

**MASTERING PAPER AND FORMS
IN THE INFORMATION LIFECYCLE:
THE SMART PEN AND PAPER ALTERNATIVE**

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Table of Contents

Introduction page 1

Paper and Forms Automation in the Enterprise: The Problem and the Opportunity page 2

Smart Pens and Smarter Paper page 4

Anoto Smart Pen and Paper Technology in the Enterprise Today page 7

Business Process Renewal and Anoto Smart Pen and Paper Technology page 10

Conclusion: Smart Pen and Paper Technology and Innovation page 12

Introduction: Mobility and the Myth of the Paperless Office

The stunning commercial success of tablets and other mobile solutions often masks the newness of these technologies, most of which have become popular only in the last two years. Their popularity also masks just how new the industry's understanding is of the role mobile devices can play in automating well-established and high-value business processes.

Nowhere is this more the case than in the world of document and paper management, and in particular that corner of the market that is concerned with the problem of capturing and managing the vast quantities of information that start their journey through the enterprise as a piece of paper, a form, or some other document. The billions of pages of printed paper created every year as part of key business processes in finance, insurance, healthcare delivery, field service management, construction, architecture and design, and myriad other industries are still an important starting point for the information lifecycles of enterprises of all sizes.

Despite the promise of the "paperless office" and the common wisdom that there's no business process

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a smart phone or tablet can't make better, there remains an enormous range of documents that still need to be filled out or marked up by hand, even as the need for the capture of the information in these documents becomes increasingly valuable. As the enterprise's understanding of the possibilities and limits of tablets and smart phones grows, it is clear that other approaches to solving the problem of capturing paper-based data are not only worth exploring, but can add significant value to existing enterprise processes while leveraging new technologies and users' growing familiarity with existing mobile-based enterprise processes.

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One of the more salient technologies that has already proved to be a key component in revaluing existing business processes is the original mobile device – the pen – which has been transformed from a device that puts ink onto paper into a rugged, versatile, and easy to use data input device – a smart pen – that lends itself to some very unique and valuable use cases. In particular, the smart pen and paper – in use for over a decade – excel in areas where the tablet and smart phone fall short. In other cases, adding a smart pen to a tablet or phone-based process can significantly enhance both usability and value.

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These smart pens, when used to write on paper and forms impregnated with microcapsules, turn pen and paper into a digital information device, and transform writing on paper into the automated management of data and information. As the advent of the paperless office becomes firmly rooted in an unattainable future, and the need for improving existing paper-based processes grows daily, the case for smart pen and paper in the enterprise becomes more and more compelling.

This report discusses the opportunities presented by smart pen and paper technology, pioneered by Anoto Group AB, particularly with respect to the unique use cases that define a next-generation approach to automating document and paper-based forms used in the enterprise. The first section defines the scope of the opportunity for automating existing paper-based processes in the enterprise using smart pen and paper technology, highlighting the domains where smart pen and paper offer a superior user experience or use case to tablets and smart phones. The second section highlights how customers and partners of Anoto's technology have leveraged this technology to enhance existing business processes and thereby create high-value paper and forms management use cases where smart pens are the mobile device of choice. The final section discusses how Anoto's technological impact on the enterprise and enterprise business processes will evolve as document and form processing converge with mobility and the requirements for digital data input.

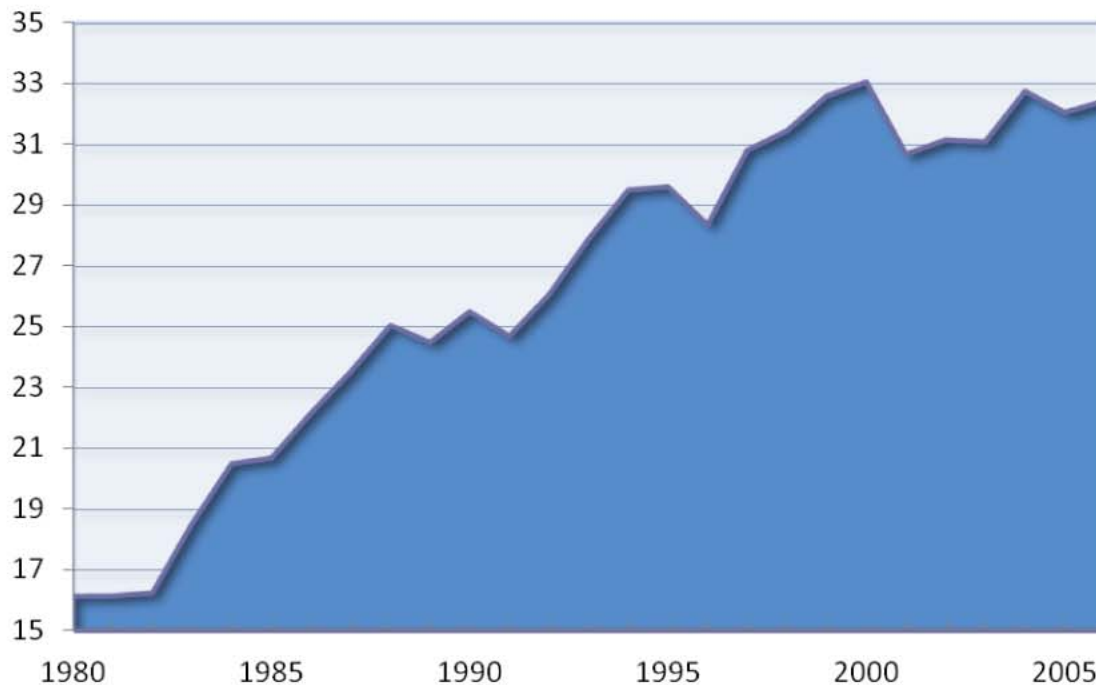
Paper and Forms Automation in the Enterprise: The Problem and the Opportunity

An online search of the term "paperless office" yields numerous references to real and imagined paradigm shifts that have fascinated technologists and companies since the dawn of the personal computer in the 1970s. The facts on the ground tell a different story, however. According to the Statistical Abstract of the United States, printing and writing paper production in the U.S. has actually increased over the last 30 years, from over 16 million tons per year in 1980 to over 32 million tons in

year. Meanwhile, the global printer market is expected to grow at a compound annual growth rate of 4.5 percent through 2015, according to research firm Technavio. According to Technavio, the global printer output reached 3.1 trillion pages in 2010. In the business world, the document management market includes scanning and other technologies for digitizing paper – continues to grow at a compound annual growth rate of 10.5 percent through 2015, according to research firm Technavio.

2006, the latest reported annual growth rate of 4.5 percent, according to research firm IDC, printer and scanner market – which in 2010 reached \$10.5 billion, according to research firm Technavio.

Figure 1. Amount of Office Quality Paper Produced in US (in millions of tons), 1980–2006



Source: American Forest and Paper Association, Washington, DC.

Behind these numbers is the stark reality that the use of printed paper, as part of core business processes across numerous industries, remains a fact of life. This is true whether one is filling out a form in a doctor's office, annotating a blueprint at a construction site, or filling out a maintenance form in a rail yard: the fact remains that the intersection of paper and business processes – such as patient onboarding and insurance compliance, collaborative engineering and design, or risk management and regulatory compliance – is not slated to disappear any time soon. Indeed, if the raw data on the amount of paper, printers, and documents in use are any indication, these requirements are growing, not shrinking.

With the growth of paper-based processes still regarded as an inevitable – if to some, unexpected – reality, a wider problem has emerged that is particularly germane to businesses trying to manage the cost and complexity of their core business processes in a world of increasing competition and global operations. IT organizations and their line of business colleagues are increasingly tasked with optimizing their core business processes, many of which have to be automated by packaged enterprise software.

That automation is in many cases incomplete, however. Embedded in a surprisingly large number of these automated processes is the widespread requirement to record information such as notes, sketches, and changes, on forms and other printed documents. This may be a signature or signoff on an insurance or financial form, checkmarks on a maintenance report, a markup to a design or CAD drawing, or any other of the myriad ways in which the so-called paperless office remains very paper-centric indeed.

A key reason for the persistence of paper-based processes is the overarching usability of pen and paper. Both are highly familiar to anyone who has grown up in an even minimally modern society; they are extremely rugged and dependable; and they have no appreciable learning curve or barrier to entry. This is what makes pen and paper so unique: despite the advances in the user experience of computers, tablets, and smart phones, there are many use cases and types of users where a pen and paper are vastly superior to keyboard, mouse, or touch screen.

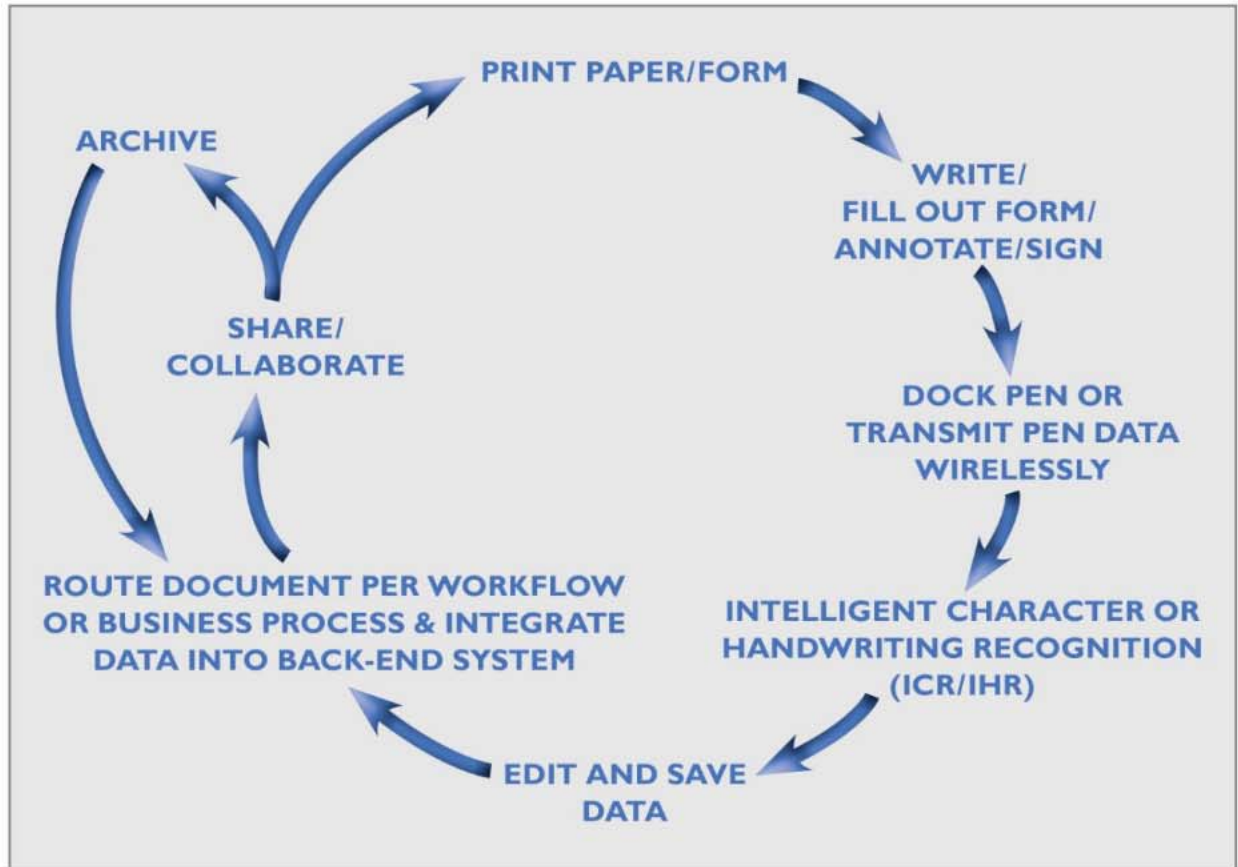
Therein lies the innovators' dilemma, paper-process version: the growing requirement for business process automation is running head-on into the problem of capturing paper-based information in a digital form. While scanning and maintaining a digital facsimile of a document can suffice in some limited cases, failing to fully capture the information entered on a given piece of paper can have the effect of grounding key elements of process automation in a 20th century piece of un-digitized paper. This is particularly true for processes in which the paper document is part of a process workflow and where the actual information entered determines the next step or steps in the process.

Smart Pens and Smarter Paper

Making the paper component of a business process “smarter” and more directly connected to an automated business process turns out to be not only simpler than it may appear, but the solution is also less costly and more easily used than many would have believed.

There are two parts to automating paper processes, and both are surprisingly simple and familiar – smart paper embedded with invisible microdots, and a smart pen that captures pen strokes and translates them into data, and understands – via the embedded microdots in the paper – how to link the pen strokes to a virtual form or other document and to the relevant business process.

Figure 2. The Lifecycle of Smart Pen and Paper



This smart pen and paper solution has six important attributes that make the combination a key tool in the drive to automate business processes while maintaining high levels of usability and user acceptance.

Smart pen and paper processes are more user-friendly. While multi-touch tablets have been praised for their ease of use and familiarity, the pen and paper vastly exceed these input technologies in terms of user acceptance and usability. Indeed, tablets and PCs can function as barriers to user acceptance in a number of cases. This is especially true where the user population is not especially technology-savvy or is actually technophobic, as is common in health care services, where elderly and lower socio/economic status patients are often not comfortable using tablets and PCs. By using a smart pen and paper, and by adding optical character recognition to digital records captured by the smart pen, familiar handwritten documents and forms can become part of a permanent, fully-digitized, record.

Smart pen and paper processes are more collaborative. In a number of cases, using smart pen and paper makes it easier for individuals to collaborate on a process. That process can, for example, involve a group of architects marking up a blueprint at a construction site, or it can involve a doctor taking a medical history without having a PC or tablet get in the way of the patient/doctor interaction. With most of the collaboration in the enterprise still ad hoc and non-digital in nature – despite the hype around social collaboration tools – capturing pen and paper-based collaboration allows the majority of the information to become part of a digital record.

SMART PEN AND PAPER ATTRIBUTES

User-friendly

Collaborative

Rugged

Inexpensive

Keeps users “on task”

Easy to integrate to existing business processes

Smart pens and papers are more rugged. Many business processes require capturing information under less-than-ideal circumstances where a PC or tablet may not be the best solution. This may be in environmentally challenging environments, where extremes of heat and cold require gloves and other equipment that impede the use of keyboard and touch screens, but where a smart pen and paper solution works very well. Other work environments require highly ruggedized equipment, which in the case of a PC or laptop can mean a significant expense, while a smart pen and paper would need little or no modification. Another ideal use case for smart pen and paper is for data collection in constrained spaces – such as inspecting the fuselage of an aircraft – that can be difficult if a laptop or tablet has to be brought along for capturing the data, but easy enough if all that is required is a smart pen and paper.

Smart pens and papers are relatively inexpensive. The cost of a tablet or PC-based solution can average \$400 – \$1200 per machine, whereas consumer and enterprise smart pens retail for \$100 – \$180. With the expanding selection of low-cost printers that are capable of printing smart paper, the cost of printing a smart paper form has declined to be largely similar to the cost of printing a standard form. This makes the overall platform cost of a smart pen and paper solution significantly lower than a PC or tablet-based

solution. This cost ratio is even more dramatic when considering the ruggedization issue, mentioned above.

Smart pens and papers help keep users “on task.” The use of smart pen and paper places an intrinsic limit on what a user can do in the course of completing a specific task. A general purpose device such as PC, tablet, or phone, provides a potentially large number of distractions and diversions for users, who may be tempted to use the device for a purpose unrelated to the specific task or process at hand. The close link between smart pen and paper means that the only interaction a user can have with the device is dictated by what is on the piece of paper. This is particularly interesting for IT managers who struggle with the impact of the use of smart phones and tablets at work: with a smart pen and paper, there is significantly less opportunity for data or other intellectual property to “accidentally” leave the premises as the result of using the device to input data into a business process.

Smart pens and papers are easily integrated into existing business processes. The ability of a smart pen to capture the pen strokes of a user and digitize them lends itself readily to the use of this technology inside an existing business process that is already dependent on the use of a paper-based form. Anoto’s smart pen technology includes form-creation software, programming interfaces, and output standards, such as Adobe PDF. Therefore, smart pen and paper technology can be used for pre-existing workflows and business processes, and can also be integrated into the development of new business processes. This adaptability, coupled with the availability of low-cost printers and quick-print solutions for smart paper output, makes it relatively easy for IT or business users to create smart pen and paper solutions.

Taken together, these six attributes have allowed Anoto’s customers and partners to use smart pen and paper technology in order to create unique solutions that leverage the technology’s low cost and ease of use in a number of highly valuable business processes. The next section highlights some of the unique use cases in the market today, and discusses how they are making an impact on usability and business process excellence.

Anoto Smart Pen and Paper Technology in the Enterprise Today

The use of Anoto smart pen and paper technology in the enterprise spans a wide range of use cases, with examples spanning health care delivery, field service management, architecture and design, clinical trial management, training, and many more. In each example, smart pen and paper technology enables companies to capture important information in an extremely efficient and non-disruptive way, augmenting existing business processes with the ability to digitize input that otherwise would have had to be rekeyed, scanned, or simply left in analog form.

Healthcare delivery. Healthcare delivery has been one of the pioneering sectors for smart pen and paper technology, as the requirement for filling out and signing paper forms has not been replaced as rapidly or successfully by all-digital input technologies as many in the field had once assumed. The persistence of paper and the preference for smart pen technology is also very much the result of the demographics of health care delivery – while many patients are tech-savvy enough to use tablets and PCs, there remains significant patient populations that lack a facility or comfort with these technologies.

I would rather pass out pens than smart phones. A smart phone has too many opportunities for doing things other than what we need to get done.

Robert Jasa, Director of Healthcare Informatics, PCLI

Using a smart pen and paper lowers those barriers, according to Robert Jasa, Director of Healthcare Informatics at Pacific Cataract and Laser Institute, Chehalis, Washington. PCLI's patient population includes many elderly patients who are not necessarily at ease using PCs or tablets. "The pen was a very natural solution given our demographic," Jasa said.

Equally important, using a smart pen and paper solution helped the company control administrative costs by minimizing the use of paper-based processes, such as consent forms and patient history forms. While the clinics still print these as smart forms, they no longer need to collect, scan, and file the forms. Once the patient fills out the smart form, the pen is docked and the patient's keystrokes are converted to information that goes directly into the electronic health record. "I can cost-justify it on this use case alone," said Jasa.

The use of smart pens also places important limits around the role of technology in PCLI's clinics. According to Jasa, the use of tablets or electronic kiosks for gathering information from patients presents other problems: "When you put a kiosk in a waiting room, or a tablet, you end up with a lot of questions," and Jasa added that these include questions about patient confidentiality. In addition, he added that using a smart phone has its own drawbacks: "I would rather pass out pens than smart phones. A smart phone has too many opportunities for doing things other than what we need to get done."

The pen maintains the intimacy of the personal contact. And the data can be shared instantly.

Guillaume Juge, Managing Director, Kayentis

Insurance underwriting and clinical trial management. The use of smart pen and paper technology in healthcare has an important analogue in the insurance and mortgage brokerage business, both of which share three important characteristics: a broad-based and potentially non-tech savvy population, numerous large and complex form-based processes, and regulatory requirements that require comprehensive archiving and support for audits.

Kayentis, a developer of smart pen and paper solutions based outside of Paris, France, has developed an insurance solution that leverages the

usability and familiarity of pen and paper for insurance sales teams. Instead of filling out forms and then scanning them, or asking customers to fill out forms on a computer, the Kayentis solution uses a smart pen and paper to capture the information necessary for underwriting a policy. “The pen maintains the intimacy of the personal contact,” says Guillaume Juge, managing director of Kayentis. “And the data can be shared instantly.”

This instant access allows sales managers to both monitor their sales teams and verify the accuracy of the documents submitted by the customers. Mistakes made in the field can be quickly noted and corrected, according to Juge.

Kayentis also sells smart pen and paper solutions that are used for clinical trial management by pharmaceutical manufacturing customers, as well as for field maintenance in the aeronautics manufacturing market. In both domains, the ability of the smart pen and paper solution to capture and digitize all notations, additions, and comments is important in maintaining the auditability of the clinical trials and aircraft maintenance records. “Aerospace is similar to pharmaceutical manufacturing in that they need to trace everything for years and years,” said Juge. Being able to respond rapidly to regulatory audits with fully digitized documents, even those filled out “by hand,” helps Kayentis’ customers with important business processes that can otherwise be a significant drain in resources, and place a company at risk if an audit is unsuccessful or delayed.

Engineering and construction. Smart pen and paper technology can support additional operations in the field, including engineering and construction, where the requirements for capturing and moving data

Our guys are in a rough, dirty environment. Pens are really rugged and durable.

President of a US-based engineering and construction consulting firm

from the field to the office often run into a number of barriers. One customer, a US-based engineering and construction consulting firm, uses smart pens and paper in its field operations. “We had a need to get field notes and records back into the office as quickly as possible,” the president of the company said. “Because they were on paper, it was time consuming and cumbersome to get them from the field.”

The company had three problems that had to be overcome in order to fix this issue. The first is that the company’s work in the telecommunications industry often meant that the “field” was no place for the average PC or tablet. “Our guys are in a rough, dirty environment,” the company’s president said. “It doesn’t work to

“Average” PC tasks: applications, filing, data capturing, transcription and review.

In fact, preserving the paper side of these field operations was essential, and fully digitizing the wasn’t an option. “Our engineering drawings are on paper,” the president pointed out. “In the need paper documents to reference and for documenting changes.”

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The smart pen and paper solution provides the familiarity of a pen and paper with the right level of ruggedization for the company's field operations. "Pens are really rugged and durable," the president noted. "I don't know if we've ever had one fail in the field."

That familiarity meant that the company's field teams needed no new training in order to use the smart pen and paper solution. "From the field perspective, they're just doing what they normally do," the president added.

Back in the office, changes made in the field are entered directly into a database that makes them accessible to the company's staff, and, more importantly, to the company's customers as well. "We can send the customers copies of the project as it is on-going," the president added. "The bottom line is that we can turn around the information to them more quickly."

The above examples show the adaptability of smart pen and paper technology, as well as the ease with which it can be inserted into an existing process where traditional paper had become a barrier to automation. By replacing plain pen and paper with smart pen and paper, each of these companies, working with Anoto partners, were able to significantly automate their business processes with a minimal to non-existent change in the user experience.

Business Process Renewal and Anoto Smart Pen and Paper Technology

The ability of smart pen and paper technology to remove barriers to user acceptance and streamline paper-based processes in a wide variety of industries is the jumping off point for a much broader set of use cases than those described above. Indeed, Anoto smart pen and paper technology can be found in many other industries, from education and training, to manufacturing, to financial services, and more.

Unifying these use cases is the ability to streamline the paper-based elements of a given business process without drastically changing that process or requiring significant end-user training. Indeed, the ability to add efficiency and automation to established business processes at low cost, with little disruption, and with high levels of user acceptance, is the hallmark of the smart pen and paper opportunity in the enterprise.

Behind the uses cases of today are numerous capabilities that enable smart pen and paper technology to be such an effective component in business process renewal. As Anoto continues to evolve its offering, the company has a new set of capabilities that will enable its customers and partners to further extend the value and reach of this technology.

Security and auditability. The ability of smart pen and paper technology to ensure high levels of security and auditability provides two capabilities that enable important enhancements to existing business processes. This is due to two key factors. The most obvious one is the ability to digitize and store information that otherwise would have to remain either in paper format or scanned and left in a non-searchable format. This ability to capture notes, sketches, and other ad hoc information, in addition to the formatted data that can be captured from a smart form, allows companies in regulated industries to maintain a much more complete and accessible “paper trail” in support of audits and other archival requirements.

~~The second benefit of smart pen and paper technology is the ability to capture and store~~

written information and better control its provenance and use. Each individual piece of smart paper or smart form has unique identifiers in the microdot patterns that make that paper document truly unique. Likewise, the smart pen that captures the pen strokes on a piece of smart paper also has a unique ID, which means that it is possible to identify which individuals made which pen strokes – a signature, for example – on which precise piece of paper. This traceability can significantly aid in any forensic discovery or audit process.

Workflow and process flow. The ability to embed workflow in a smart pen and paper document is a key capability that will grow in importance as the use cases of this technology expand, and as Anoto’s workflow capabilities evolve. Adding workflow to a paper document at the time of input is an important part of business process renewal. In most cases, standard paper documents are either rekeyed or scanned in order to digitize their contents, adding a physical process that comes with the risk that quality will be compromised in the translation.

A smart pen and paper document can be not only automatically digitized – today by docking the smart pen or using Bluetooth to connect to a mobile device, and in the near future through a Wi-Fi connection – but the data in the document can also be used to trigger external events through a workflow engine. Thus, a patient filling out a form who checks, for example, that he or she is diabetic, could be automatically scheduled for a blood test based on a workflow trigger initiated by checking “yes” on that part of the form. The same form could also be automatically routed to the patient’s different care providers based on the patient’s record number. Similarly, data quality can be automatically verified and inconsistencies flagged and routed to a quality assurance expert based on a workflow-triggered analysis of the data on the smart form.

While the underlying APIs available in the Anoto smart pen and paper platform are sufficient for supporting workflow-based functionality, Anoto’s roadmap includes a workflow-enabling tool that will allow customers and partners to more readily develop and maintain complex, smart-paper-based workflows. This will enhance the value of paper-based processes by further automating the use of smart

paper as part of highly automated business processes, without losing usability and other attributes of a smart pen and paper solution. Anoto's partners are also helping move the needle in terms of functionality. Partners like Kayentis, Destiny Wireless, and NextGen also provide complete solutions for different markets that include workflow and business process integration.

Enhanced connectivity. As noted above, Anoto and its partners plan to enhance the connectivity options for smart pen and paper technology in the coming months. This will extend the syncing options from today's USB and Bluetooth (via smartphone) to new syncing options such as an enhanced Bluetooth capability, called Smart Ready, as well as direct Wi-Fi connectivity that will also allow real-time data input from smart pen and paper. This not only removes the requirement to have a PC-based docking station as part of the smart pen and paper solution, but it also opens up broader use cases that could benefit from more rapid or even real time connectivity. This also extends the sophistication of the character and data processing capabilities of a smart pen by enabling more of these services to exist in real time on a connected device, be that a PC, or even a tablet or smart phone.

Cloud-based functionality. One of important use cases for enhanced connectivity involves enabling smart pen and paper solutions to access a set of cloud-based services, an important component in Anoto's future roadmap. This is an important enhancement for Anoto, as it will enable a significant improvement to the processes enabled by smart pen and paper solutions. Included would be relatively simple functions such as cloud based storage and information management, as well as more complex services such as enhanced workflow and application integration. An Anoto cloud would also allow for the creation of an app store for smart pen and paper technology, and would enable third party services such as print on-demand services for smart paper and forms.

Conclusion: Smart Pen and Paper Technology and Innovation

The existing solutions enabled by Anoto and its partners prove an important point concerning the relationship of paper to key business processes: as long as there are people involved, paper remains a popular and user-friendly component in many business processes, particularly those that pre-date the PC and tablet. And, as long as paper is part of the process, there is an opportunity for a smart pen and paper solution to automate or optimize that process without requiring significant reworking of the process or retraining of the users.

Empowering old processes with new forms of optimization, however, isn't the only sweet spot for Anoto's smart pen and paper. There are numerous examples of net new processes that leverage this technology. In one example, a Swedish home healthcare provider places a printed "box" on the doorsill of a patient's home, and when that home care worker arrives, he or she touches a smart pen to the box

and thereby records the time and date of the start of the visit. The process is repeated upon exiting, and digital time stamp has now been created that can be used for supervisory or audit purposes.

This flexibility is the hallmark of smart pen and paper technology – the best of an old, familiar experience with the best of the new digital, mobile world. Two years into the tablet revolution, it's becoming increasingly clear that sometimes a smart pen and paper are all a user needs. As Anoto expands the scope of its offerings and makes it easier to create smart forms, store, and manage these forms in the cloud, and create smart paper and pen processes that enhance existing business processes, the more it will be obvious that a PC and tablet aren't always the best tools for the job.