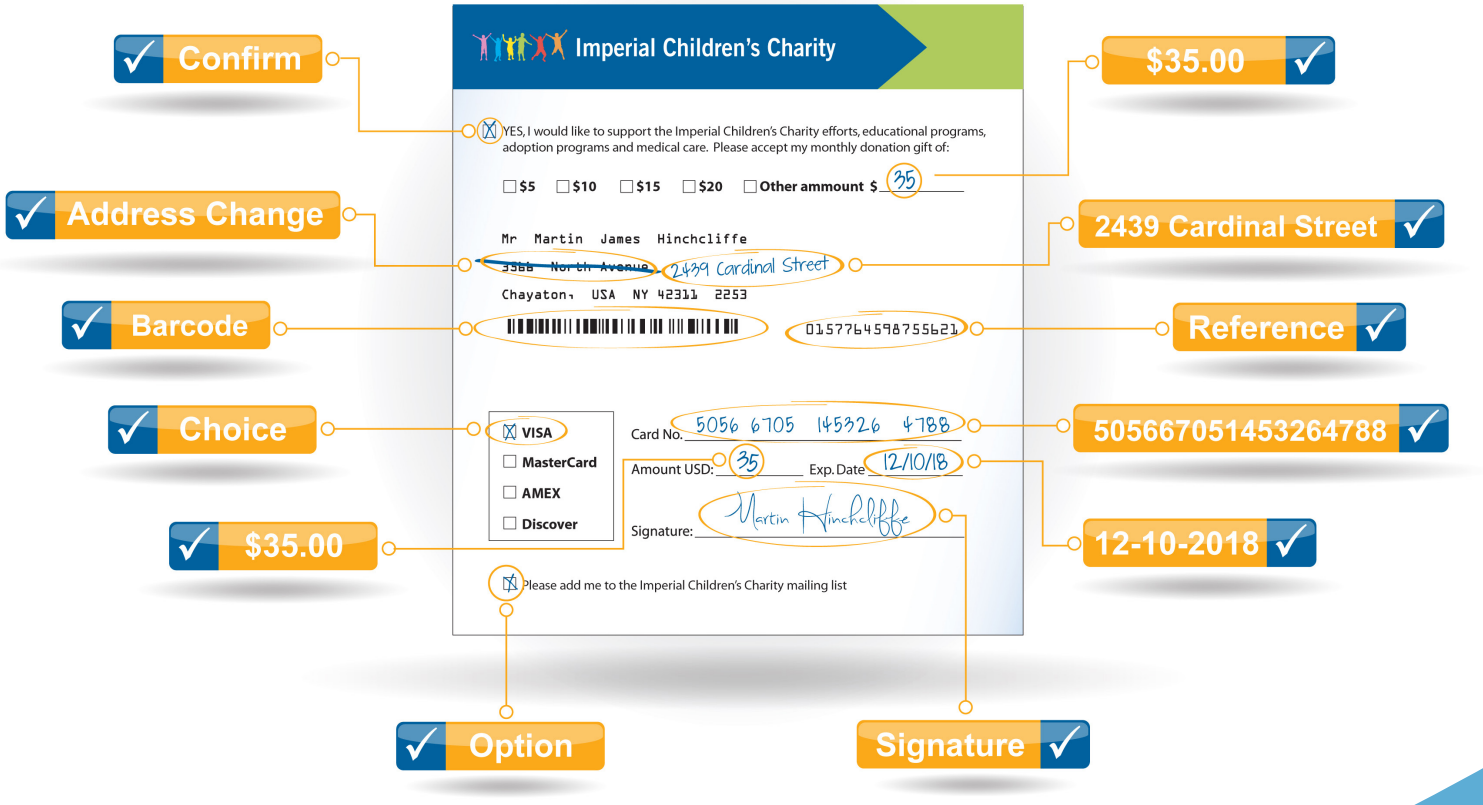

Shedding light on the dark data in your document capture processes

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Process used and survey demographics

The survey results quoted in this report are taken from a survey carried out between 14 February 2013 and 03 March 2014, with 385 responses from individual members of the AIIM community surveyed using a Web-based tool. Invitations to take the survey were sent via email to a selection of AIIM's 80,000 registered individuals. Two-thirds of respondents are from North America, 19% from Europe, and 12% from elsewhere. They cover a representative spread of industry and government sectors. Results from organizations of less than 10 employees and suppliers of ECM products and services have not been included, bringing the total respondents to 267. Full demographics are given in Appendix 1.

About AIIM

AIIM has been an advocate and supporter of information professionals for nearly 70 years. The association mission is to ensure that information professionals understand the current and future challenges of managing information assets in an era of social, mobile, cloud and big data. AIIM builds on a strong heritage of research and member service. Today, AIIM is a global, non-profit organization that provides independent research, education and certification programs to information professionals. AIIM represents the entire information management community: practitioners, technology suppliers, integrators and consultants. AIIM runs a series of training programs, including the BPM Certificate course. www.aiim.org/training/BPM-Business-Process-Management-Course

About the author

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Introduction

"If I could get the computer to see what I see when I read, and collect, and collate, and check, and bundle documents ready for processing or filing, we could get things done in half the time – and the computer would probably make less mistakes than I do!" This is the next challenge for process automation. Recognizing forms content is a big part of it, but extracting text from documents and forms for indexing, validating signatures, removing or obscuring personal information, checking for completeness, and sorting to the right order are more complex tasks that need a much more flexible approach.

In legal discovery, it may be a check for hand annotations on contracts, or specific signatures on letters. In healthcare it might be detecting and redacting data for HIPAA compliance. In financial services it could be checking for completeness of new account forms and for signatures on compliance statements. In consumer goods it could be content extraction from inbound correspondence for automated indexing and prioritization. In pharmaceuticals it might be validating signatures against authorized professionals. For a utility or telecom company, it might be the ability to log comments collected in the field shedding light on otherwise "dark content", tagging and enabling it for big data analytics.

What all of these things have in common is that humans can easily grasp what needs to be done, but are not very consistent at doing it, whereas for computers, it has traditionally taken a long time to train them what to do, but once trained, they can perform quickly and accurately. In the past, however, recognizing text, particularly handwritten text and signatures, has not been quite that simple.

Multi-core processors and huge amounts of RAM have greatly improved the capabilities of intelligent text recognition. If this can be combined with the intelligent deduction of how to handle a document as a result of its shape, layout, content, and context, then process automation can take a huge leap forward.

In this report, we look at user experiences of content recognition from documents and forms, and find out what higher levels of intelligent processing they are currently using, might be considering, or may not even have thought possible.

Key Findings

- **Of the 73% survey respondents who scan forms, only half do text recognition.** A quarter only scan to archive, and the remaining quarter workflow scanned images but manually re-key the data.
- **Since 2012, use of captured text for archive indexing has grown from 64% to 87% (of those who do use text recognition). Use for routing has risen from 59% to 66%, and full forms capture to process has doubled from 19% to 37%.** Data capture to AP/AR financial processes is up from 32% to 40%.
- **Among the most likely reasons for not using recognition are too many types of forms, and not enough critical mass.** This is mostly due to localized decision-making within business units.
- **For 40%, half or more of inbound forms have handwritten data fields.** For 29% half or more of their forms have hand-written free text or open-ended data fields and 55% have signatures on half or more of their forms.
- **Hand-written fields and notes "play a key role" for 22%,** and are "quite important" for a further 45%.
- **37% have never assessed ICR (handwriting recognition) compared to 12% who have never assessed OCR (machine print recognition).** Only 43% have assessed ICR performance in the past 2 years.
- **12% use ICR to recognize hand-printed constrained field entries.** 6% use ICR to recognize hand-written script and free-form entries.
- **For all respondents, an average productivity improvement of 31% was considered likely if recognition of hand-written text could be automated.** 28% of respondents would expect a 50% or more improvement. For current ICR users, the average rises to 37.5%.
- **35% of ICR users report a payback period of 12 months or less.** 55% see ROI within 18 months.
- **44% would find it extremely or very useful to recognize hand-written keywords on open-ended form fields, or on business documents, for use in tagging or metadata correction.** Routing and workflow, and legal discovery are also key applications.
- **25% have processes that require signatures to be matched and verified.** For 45% it would be extremely or very useful to automatically match signatures on contracts and purchase agreements, and also to flag up amendments or hand-written notes.

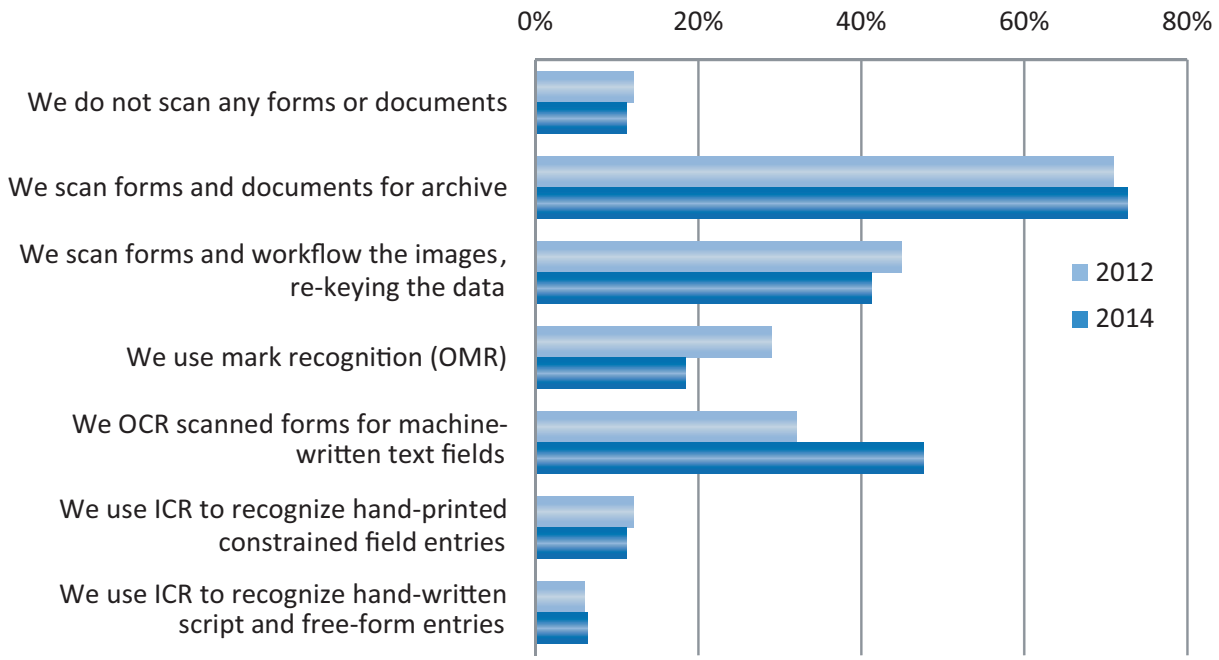
Capture Characteristics

Nearly 90% of the organizations responding to our survey do some scanning of the forms and related documents coming into the business. This has changed very little since our previous survey in February 2012. What happens to the scanned image varies considerably in different organizations, and indeed in different parts of the organization. Most organizations will scan some documents purely for archive, generally as a way to remain compliant. The step beyond that is to workflow the electronic image of the form or document through the appropriate process, re-keying the data as required into a database or a transactional system. There has been little change here since 2012.

To speed up this process and provide varying degrees of automation, there are 3 levels of data recognition that can be applied. At the basic level, optical mark recognition (OMR) will recognise simple check-boxes. Barcode recognition is generally included in this category, and is often used to recognize pre-printed form types. The next level up is conversion of images to text using optical character recognition (OCR), which will seek to match individual characters against image templates, and works well on machine-written text. Beyond that is intelligent character recognition (ICR) which parameterizes the character shape and style, as well as the context with adjacent characters, and is used for hand-printed field entries (constrained hand-print) and in some cases, freehand script.

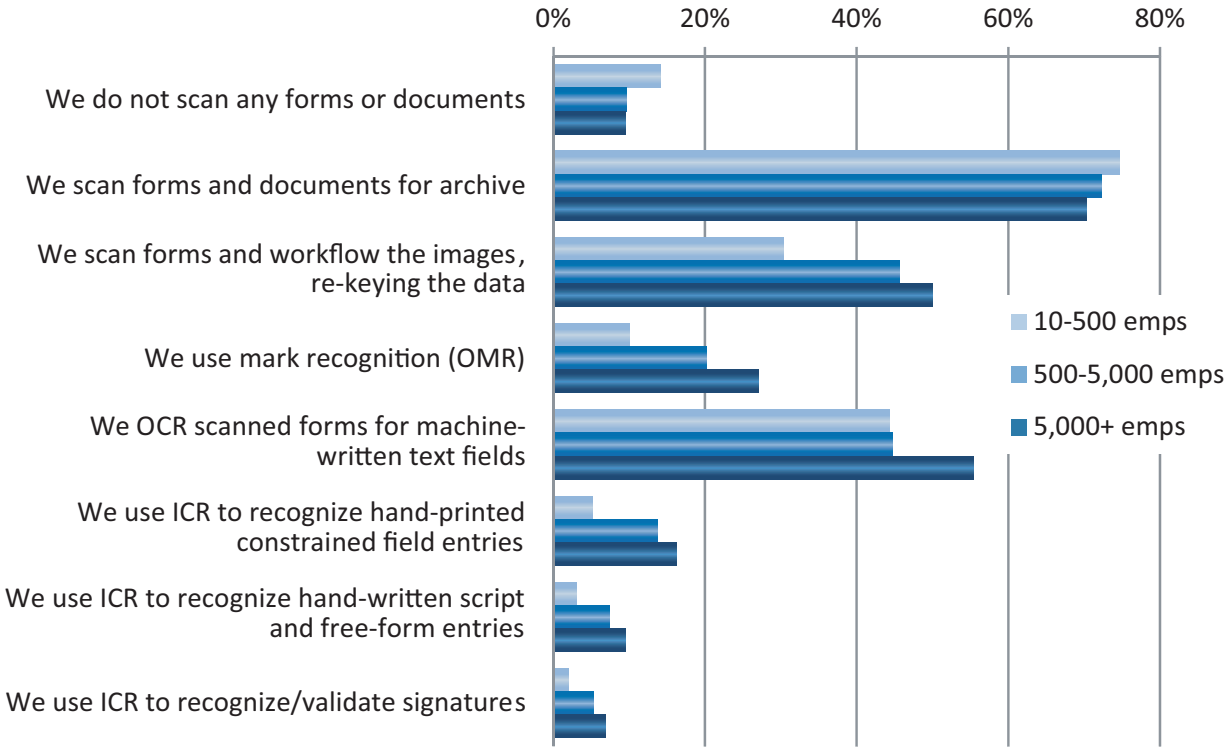
We can see from Figure 1 that in the last two years many users have moved on from basic mark recognition, and the use of OCR has increased somewhat from 32% to 48%. As we will see later, hand-print recognition offers further opportunities for those organizations to take the next step beyond OCR.

Figure 1: How do you pre-process forms coming into your business unit, or generated within it? (Check all that apply, including outsourced services) *(N=267)*



Breaking down this question by company size (Figure 2) indicates that price drops in the cost of recognition technology have encouraged small and mid-sized businesses to adopt OCR, perhaps as a first step, rather than going through the progression of image-only workflows and mark recognition. The availability of packaged invoice processing (AP) solutions may have had an effect here. It is notable that smaller businesses have been much slower to move to the next level of hand-print recognition.

Figure 2: How do you pre-process forms coming into your business unit, or generated within it? (Check all that apply, including outsourced services) *(N=267)*

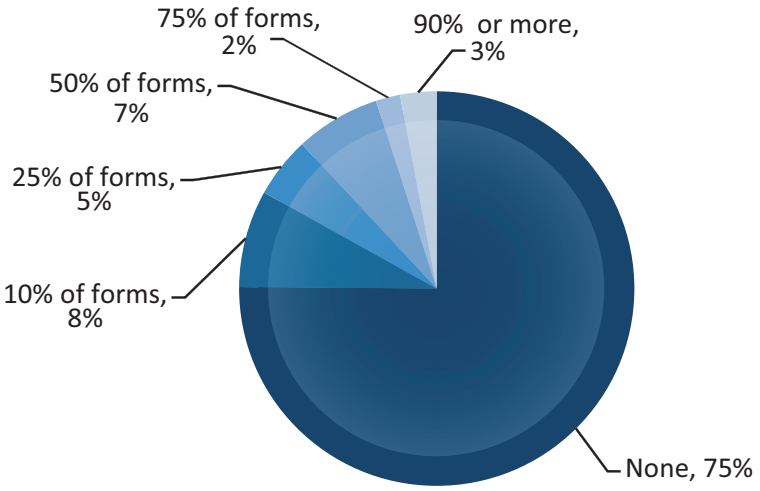


Forms throughput and outsourcing

When it comes to the overall volume of forms processed per day, this varies dramatically amongst our respondents. A third process less than 50 forms per day, but 54% are processing over 100 forms and 29% over 1,000 forms daily, including 11% of smaller businesses. Of the largest businesses 22% process over 10,000 forms per day – a huge commitment of labor if considerable amounts of data need to be keyed-in from each form.

Overall, a quarter of our respondents outsource some of their forms processing – 15% of the smallest and 38% of the largest. 12% outsource half or more.

Figure 3: What percentage of your forms throughput do you outsource? *(N=221)*



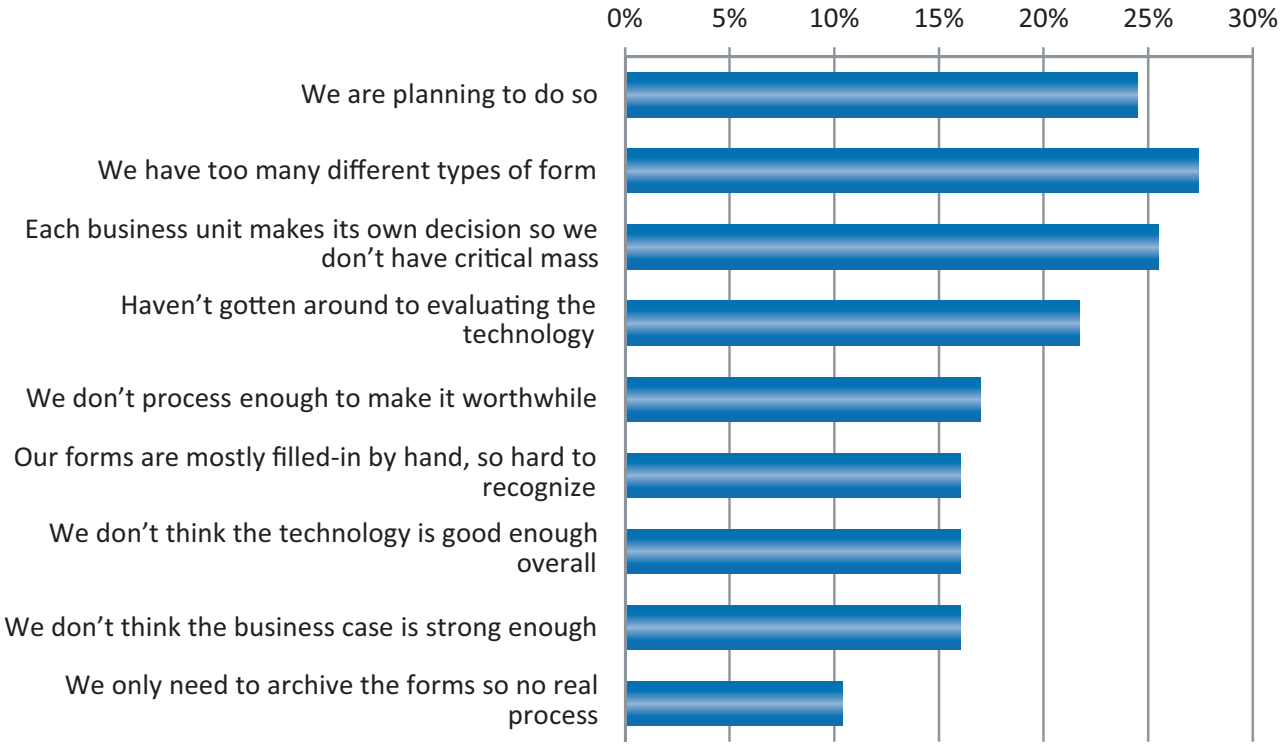
Non-adopters – recognition

The main reason given for not adopting recognition is a view that there are too many different types of forms in use across the business. With the availability of automated form detection and layout training, this may not actually be an issue, and in fact, during most implementations, a simple analysis exercise will often produce a significant consolidation in the number of unique in-house generated form layouts. With a modern system, multiple form types can then be fed from the scanner in a mixed feed, and the capture software will automatically separate and detect each form-type and its layout, and use the correct template to find the fields.

Localized decision-making within individual departments and processes will fail to exploit the throughput numbers that could be pooled, reducing the amortization on investment compared to a central facility.

Hand-written form entries is given as an issue, and some have doubts about the capability of the technology, but we will also see that many have not evaluated the technology recently – if ever.

Figure 4: What are the two main reasons that you do not use recognition technologies to capture forms data? *(N=123 non-recognition users)*

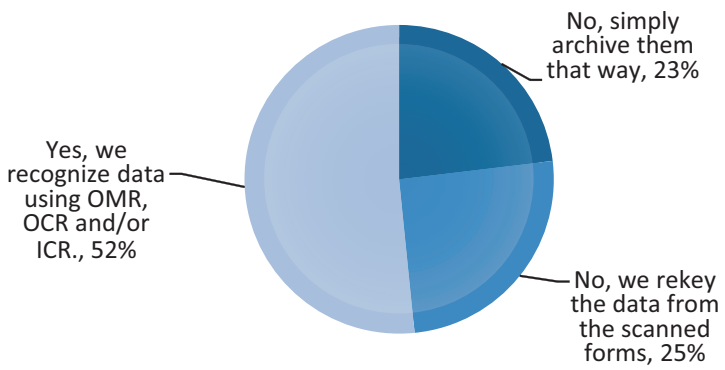


Utilizing Captured Data

As we suggested earlier, only half (52%) of those who scan inbound forms go on to capture and recognize data from them. The other half are split, with 25% manually re-keying the content, and 23% simply archiving them as they are. Since our previous survey, smaller organizations have caught up somewhat, with 49% using recognition compared to 54% of the largest.

This is not to ignore the fact that some forms, such as a healthcare consent form, for example, might only contain the name of the patient, their signature, and the date, and yet the completed form is a vital part of the compliance procedure. However, recognition of the patient's name, or better still their healthcare ID, would allow the records filing to be automated, and as we will see later, checking that it has indeed been signed could be an automated part of the pre-treatment workflow.

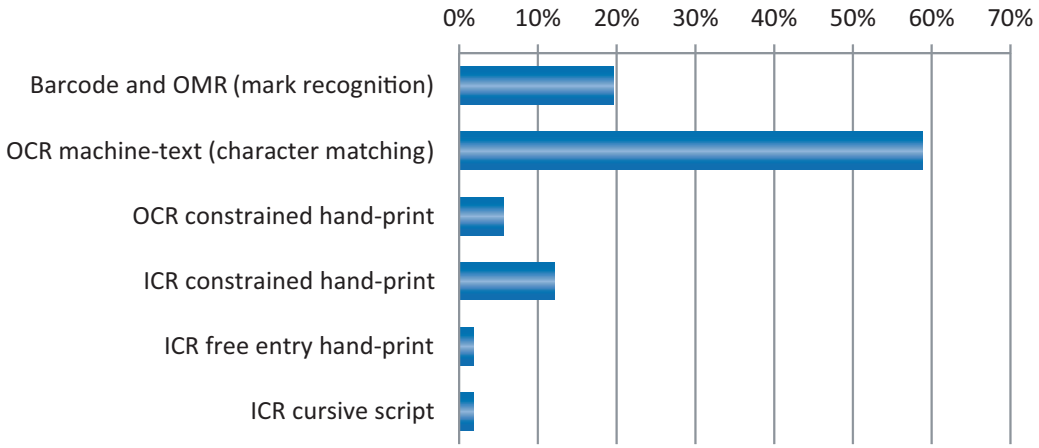
Figure 5: Do you capture data from your scanned forms?
(N=255 who scan)



Highest level of recognition used

Traditional OCR of machine text using character-matching techniques is by far the most popular method in use. Along with the much simpler optical mark or barcode recognition, this is the highest level of sophistication for nearly 80% of our recognition users. 22% are recognizing hand-writing in some form, mostly as constrained hand-print where the person filling out the form needs to keep within a box or marker for each character. 6% are utilizing un-constrained hand-writing recognition and/or cursive script, which tends to be much more challenging for the recognition software.

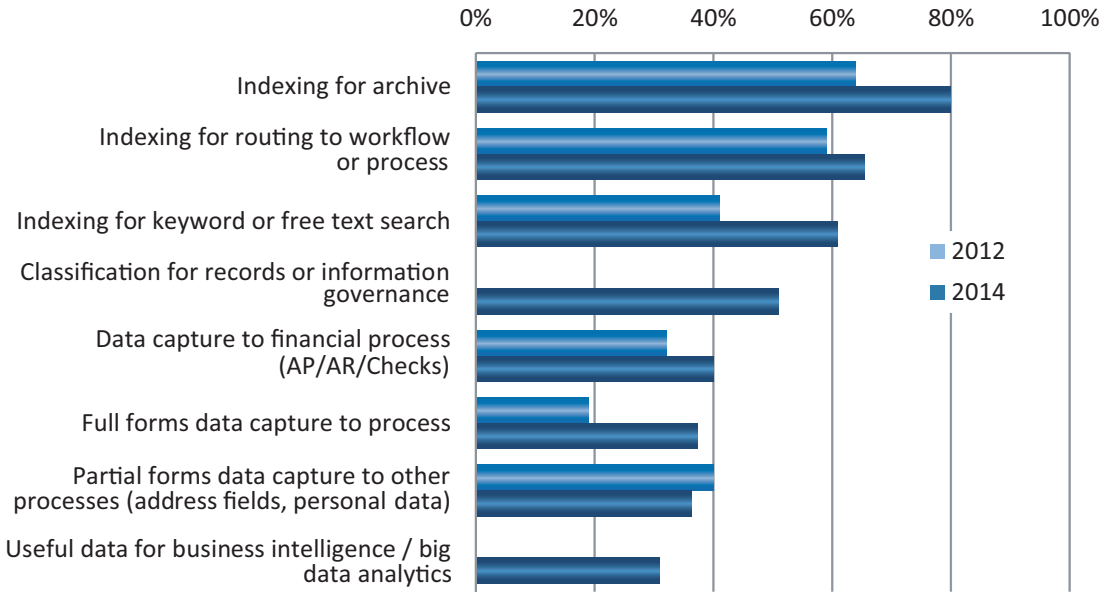
Figure 6: What is the highest level of recognition that you regularly use?
(N=112 who capture)



Use of captured data

Figure 7 shows that the utilization of captured data has grown considerably since our 2012 survey. This is particularly true of full forms data capture which has doubled from 19% of recognition users to 37%, but all applications have increased, and we have also measured two new applications this time: information governance and Big Data.

Figure 7: What uses do you make of captured data?
(N=110 using recognition. IG and Big Data not asked in 2012.)



Each of these applications is worth some comment and explanation:

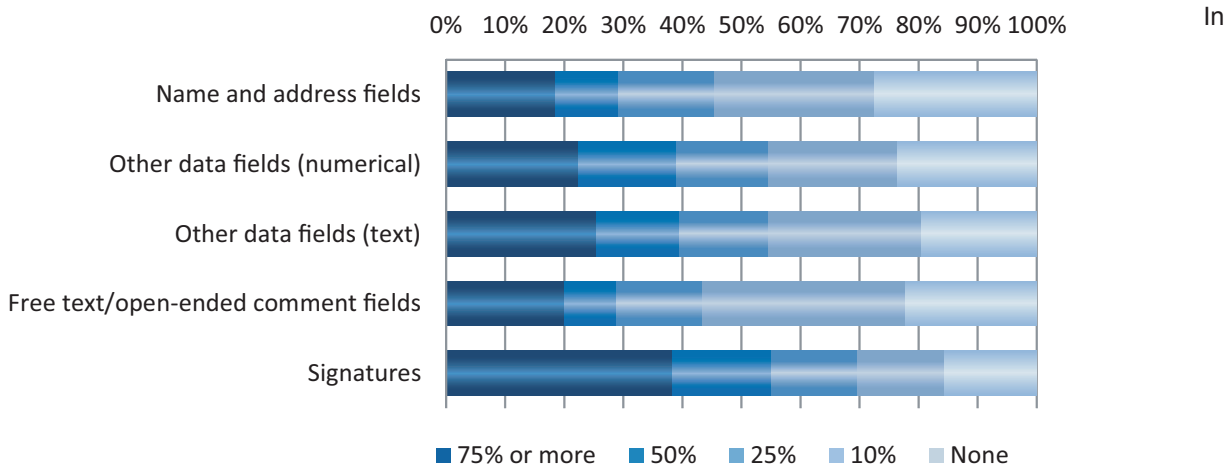
- Records managers are increasingly coming round to the idea that computers can be as accurate as humans in classifying content for records purposes, and they would certainly agree that they are more consistent.
- A similar classification technique can be applied to route inbound scanned documents to the appropriate process, particularly where a digital mailroom scan-at-the-door approach is used. This speeds up customer response and reduces physical mail sorting and transporting.
- Free-text search technology has been around for a while, relying on an approximate conversion of the text within a document to index and find it, and then displaying the image for confirmation. Indexing for keywords requires a more reliable conversion, but this is now becoming more sophisticated, using context aware analytics to more precisely tag content and update metadata. This is a key enabler for governance.
- Information governance extends control of a document across its whole lifecycle, both active and as a record. Security is key and captured data can be used to identify sensitivities in the document. Detection of personally identifiable information (PII) such as social-security numbers or credit card numbers will affect the security rating, and these can be automatically redacted if required.
- Capture to financial process, particularly capturing inbound invoices into the accounts payable (AP) process has been a very popular application for OCR recognition, speeding up processing, and potentially providing a “hands-off” matching and payment process. Validation of captured data against the transactional detail stored in the finance system is an important part of this process.
- Forms are fundamental to many business processes, particularly customer on-boarding, account opening and claims handling. Automated extraction of the contents of application forms is a huge productivity saver, although, of course, many of these forms are likely to be filled in by hand. Sorting and tallying forms and mandatory supporting documents into a case folder, and verifying completeness, can make a vital contribution to compliance.
- Organizations are coming to realize that no matter how sophisticated their analytics and big data capability is, if the content that needs to be analyzed resides on paper, it’s simply not going to be possible.

Hand-Writing Recognition

As mentioned above, the limit for many businesses in their use of capture will be reached too early if they confine their recognition to machine-text. Although PDF forms and web forms have much improved things, the majority of paper forms are filled in by hand – in fact in the business-to-business area, the passing of the typewriter has made this worse! The legacy requirement in many businesses for wet-ink signatures simply adds to the prevalence of paper-based, hand-written forms. 55% of responding organizations estimate that half or more of their forms have signature fields.

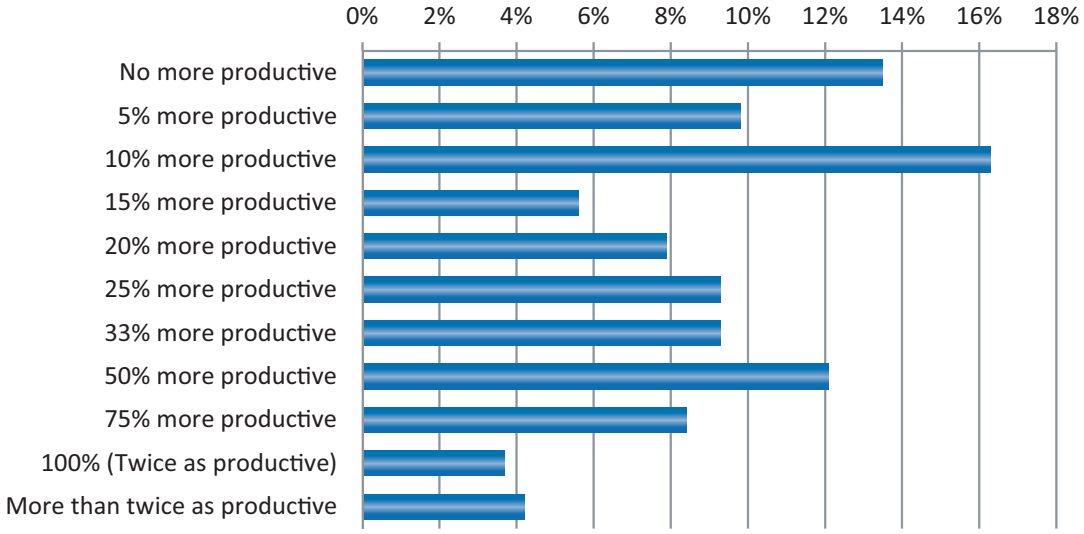
Forms are generally littered with other hand-written fields for name and address, numerical and text data, and for 29%, half or more of their forms contain free text or open-ended comment fields – which are often the most crucial as regards customer satisfaction, previous histories, extenuating circumstances, etc., and would represent key inputs to many analytics projects.

Figure 8: How many of the forms processed by your business unit (or outsource) would you say have hand-written fields for: *(N=218, normalized for Don't Know)*



fact, when we asked respondents how important the contents of handwritten form fields and notes are to the efficiency of the business process, 22% feel they play a key role, and a further 45% feel they are quite important. Asked to measure the potential productivity gains from automating recognition of hand-written fields, our respondents overall estimated an average productivity improvement of 31%, with a median of 21%. Overall, 28% of respondents would estimate a productivity improvement of 50% or more. When filtered to reflect the experience of current users of ICR, the average rose to 37.5% and the median to 32%.

Figure 9: How much more productive would you estimate that your admin staff would be (or are) if you could automate (or have automated) the recognition of hand-written text? *(N=215)*

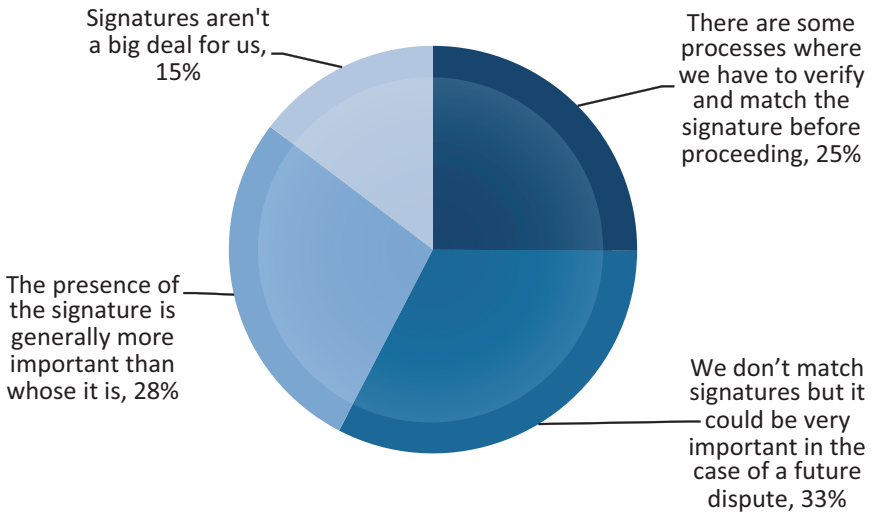


Signatures, Keywords and Annotations

Signatures crop up whenever paper-free processes occur, and in a true all-electronic world we would all have our own digital signatures with which to sign electronic documents, with no need to print them out, sign them, and then scan them back in. Pragmatically, this is not the case, and the "wet ink signature" is a strong element of any approval or compliance process. Having said that, for many business applications it is the presence of a signature that is important to downstream workflows as much as a need to actually verify that the signature is that of the signee.

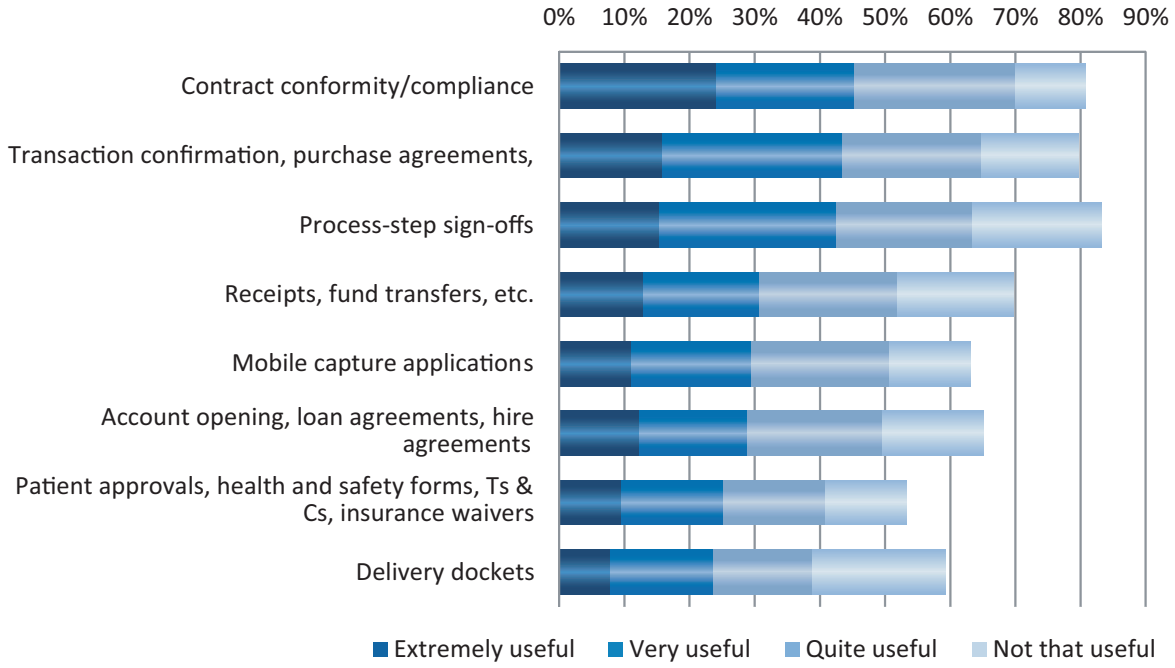
So looking at the generalized picture, 25% of our respondents have some processes where they need to verify and match the signature before proceeding – and this would apply in a host of medical, financial and mission-critical situations. A further 33% acknowledge that they don't actually match the signature as part of the process workflow, but it could be important to know who signed the form or document in the case of a future dispute. In a further 28%, the process needs to know that a signature has been placed on a form or contract, but it is not so important to verify whose signature it is.

Figure 10: For the signature requirements in your business unit, which of the following would generally apply? *(N=231)*



So if we turn that around, and say that, with signature recognition and verification, we could automatically match a signature, how useful would that be? 45% said extremely or very useful for contracts and purchases, and 42% for process sign-offs. There was also a strong interest in using mobile capture applications in order to collect and verify signatures. Other applications suggested included security access and legal discovery.

Figure 11: If you could check the presence of a signature and automatically match it for verification, how useful would it be for the following? *(N=227)*

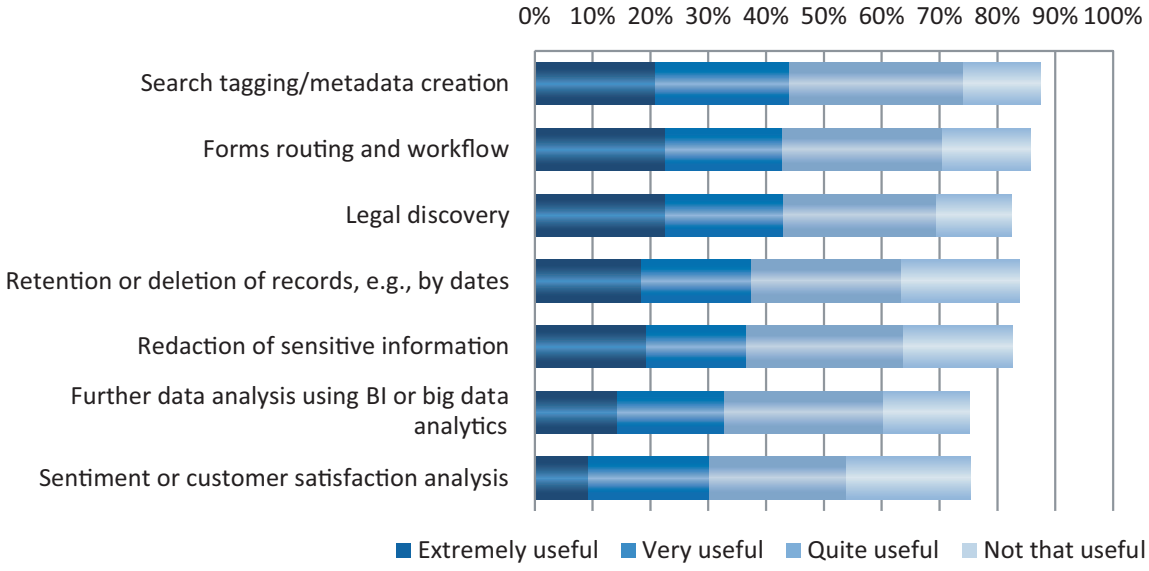


Keywords

Looking for keyword matches in hand-written reports or notes, or within open-ended form fields, is a simpler task than converting whole sentences, although the sentence context may be used to confirm the keyword (eg, "my name is…" or "the patient has presented with…" Again, search tagging and workflow routing show up as key applications, but legal discovery also comes in, and around that is the issue of defensible disposition where records, and indeed other non-essential content, can be deleted in a compliant manner.

A much more straightforward application is the redaction of sensitive information. In an era of open government and public audit, this can be important, but also within the organization it can be prudent to obscure private or financially useful information once the core process has taken place. Finally, customer sentiment analysis is one branch of big data analytics that often relies on simple feedback forms, or hand-written correspondence. On an individual basis it can expedite a more graded response, and in aggregate it can point to trends and patterns, or potential brand problems. Looking for specific keywords that express positive or negative sentiment, and grading the document accordingly, can head-off problems very quickly.

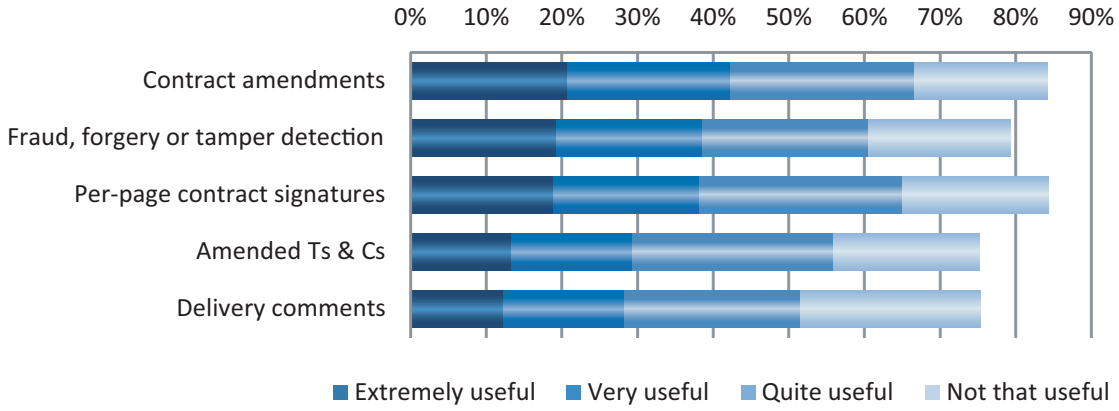
Figure 12: If you could recognize or spot hand-written keywords within open-ended form fields or on business documents, how useful would it be for the following? *(N=277)*



Hand-written annotations

Another quite specific application of hand-writing recognition is detecting the presence of hand-amendments and annotations. Practice here can vary between industry sectors and from country to country. In some countries signatures or initials are placed on each contract page. In others stamps or initials are used to confirm that the document has been read. Amendments to contracts, particularly terms and conditions need to be detected and dealt with as they can cause considerable harm to a legal case further down the track. It may simply be small suggestions for change hidden in multi-page documents or across large paper drawings that must be updated accordingly. Tamper detection for fraud or forgery is another area where recognition technology of the type used for hand-writing recognition can be brought to bear to prevent fraud.

Figure 13: If you could recognize the presence of annotations and hand-amendments across a form or page, how useful would it be for the following? *(N=223)*

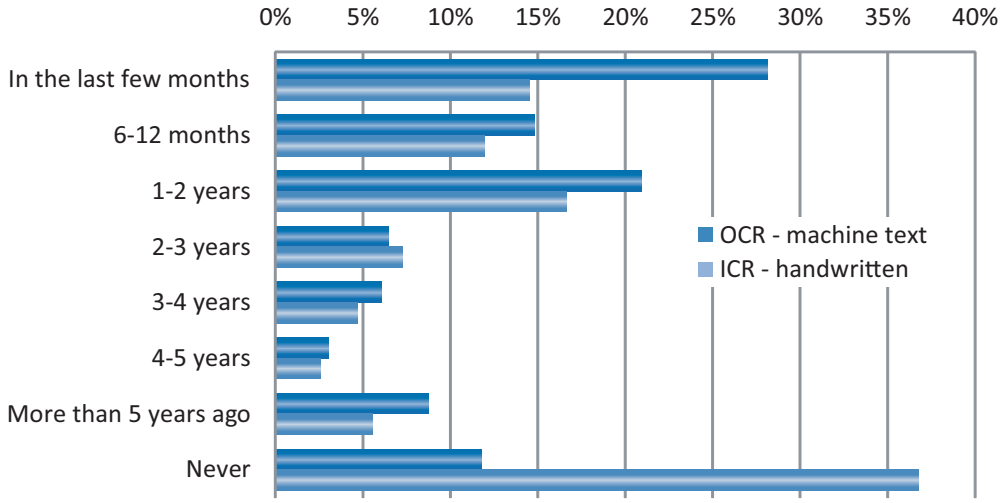


OCR/ICR Products

OCR and particularly ICR is a compute-intensive application, and is often centralized in dedicated servers. Modern scanners, meanwhile, have integral clean-up and compression, and can feed into networks or clouds with orders of magnitude higher bandwidth than we have had in the past. A distributed capture and recognition network is now a reality, encompassing digital mailrooms, process production scanners, branch-office MFPs, desktop scanners, and even mobile devices. These can connect back to a centralized capture server for recognition, which can then immediately feed back to the user that the data has been verified, and the appropriate process initiated.

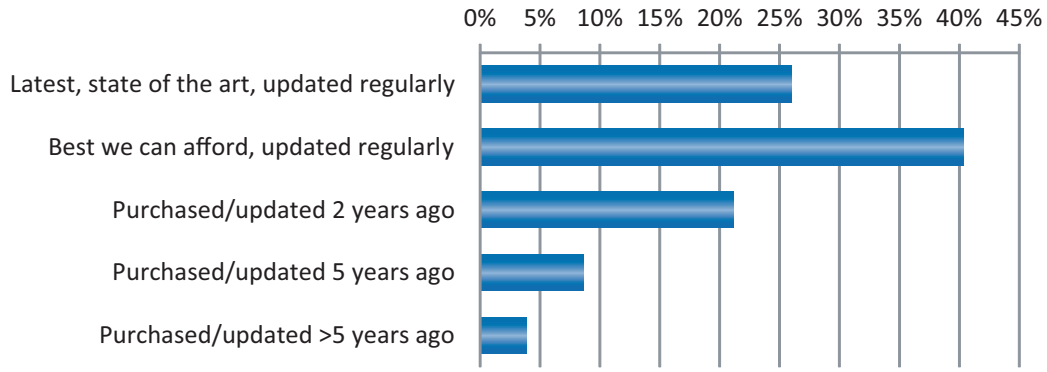
The affordability of sophisticated OCR and in particular ICR software has, therefore, never been better – but these products are in a state of constant improvement, so it's important to keep up to date with changes. As we can see in Figure 14, 37% of our survey admitted to never having evaluated ICR handwriting recognition, and a further 21% haven't taken a look in the last two years.

Fig 14: When did you last assess the latest technologies for text recognition?



When it comes to the actual software in use – albeit mostly OCR – 66% of users feel they are up-to-date, although 40% admit that they may not be using the most sophisticated product on the market. A third have not updated their software for over 2 years.

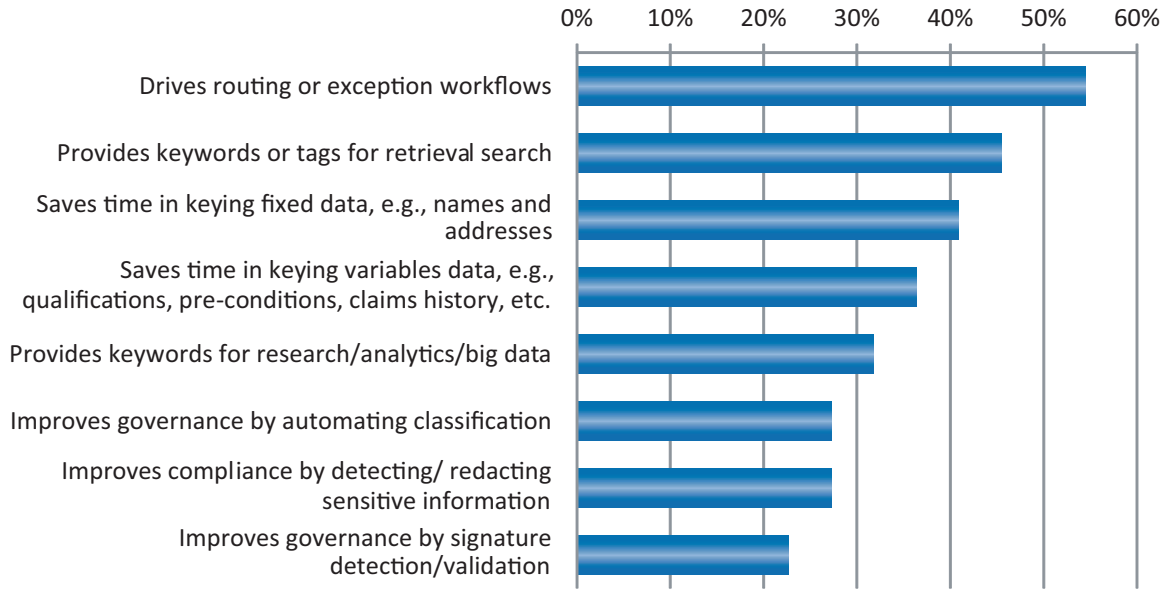
Figure 15: How up to date is your recognition software? *(N=112 capture users)*



Benefits seen by ICR users

Driving routing and workflow is the most quoted benefit for users of hand-writing technology, automating that initial journey into the organization and directing the form or document to the correct process. Providing keywords or tags for search is the next biggest benefit – coming higher than the productivity savings from not having to key in things like name and address fields. 32% of the respondents can also see the benefit of recognizing keywords for research and big data analytics. Finally, information governance and the protection of sensitive or private information is beneficial for a quarter of users, including the ability to detect and verify signatures.

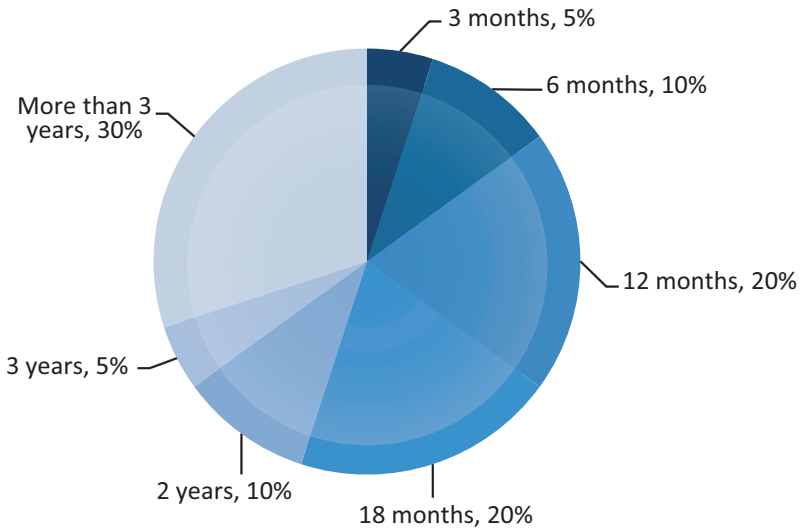
Figure 17: What are the main benefits you get from hand-writing recognition? (check those that apply) *(N=22 users)*



ROI for ICR

We have always measured strong ROI from any investment in capture and recognition. In this instance we were quite specific in only including ICR/handwriting recognition users. The fact that 35% have seen a payback period of 12 months, and 55% have achieved payback within 18 months suggests that ICR is working well for most. It is a relatively sophisticated technology, and there is a tail of those looking at a much longer payback. This perhaps stresses the importance of doing a careful evaluation up front of more than one recognition engine, and testing with a good range of typical material from your own business processes.

Figure 18: What would you say has been (or is likely to be) the payback period for your investment in ICR/handwriting recognition? *(N=20 ICR users)*



Conclusion and Recommendations

Until such time as we are all equipped with tablets and e-forms, or within easy reach of an always-on computer, paper forms will be the backbone of information gathering and process input. Scanning forms for archiving or image workflow is a widely accepted way of reducing storage space, improving access and speeding up processes. Beyond that, the use of recognition technologies for full-forms data capture has doubled since our last survey two years ago, replacing manual data-keying with OCR, and automatically transferring data into the routing or indexing engine, or better still, into the process itself. It is generally acknowledged that the accuracy of OCR on machine text will usually be higher and more consistent than human re-keying.

We found that hand-written address, data and free-format fields play an important role in most business processes – and an increasing one as organizations seek to exploit the “big data” they may contain. We also found that a significant proportion of business forms, no matter how well designed, still contain a significant number of hand-written field entries, as well as the inevitable signature box.

Although users admit to the potential benefits of hand-writing recognition in terms of a substantial improvement in process efficiency of around 30%, there is a level of both perception and complacency that is based on out-of-date evaluations of how well a modern ICR hand-writing recognition system can work – and indeed how much it might cost when used as part of a modern distributed capture network.

Over and above the capture of field content, there are a number of recognition applications that involve hand-writing, such as checking the presence of signatures, and matching signatures for approval processes. Information governance for privacy and records retention can be triggered by specific keywords, and sensitive content can be automatically redacted. Initials, hand-written notes, text amendments and tampering can all be important to the process, especially if they can be automatically detected and process staff alerted.

Recommendations

- Ensure that there is a clear responsibility in your organization for pursuing paper-free processes. Consult with process owners to consolidate requirements, particularly if a digital mailroom solution serving multiple business processes might be appropriate.
- If you are scanning forms but not capturing data through OCR, evaluate savings in keying costs, speed improvements, and quality of data.
- Do not assume that you do not have sufficient forms to be cost-effective, nor that you have too many different types of form. Centralizing all mail processing can change the tipping point, and the cost/performance ratio of OCR/ICR technology has dramatically improved over the last few years.
- If the prevalence of hand-written fields on your forms has put you off automating your capture, or if you are currently using OCR for partial capture and ignoring valuable hand-written content, take a fresh look at hand-writing recognition and the latest ICR capabilities.
- Collect a number of examples of both typical and demanding forms, with mixtures of machine text and hand-writing, and have different capture vendors show how well they can capture the data. Be prepared to provide supporting data for look-up and validation. Ask about mixed feeding of form types.
- If you are using a bureau or DPO outsource, ask them if they have an up-to-date ICR capability that could further improve the level of capture they offer. If you are a bureau or DPO outsource, have you geared up your capabilities to offer the maximum value-add as far into the process as possible?
- Are there certain keywords or formats in documents that would be easier to recognize than general hand-written text? If so, look to extract them for indexing and search. Also consider using them for routing, security classification and governance. Automated redaction of personally identifiable information or sensitive financial data could considerably reduce security risks.
- When considering advanced analytics or big data, does some of your vital source data reside on paper documents or forms – in particular in free-form text fields such as feedback boxes or qualifying comments? Relying on human transcription is unlikely to be cost-effective.
- Think more widely about hand-written elements of documents in general – signatures, notes, amendments, alterations. To what extent could workflow approvals be automated? Could process staff be alerted to problems, omissions and amendments? Is there a potential fraud-prevention or legal discovery element?

References

1 “ECM at the Crossroads”, AIIM Industry Watch, April 2013, www.aiim.org/research

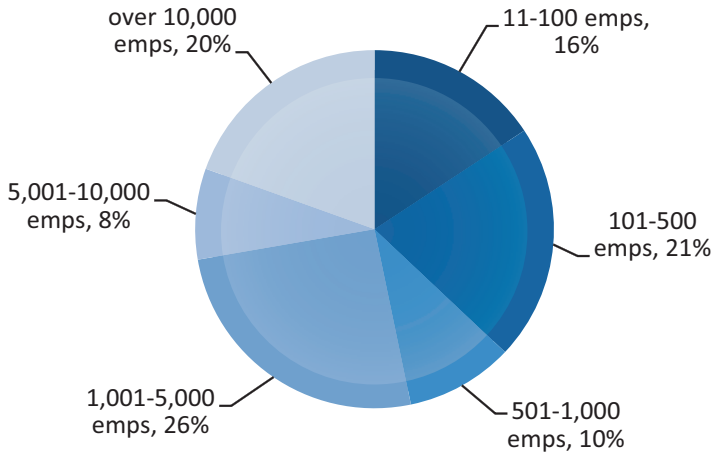
Appendix 1: Survey Demographics

Survey Background

The survey was taken by 267 individual members of the AIIM community between 14 February and 03 March 2014 using a web-based tool. Invitations to take the survey were sent via email to a selection of the 80,000+ AIIM community members

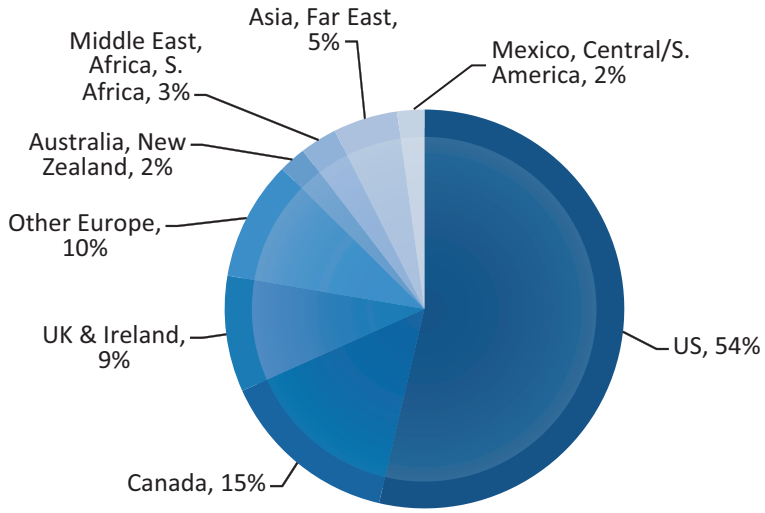
Organizational Size

Organizations of 10 employees or less and suppliers of ECM products or services are excluded from all of the results in this report. On this basis, larger organizations (over 5,000 employees) represent 28%, with mid-sized organizations (500 to 5,000 employees) at 36%. Small-to-mid sized organizations (10 to 500 employees) represent 37%.



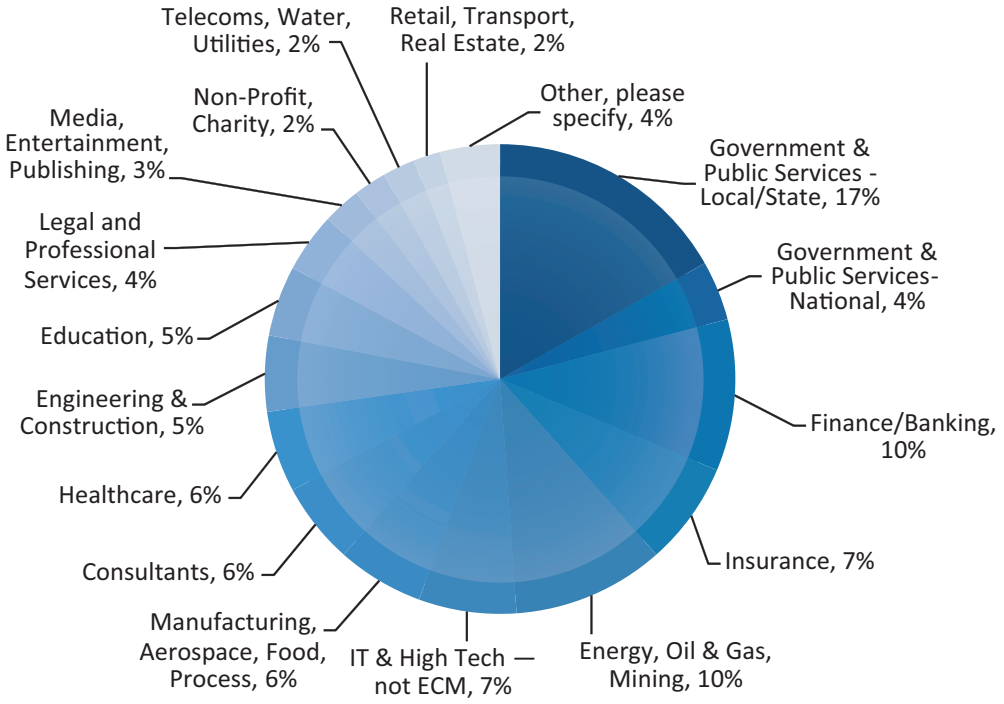
Geography

US and Canada make up 69% of respondents, with 19% from Europe and 12% elsewhere.



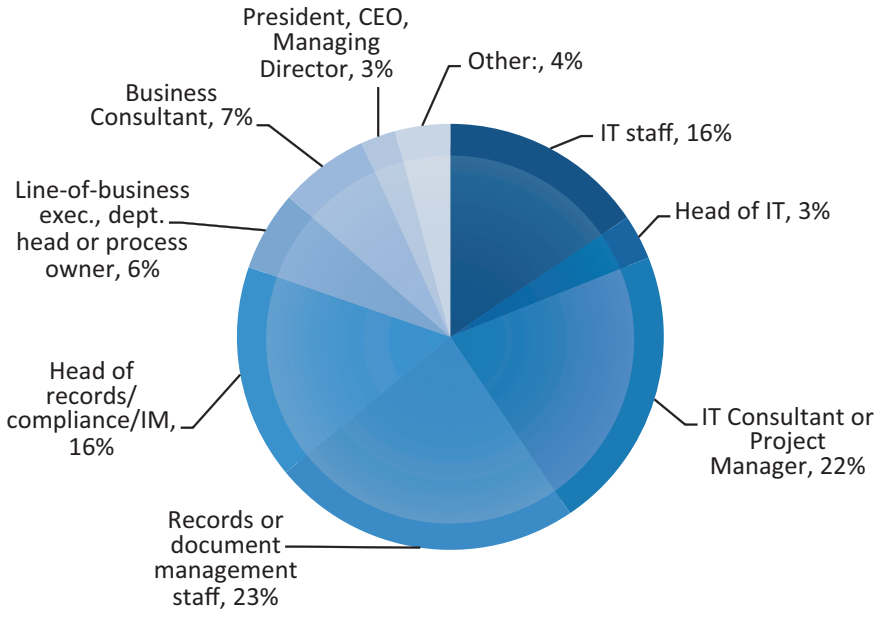
Industry Sector

National and local government, and public services, represent 21%. Finance, banking and insurance represent 17%. ECM suppliers and outsource bureaus have been excluded. The remaining sectors are evenly split.



Job Role

Records or Information Management disciplines make up 39% compared to 41% from IT. Line of business managers and business consultants make up 20%.



Appendix 2: Open ended comments (selective):

"Do you have any general comments to make about your document processing projects?"

- I see a lot of value for the Personnel Division which receives many handwritten forms and requests.
- Most all processes within engineering are automated with the exception of obtaining signatures or approval initials on finalized drawings.
- We intend to use current OMR, OCR and possible ICR in the future to automate business.
- In general, our client's education levels are quite low. Clarity of their hand writing, spelling, and sentence structure would make machine recognition difficult.
- Technology for handwritten words recognition must improve for wider adoption in legal and financial environments.
- Very useful in financial transactions, but needs improvement for health care forms analysis. Dealing with old medical records and case histories.
- We like quite a few organizations utilize many types of data capture processes, which are often intermingled within a process. These include manual keying, OCR and ICR.

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