possible in thumbnail size but zooming into a document to any extent on the screen was also possible. Printing was possible at a paper size specified for the printer or plotter (fit to page) and tiling could be done, but printing parts of an image was not possible. E-mailing was catered for, while faxing of items was not a prerequisite and had not been tested yet.

System architecture

The information and the number of end-users would increase, so the system had to be scalable. Because the information had to be accessed and entered from different locations simultaneously, it was necessary to opt for a local area network (LAN) installation as depicted below in Figure 1. The Alchemy database was stored on a network server, with several searching stations connected to it. The scanning station was currently used for indexing and image editing, although it would be possible to separate these in future. The system administrator was the only one with access rights to design and build the database.

Figure 1 Alchemy system architecture

Alchemy
Database
on network
server

| Scanning station: Adding images to database | Indexing and image editing station: Profile documents, image quality control | Searching station: Search, view & retrieve | Searching station: Search, view & retrieve | Administrator station: Design & build database |
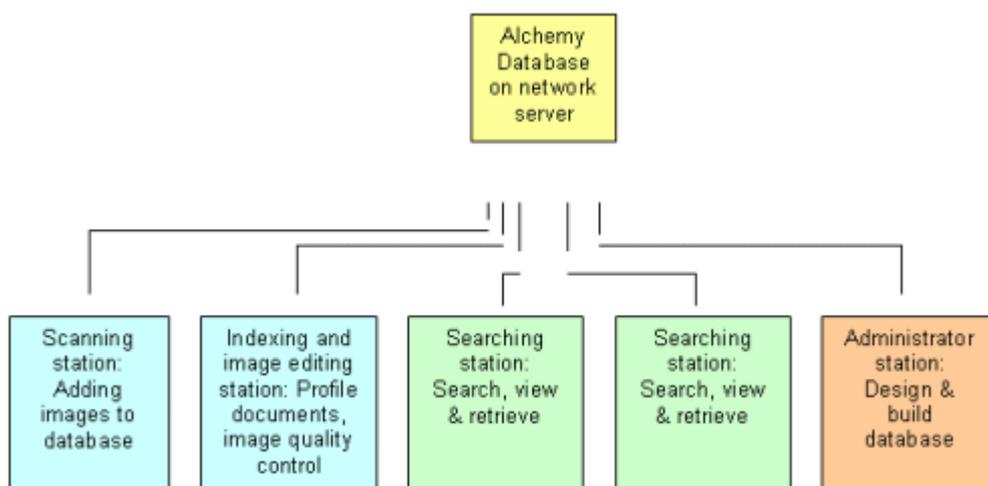
5.4 Project implementation

Implementation of the digitizing project required careful planning and included several steps:

Defining the scope

The first step was to define the scope of the project in order to establish the amount of file space required, the time it would take, the amount of human resources required and the costs involved. An option was to outsource the digitizing project to consultants, but preliminary costing indicated that this would exceed the available funds.

Project planning and allocation of resources

Against this background the project had to be planned by breaking it down into tasks, defining the linkages and sequences and allocating responsibilities to each task. The target date for completion of the project was determined by the physical move of the filing cabinets to Johannesburg. The biggest stumbling block turned out to be the setting up of the scanning station. Eventually it was discovered that the workflow software installed on that computer caused a conflict with the Alchemy scanning software. After more than a week's delay, and shifting blame from hardware to software and back, the problem was sorted out by bringing the parties together for testing both hardware and software. Eventually a separate computer was used to install Alchemy and run the scanning from there. The timing of the project allowed for the appointment of students for the scanning task. Another setback was encountered when the signing powers of the then acting Regional Director had not been formalized due to the new administrative structure. This caused a further delay, but the students were eventually appointed and the capturing process could start.

Designing procedures

Saving money by appointing students rather than consultants meant that the procedures had to be designed right up to the finest detail. The profiles of the documents were designed prior to their arrival and they served as intuitive input templates. The counter personnel were involved in the specifications for the templates to ensure retrieval optimization. The physical working environment and working procedures were refined as the students started with the scanning and indexing. The scanner was, for instance, moved to the right hand side of the computer as both students were right handed and could operate the scanner easier from this position. Because the files could not be taken out of circulation for a long period of time, copies were made. Taking out the staples of the documents and replacing them with paper

clips made the scanner procedure quicker. A 'entered' stamp was bought, which was used to stamp each page of the documents after they had been scanned. This turned out to be of tremendous assistance to minimize duplicate images. After the first few days the students had sorted out the flow of the procedure in such a way that the scanner was occupied full time. While one was taking out staples and making copies, the other one was scanning and indexing.

Training and quality control

Self-training was required to set up the database and profiles, but the manuals were comprehensive in this regard. The students were both computer literate, which turned out to be of essence due to limited time. Minimal training was required to master the software because of the user-friendly interface. The time spent on training them for indexing and the organizing of the files was well worth the effort as this ensured retrieval success, the ultimate purpose of the project. Quality control was built into the process by checking images at random and by doing spot checks on the indexing. Any irregularities were entered into the comment field of a specific item.

Building the database

After all items had been captured, a consultant was commissioned to 'build' the database, which (from the manuals) was quite complicated. In Alchemy, the building of the database sets all the parameters required for the search and retrieval functionality.

Preliminary testing

Once the database had been built, it was ready for preliminary testing at the counter. The counter personnel were at first a bit weary to use the electronic method and needed some encouragement, as they were afraid for failure in the presence of the customers. They gained confidence once they started 'practising' before and after counter hours. Fortunately they were motivated because they realized the urgency of their having to learn how to use the system. This preliminary testing served as a further quality control mechanism and several edits and changes were made.

Implementation

The final database was implemented at the counter and was successfully utilized to search and retrieve amendment schemes and promulgations. Value was added to this process by plotting all amendment schemes on a map. The counter personnel was able to query any property on the geographic information system (GIS), which visually displayed the extent of the amendment scheme. By retrieving the Amendment Scheme from the Alchemy database, the relevant detail of the restrictions was obtained.

The life cycle of the information in this case study is depicted in Figure 2.

Phase three was identified as being pivotal to the success of phase six. The publishing or screen output (publishing) becomes relevant in phase seven.

Figure 2 Information flow model

1. Creation of new image file

2. Image editing

3. Indexing and organising into folders

4. Storage in Alchemy Database

5. Customer information inquiry

6. Database search and item retrieval

7. Item output on screen and zoning certificate issued
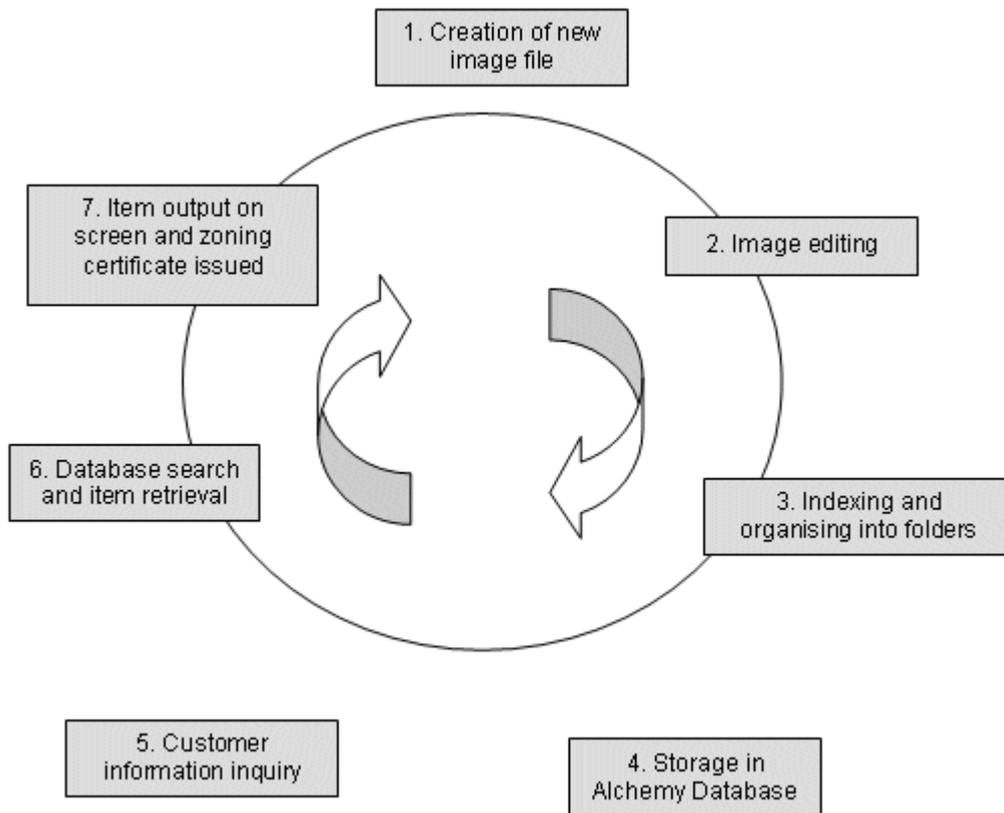
5.5 Recommendations

The digitizing of the mentioned items was part of larger processes, which needed to be converted to automated electronic workflow procedures. Such an automated workflow ensured that digitizing was integrated into the business process with consequent continuous maintenance and built-in control mechanisms. In future access from the intranet will improve efficiency.

6 Conclusion

The 'paperless office' in the strictest sense of the word as propagated during the 1980s is still not a reality. A mindset of producing paper output still prevails, although Internet technologies have made distributed printing or printing-on-demand a more desirable option.

It is concluded that the paperless office is more than just an effective output strategy. An organizational information management strategy is required to ensure that systems and expertise are in place at each stage of the information lifecycle to ensure effective utilization and availability of information. Finding a solution that manages the physical (paper) as well as the electronic distribution, storage, archiving and retrieving of electronic items are key ingredients for success (Mullin 2001).

Although document management and workflow automate processes for the paperless office, the information professional still has an important, albeit much broader, role to play. The information manager understands the internal and external environments of the organization, works across organizational boundaries and is part of the alliance between domain experts, information experts and IT experts. Before capturing or publishing, a judgement needs to be made on each item to evaluate the cost and benefit of storing or archiving and to determine what needs to be preserved or to be destroyed. Furthermore documents need to be evaluated

to assure reliability, the understanding or anticipating of user requirements and the tracking document utilization. The only difference is that in an automated document management system this will have to be addressed during the design or evaluation phase. As mentioned before, the indexing, searching and retrieval phases can become the weakest link in electronic document management if indexing does not receive the required professional attention. The information professional can play an important role as project manager for the projects and phases towards electronic transformation. This will include identifying the most suitable software packages, managing the digitization (capturing) of existing paper records and managing ancillary costs for implementation such as training for end-users.

Document management and automated workflow are paving the way for electronic transformation and a paperless working environment. The focus on business processes and their automation is preparing organizations for e-commerce in the new economy. It forces organizations to be customer orientated and to operate across organizational boundaries in cross-functional teams, ensuring competitive advantage. Real business integration remains a major challenge that needs to address the seamless integration of existing applications, documents, items, paper, voice and data into the electronic workplace, addressing electronic mail, fax and telephone. The role of the enterprise information portal in this regard should make for interesting research.

The effect of the paperless office on the publishing industry as a whole is proposed as further research topics.

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