Impact of Robotics, RPA and AI on the insurance industry: challenges and opportunities



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Abstract
We consider the current challenges and opportunities in applications of Robotics to financial services and to insurance in particular. Combinations of Robot Process Automation (RPA) with digitization have been considered by the industry, with important benefits in cost reduction and efficiency. We highlight the general benefits of RPA and the related implementation challenges in detail. We discuss more advanced Artificial Intelligence (AI) applications, arguing that such applications depend on the general advancements of AI, where human level interaction is not yet available. We discuss the great potential for AI applications in the near future and consider some initial examples. We also briefly discuss the hard problems of AI in relation to intelligence and consciousness in the introductory part, and briefly look at the implications AI and robots could have for human society and employment.

1. Introduction

The umbrella term "Robotics" brings about worry and excitement at the same time, leading to extreme reactions ranging from alarm to exaltation. From the very beginning part of the public feared that unemployment would be an obvious consequence of widespread use of Robotics, see Frey and Osborne (2013) for a recent study on computerization and unemployment, while others have been more optimistic and argued that only specific parts of jobs would be affected, see for example Chui et al (2015). Robots have also been seen as saving humanity from routine and menial tasks, giving humans the opportunity to focus on more pleasant jobs and activities, and on more rewarding intellectual activities, see Belfiore (2014).

At a more fundamental level, the related advances of Artificial Intelligence (AI) have caused a lively debate that continues over the years. One can easily witness extremes in this space too. Consider the bestseller books from Hofstadter (1979), a cult book by now, and especially Kurzweil (1999, 2006), supporting "strong AI" and predicting a machine singularity. In the ironic words of Lanier (2000), one of the pioneers of virtual reality, authors and friends he humorously calls "cybernetic totalists" espouse a number of beliefs that could be roughly described as follows. First, cybernetic patterns of information provide the ultimate and best way to understand reality. Second, people are cybernetic patterns. Third, subjective experience doesn't exist and if it exists it is unimportant, being an ambient or peripheral effect. Fourth, one can extrapolate Darwin's findings outside biology to obtain the singular, superior Darwinian description of all creativity and culture. Fifth, information systems will be accelerated qualitatively and quantitatively by Moore's law. Finally, sixth and most dramatic, in Lanier's words, "biology and physics will merge with computer science (becoming biotechnology and nanotechnology), resulting in life and the physical universe becoming mercurial; achieving the supposed nature of computer software. […] Computers […] will overwhelm all the other cybernetic processes, like people, and will fundamentally change the nature of what's going on in the familiar neighborhood of Earth […] maybe in about the year 2020. To be a human after that moment will be either impossible or something very different than we now can know" (Lanier 2000, 2010). A heated debate on whether a machine adopting computational algorithms can really reach human intelligence has developed over the years, jointly with the related question on whether machines can have subjective experiences and be conscious. Chalmers (1995) formulates the following related questions:

Q1: What does it take to simulate a human being's physical action?

Q2: What does it take to evoke conscious awareness?

Q3: What does it take to explain conscious awareness?

For each of the three questions, one may answer that:

(C) Computation alone is enough,

(P) Physics is enough, but physical features beyond computation are required, or

(N) Not even physics is enough.

In terms of the three questions, Chalmers argues that Descartes would be Q1=N, whereas strong AI people would probably say Q1=C, Q2=C,Q3=C, while Penrose (1994) argues Q1=P, Q2=P, without saying much on Q3, and Chalmers himself declares he believes that Q1=C, Q2=C, Q3=N. In other words, Chalmers believes that while a human being's intelligent behaviour can be simulated computationally and that conscious awareness can be evoked computationally, it cannot be explained computationally. Penrose instead argues that human intelligent behaviour cannot even be simulated computationally, nor can conscious awareness be evoked with a computational method. The latter is also the position of Searle's (1980) with his famous Chinese Room experiment, where he sets up a thought experiment meaning to show that the Turing test cannot detect conscious awareness. More generally, as Cole (2014) explains, Searle means to reach the broader conclusion of refuting the theory that human minds are computer-like computational or information processing systems, a position related to computational theories of the mind and to "strong AI". Searle suggests that minds must result from biological processes; computers can at best simulate these processes. Searle's arguments have been vigorously challenged by AI researchers and philosophers among others, see for example Dennett (1991). The debate has important implications for semantics, philosophy of language and mind, theories of consciousness, computer science and cognitive science.

Clearly, an in-depth discussion of such issues is beyond the scope of this paper. However, we decided to list such debates to help the reader appreciate the holistic nature of AI discussions and the enormous cultural stakes that are invested in this research, going well beyond specific industries. Having said that, and leaving eschatology aside, such fundamental questions and debates have not discouraged companies and practitioners: one need only think about computers' supremacy in the game of chess, personal assistant vocal applications offered by mobile phone companies, computer systems beating human champions on the television game show Jeopardy (Cole 2014), and modern search engines, to name just a few developments. However, one should contrast this with the mostly exaggerated predictions AI experts have been suggesting over the years (Armstrong et al 2014), and with Hofstadter suggesting in Herkewitz (2014) that the actual advanced AI content in many such applications is very limited. It remains to be seen how much human intelligence is really present in the current AI achievements. In the meantime, optimism on the AI enterprise may be justified on more practical terms. Indeed, it may well be that technology and computing companies may reach AI as an emerging property progressively rather than through a mathematical breakthrough, and that formal properties of AI will be investigated more productively "after the fact".

In this paper we will keep such fundamental questions in the background, and look at Software Robotics, Robotic Process Automation (RPA), Cognitive Robotics/Artificial Intelligence mostly from the practical point of view, briefly considering the potential disruption and opportunities these areas bring to the insurance industry in particular. In doing so, we will focus on implementation as a key feature of the process, highlighting its challenges. Finally, even though we consider the U.K. economy in some of the examples below, given that the U.K. economy is similar to other advanced economies with respect to the issues at stake we believe this article maintains a global appeal and may be of interest to the global community.

The paper is structured as follows: In Section 2 we introduce Software Robotics and RPA. In Section 3 we look at the opportunities and synergies that show up when software and Robotics are combined. In Section 4 we highlight the implementation challenges that an RPA and AI innovation process may involve for a company. In Section 5 we focus on insurance companies and briefly analyze the potential impact of Robotics on a number of fields of insurance businesses, including claim automation, bespoke insurance solutions design, customer contact, fraud detection and prevention, dangerous/catastrophe site inspection, recognition via drones and risk measuring sensors, among others. We include a brief description of a case study involving RPA implementation for a large insurer. We conclude assessing the overall challenges and opportunities that Robotics represents for the insurance industry in particular.

2. What is Software Robotics, and why does it matter?

Software Robotics has received a lot of attention in the last year. This includes both popular press speculation about the impact on jobs (FT, 2015) and the analyst press discussing the potential impact on offshoring and outsourcing (BBC, 2015). The promise of Software Robotics is to deliver a solution that can rapidly automate manual back-office and customer-facing processes, making them faster, significantly more cost-effective, and improving consistency and regulatory compliance, all with a return on investment typically in less than one year.

Many leading banks and insurers have successfully piloted Robotics solutions, but to date relatively few have succeeded in industrializing the benefits. However, the size of the prize on offer from doing so, in terms of both cost savings and service transformation, places accelerating and industrializing Software Robotics firmly on the agenda for the C-suite of most financial services groups.

But what is exactly RPA? Robotic Process Automation, also known as Software Robotics, is the use of a new class of software to automate business processes at a fraction of the cost of traditional solutions, without the need to change current IT systems. RPA works by replicating the activities that people currently undertake, using existing core applications, accessing websites, and manipulating spreadsheets, documents and email to complete tasks. Using RPA software involves mapping out current or new processes, linking it to existing applications, and then scheduling them to run on one or more robots whenever required.

The individual elements of RPA software are not new. However, it's the combination of all the features into a single, mature package that works with existing systems which, in many cases, creates a compelling alternative to core-platform integration or replacement. And not only can RPA reduce manual operations costs by 25-50% or more, it does this while improving service and compliance, and typically provides a return on investment in less than a year.

Because the software replicates human activity, it can be thought of as a set of software "robots", forming a virtual workforce available 24 hours per day, with full audit and 100% accuracy. We briefly discussed the concerns about potential impact on unemployment in the introduction, highlighting also the potential positive effects. Overall, the concept of a "virtual workforce" has proven to be a useful perspective from which to approach Software Robotics, as it emphasizes business rather than IT control, and provides for rapid adoption through existing compliance and risk management frameworks.

RPA software distinguishing features:

1. **Purpose**: Designed to carry out business processes, replacing manual activity
2. **Approach**: Visual, or "code-free" interface to define target processes and link to existing core platforms user interfaces and desktop applications. No (or limited) technical integration required
3. **Usability**: Suitable for IT-literate business users and operations teams, rather than IT development or integration teams
4. **Scalability**: Runs in a data center, and can support high-volume, 24x7 operation, with scheduling, monitoring and reporting
5. **Compliance**: Full audit of both process definitions and individual tasks executed, and full security model supporting segregation of duties

In addition to "Standard Robotics", there is also an increasing interest in "Intelligent Robotics" – the use of machine learning and AI approaches to allow automated processes to self-adjust and improve, and to tackle subjective decisions as well as following simple rules. This extension offers both improved, data-driven decision-making at speed, and increases the scope of manual work that can be automated. We see two different approaches to Intelligent Robotics. First, use-case specific solutions (such as intelligent document scanning for handling paper, or speech-recognition systems for call centers), and second, the combination of analytics platforms with RPA software. In the latter case, the analytics platform is the "brain", with the RPA software providing the "body" of the robot, able to collect the information required and take the resulting action.

What about Cognitive Robotics/AI?

There is also a lot of focus at global tech conferences on the potential of Cognitive Robotics/AI, with leading companies developing driverless cars and self-navigating drones. While the progress being made in these projects is very impressive, the costs are significant and they expose some interesting challenges related to the general AI issues we discussed in the introduction.

Relating this back to financial services, the equivalent would be self-optimizing customer service, loan pricing, financial advice, or claims or complaint handling. Designing a good statistical or machine-learning optimization approach is challenging, but designing and monitoring one that aligns to legal, regulatory and ethical conduct requirements can be even more challenging. From an emotional perspective, there are currently no intelligent solutions that have yet reached human capability, as everyday experiences with voice solutions testify, see again Herkewitz (2014). Indeed, as we pointed out in the introduction, it is not even clear what human intelligence is, and whether it can be simulated or even evoked with a purely computational approach.

Nonetheless, there are clearly areas where a degree of learning or "cognitive" technology offers a significant advantage, such as processing of paper documentation, understanding speech, detection of fraud, and so on. In these areas, there are three standard approaches:

1. Adoption of a niche product. This is common for highly specialized situations like voice processing and natural language interpretation, or for analysis of legal contracts.
2. Adoption of a targeted solution, such as a generic document scanning and intelligent character recognition solution for processing a variety of paper documents.
3. General cognitive robotic platform, combining an analytics or machine learning platform with the Robotics tool as described above.

One may argue that Cognitive Robotics carries a substantially higher cost than standard RPA, and therefore should be reserved for the highest value processes only. As a more general solution, it could also belong to a future wave of automation at a point when both financial services organizations are more mature in the deployment of advanced analytics techniques and associated model risk management, and the technologies are more mature and lower in cost.

3. Digital and Robotics: combination benefits

As outlined above the gains from automation can be considerable. But much more is possible when Robotics and digital are brought together. RPA needs to work with content that is available within a system. So for example, it can only automate a claims process once the initial information has been dealt with by one or more agents. That might involve a number of conversations and the manual input of information from supporting documentation. But if those preliminary stages are delivered via digital channels that maximize the extent of customer self-service, robots can get to work faster and across an entire end-to-end process. In other words, digital and robotic automation can deliver an overall solution that is far greater than the sum of its parts.

The return on investment that the combination can deliver will significantly outstrip those available from Robotics alone in fact by as much as two and a half times. As Robotics takes on greater responsibility for an end-to-end process and minimizes or even eliminates altogether the amount of human intervention required, potential ROI rises sharply.

Connecting digital with Robotics addresses some of the largest inefficiencies in current processes. And it can achieve this in a number of ways, working with any legacy system and, with a digital adapter sitting on top of the Robotics, can in fact digitize whole new areas of business process. And this is where one may see the next big wave of opportunity. Digitizing the entire estate is far too costly a prospect for most businesses to even contemplate. For example, insurers are likely to be able to digitize support for only in the region of just 25% of their current products and services. But the combination of Robotics with digital expands the scope across a far wider range – and therefore the available savings too. And even where it's not possible to digitize certain elements of a process, using intelligent Optical Character Recognition (OCR) technology can achieve comparable results.

4. RPA implementation challenges and opportunities

As EY (2016a) points out, while combining digital and Robotics is an essentially simple concept, it requires care in realization to ensure that appropriate digital service levels, cyber controls and volumetric requirements are met, without compromising the agility of the core robotic capability being created within the business. EY (2016a) looks at some of the more practical challenges associated with using RPA. That includes identifying use cases, common problems encountered in implementing RPA and some pointers from EY's experience of working on successful projects in financial services. We report some of the main findings here. EY (2016a) breaks the issues into two components: the common single issues across failed RPA projects and the multiplier effect from multiple issues. We will discuss these components in the following sections.

4.1 Top 10 common issues in failed RPA projects

Issue	Description	Mitigation
1. Targeting RPA at the wrong processes	Targeting RPA at a highly complex process is a common mistake. This results in significant automation costs, when that effort could have been better spent automating multiple other processes. Often these processes are tackled only because they are very painful for agents, but may not offer huge savings.	Perform a proper opportunity assessment to find the optimum portfolio of processes. Low or medium complexity processes or sub-processes are the best initial target for RPA, with a minimum of 0.5 FTE saving, but preferably more. Only tackle complex processes once you are RPA-mature, and then perhaps look to automate the highest value/easiest parts first and increase the percentage of automation over time.
2. Using the wrong delivery methodology	Quite often companies try to apply an over-engineered software delivery method to RPA, with no-value documentation and gates, leading to extended delivery times – often months where weeks should be the norm.	While IT governance is essential, most software delivery methods are over-engineered for RPA – especially as RPA rarely changes existing systems, and processes are documented in the tool. Look to challenge existing methods, and use an agile delivery approach to deliver at pace. Good RPA centers of excellence, with the right methods, can deliver new processes into production every 2-4 weeks.
3. Thinking skills needed to create a PoC are good enough for final production automations and one can move immediately and trivially from prototypes to full production	One of the common traps of RPA is that with just a day or two of training, most business users can automate simple processes. But the skills needed to create scalable, resilient RPA processes are significantly greater, leading to lengthy testing and re-work cycles.	It is good to expect needing at least 2 weeks of classroom training, then 2-3 months of hands-on project delivery with supervision and coaching, before an analyst can deliver production-quality automations well. It's essential not to skimp on teams' training or skills transfer or support.
4. Automating too much of a process or not optimizing for RPA	Often we see that companies try to totally eliminate human input in a process, which ends up in a very significant automation effort meaning additional cost or a delay to benefits. But we equally often see no effort in changing existing processes to allow RPA to work across as much of a process as possible, and hence reduced savings.	The best way to view RPA initially is as the ultimate "helper", carrying out the basic work in a process and enabling humans to do more. Automating 70% of a process that is the lowest value, and leaving the high-value 30% to humans is a good initial target. It's always possible to back and optimize the process later. And while fully "learning" every process may take too long, look to see if simple tweaks mean that a robot can do more of a process.
5. Forgetting about IT infrastructure	Most RPA tools work best on a virtualized desktop environment, with appropriate scaling and business continuity setup. It can be so quick to deliver RPA processes (typically weeks not months), that IT has not had the time to create a production infrastructure and hence get on the critical path to delivering benefit.	Take advice about exactly what IT infrastructure will be required from the RPA vendor or RPA SI. Knowing your company's lead times, ensure an appropriate "tactical/physical PC-based infrastructure" plan is in place, if a production environment is not feasible quickly.
6. Thinking RPA is all that's needed to achieve a great ROI	While current RPA tools can automate large parts of a process, they often cannot do it all – frequently because the process starts with a call or on paper, or requires a number of customer interactions. Hence companies often end up automating many sub-processes, but miss the opportunities to augment RPA with digital or OCR and automate the whole process.	The cost arbitrage of RPA is significant. As an example, in the UK a robot can be 10-20% of the cost of an agent. But more often than not, a robot only works on sub-processes and hence leaves a lot of the process that a robot cannot handle, and therefore limit savings. Having invested heavily in digital and OCR technology that works well with RPA (and most don't), we are seeing that benefits can be up to 2.5x that of RPA alone – can truly deliver near 100% straight-through processing even on old legacy systems, and are just as easy and cheap to deliver as RPA alone.

Table 1: Delivery/Technology Issues

Issue	Description	Mitigation
7. RPA being IT-owned, whereas it's best being owned by the business	As RPA is software, some companies assume that RPA should be IT-controlled. However this approach can significantly limit its take-up within a business, and hence waste significant investment and potential.	Often companies think about the initial automation project, but forget that ultimately RPA will deliver a virtual workforce that allows the business to task robots across the entire business. IT would not be in charge of managing the current agent workforce, nor should they manage a virtual one. And as back-office agents can be trained to teach robots, having a business-owned RPA Center of Excellence (CoE) means having very little dependency on a constantly stretched IT dept. So business-led CoEs allow the business to prioritize which processes to automate and what the virtual workforce does, requiring only oversight from IT.
8. Not thinking about scaling past PoCs or pilots, and not having an RPA business case	A common route for most organizations is to perform an initial proof of concept (PoC) or pilot, to see that RPA delivers on its promise. But often there is then an embarrassing gap between a successful PoC and large-scale production automation, as RPA programs cannot answer simple questions from the board about "Where are we going to target RPA?", "How much will it cost?" and "What's the return?"	There is a significant body of evidence to show that RPA can deliver tangible business benefits across all types of company, even those with the most archaic IT systems. We typically advise companies to carry out a rapid company-wide or unit-wide opportunity assessment alongside a PoC. Typical PoCs can automate sophisticated processes in weeks, which is all it takes to perform a solid opportunity assessment and create a detailed business case. This means quick stakeholder sign-off, and enhances the momentum of the RPA program.
9. Not thinking about after processes have been automated	As described above there are a number of issues with just getting an RPA program mobilized, targeted and delivering at pace. But another common mistake is neglecting to consider how to get processes live and who runs the robot workforce – both issues that will delay go-live and timely delivery of benefits.	As described above, we believe a business-led RPA CoE is the best way to manage and enhance a virtual workforce – but it doesn't just spring into existence. So the CoE processes need to be in place, IT governance agreed, and staff trained to operate robots and continue to enhance processes. While this seems daunting, a well-executed skills-building program can see a fully self-sufficient CoE established within 6-9 months – and usually quicker and less restrictive than negotiating an outsourced CoE arrangement.
10. Not treating RPA as a change program, with a focus on realizing benefits	RPA often involves automating sub-processes and hence people are still involved in the remainder of a process. So unless a structured re-organization and FTE-release or capacity happens, then agents "drift off" and start to perform other work – which is often providing a better service as they now have more time.	While providing better service is laudable, ultimately an RPA program must deliver its planned benefits in order to continue to roll out. Focusing on measuring and realizing benefits is therefore key. Note that in doing opportunity assessment, we usually recommend a portfolio of savings, service improvement and transformation processes is delivered – each of which needs to be measured and benefits delivered in order for ongoing investment to continue.

Table 2: Program issues

4.2 The multiplier effect

More than one of the issues outlined above is often present, creating a significant multiplier effect. As our "top ten issues" list shows, it takes sufficient forethought or outside help to mitigate these issues. And, unfortunately, if more than one of these issues occurs – which is common – there's a significant multiplier effect that can lead to loss of belief in RPA and projects stopping.

Let's look at an example, creating a simple data-entry proof of concept (PoC) and taking into a user pilot on test data, where three of the simpler issues are encountered in a RPA program.

Issue	Typical time to deliver if issue avoided	Typical time to deliver if issue impacts
1. Using the wrong delivery methodology	With skilled resources and an agile, RPA-centric method employed, simple sub-processes are typically automated and ready for live in 2-4 weeks. And as one has agreed the governance with IT, and met the criteria, the CoE can promote into the test environment.	If a software delivery method is used, then excess documentation and governance gateways can quickly mean a process can take 6-8 weeks to deliver ready for live.
2. Assuming skills needed to create a PoC are good enough for production automations	If one knows a PoC is due to go live then the right development rigor is used and unit tested. Hence PoC may go from 1-2 weeks to 2-3 weeks with negligible overall impact.	If a PoC is delivered without the right design or quality for production, there can then be numerous cycles of testing and re-work before it is fit to go live – adding 2-3 weeks.
3. Automating too much of a process or not optimizing for RPA	Assuming we only look at the optimum 70% of a process, we should be able to automate in 2–4 weeks.	Continuing to automate the remaining 30% often involves convoluted exception handling or multiple diversions from the "happy-path", so can double the time to deliver – adding 2-4 weeks.
TOTAL	2–4 weeks	10–15 weeks

Table 3: Data-entry PoC example

So what should have taken two to four weeks to deliver under a high quality approach, can rapidly increase in duration – and hence cost – four- or five-fold. Often these simple errors and delays give senior stakeholders a reason to withdraw support from the project. It's therefore important to recognize and mitigate these (and other) common issues in order to ensure the success of the company's RPA program.

4.3 RPA vs platform upgrade

As we pointed out earlier, the core benefits from Software Robotics are the same as for any automation approach: reduced overall cost; improved speed and timeliness; improved accuracy; improved governance and control; and full audit history. In a sense, these benefits are the same as those typically associated with a core-platform upgrade. However, Robotics can, in many cases, deliver these benefits much faster and at lower cost than traditional IT integration projects. That's for three key reasons:

1. The use of existing user interfaces means there is no (or very limited) requirement to change existing legacy systems, something which is often expensive and time-consuming.
2. Integration testing costs are also significantly reduced, as there is no requirement to synchronize releases across all the platforms. Robotics works with the core platforms as they are at any given point in time, and contains many accelerators for accessing existing systems and desktop resources.
3. The visual nature of RPA tools, and the fact that they are building on existing core applications, allows process automation to be delivered incrementally using an agile approach – we typically see a two-week release cycle. This accelerates benefit realization, and improves transparency, reducing risk, and also allows for automation of processes which evolve over time.

4.4 Initial approach

One common challenge that organizations face when approaching the application of Robotics in their business, is simply knowing where to start. With candidate processes running into the thousands, identifying the opportunities that will yield the greatest and fastest returns can be an overwhelming prospect.

The simple answer is any team or process within your business which requires a significant manual team (for example greater than ten people) but limited personal customer contact. These are the processes which are most likely to yield realizable benefits that enhance customer experience. For a pure cost-reduction business case, we would also suggest selecting processes consuming at least 0.5 Full-Time Equivalent (FTE) resources each, with an initial target aggregate of 15-20 FTE minimum. In this way, it's reasonable to expect the overall savings to cover the cost of establishing an RPA capability. But the human cost element isn't the only benefit; that approach often underestimates the return on investment (ROI).

Let's take customer onboarding as an example. Automating application processing, verification and account set-up processes across multiple legacy applications and teams can reduce cost and improve the customer experience by reducing the time taken from weeks to days or even hours. Insurers could automate claims processing for a large percentage of cases, reducing the timeline to hours or days, as opposed to weeks or months. In both of these cases, RPA provides a fast and cost-effective solution to transforming the customer experience with very limited impact or change to core platforms. In comparison, a traditional core platform integration or replacement program would impact many systems, and would be complex and expensive to implement.

Additional sources of benefit derive from areas of process improvement and standardization, for example:

- Processes where increased speed and timeliness would improve customer experience
- Processes with quality or consistency issues, or where there is a regulatory requirement for automation and control
- Changes and new features required for propositional enhancement that have been stuck on core platform development roadmaps for more than 12 months, or which are seen as prohibitively expensive to implement
- Processes which evolve on a monthly, quarterly or annual basis, and for a solution is required which can be adapted easily by business users

According to EY (2016a), to help companies target their investments, EY has developed an opportunity assessment framework taking all these factors into account. This helps organizations to assess operations across a given country or countries with analysis of the business case for robotic automation that each process offers. For insurers, the framework is "pre-loaded" with value chains illustrating the automation opportunities across life and pensions and general insurance. Using the framework enables companies to understand the targets for automation that will generate a given level of savings and shows the costs and ROI for every potential project.

4.5 How is Robotics deployed and what is the target operating model?

While Robotics is based on deployment of a software tool, it should not be treated as an IT integration. That approach generally leads to low adoption and reduced benefit. A far more effective approach is to imagine a virtual workforce, or a set of invisible robot hands, working from a task list and following documented processes. In a sense, this is comparable to the deployment of desktop tools: IT provides the platform, and business users make use of the software to add value. For Robotics, it should be business users (or staff very close to business departments) automating processes.

Within a large organization, the actual operating model will need to be scaled into a centralized, hybrid or distributed Robotics capability, but the principle of keeping ownership and control for process automation close to business users and departments is key to successful adoption, and for protection of business agility.

4.6 Robots and people

We now go back to the central theme we mentioned in the introduction. Robots are a highly flexible workforce that can seamlessly move from any defined task to any other to meet business needs, at the same time freeing people from routine tasks and allowing people to work on more intellectually and emotionally interesting tasks. What robots are not intrinsically able to do, however, is to exercise subjective judgement, to build empathy or support customers' emotional needs. They are not able to handle situations that are new and different from the processes prescribed to them. In this sense, they are not a replacement for people.

The real benefits come from the combination of people, core platforms and robotics so that:

- Core platforms support core data records and automate highest value processes.
- Robotics runs all the repetitive, standardized processes across separated core platforms, and one-off high-volume processes or rapidly evolving processes which are costly to automate within core platforms.
- People focus on adding value through strategy, building deep customer relationships, managing exceptions, driving change and continuous improvement, and low-frequency activities that are not cost-effective to automate.

In a sense, this is "taking the robot out of the person";

stopping asking people to perform tasks that people are bad at (repetitive, high-volume activities), so they can focus on what they are good at, reducing cost, improving quality and improving productivity.

In many instances, we see this enabling a business to run a better service with a reduced headcount, but in many others it can simply free people to accelerate strategic change and to enhance service and productivity.

5. Robotics for insurance

We now briefly look at the potential benefits of RPA, AI and drones for the insurance industry. A similar analysis has been presented in Cranfield and White (2016). We may begin by looking at the potential benefits of RPA and AI, or cognitive computing, for insurance. A quick list, overlapping with our previous analysis above, would suggest reduced costs for operations, possibility to offer new services, bespoke products for individuals, fraud detection and prevention, and improved risk assessment accuracy. A few of these possibilities are still tentative right now and depend crucially on a rapid advancement of AI.

5.1 RPA in insurance

As far as RPA is concerned, we already discussed the general benefits and implementation issues for RPA above. RPA is already a reality for insurance, and most of the general discussion we had earlier extends straightforwardly to insurance. RPA benefits for insurance include the reduction of a claims documents processing team and of costs more generally. Cranfield and White (2016) explain how an insurance claims outsourcing and loss adjusting firm managed to implement RPA, leading to a team of just four people processing around 3,000 claims documents a day. Without RPA, running a similar service would involve a team up to 300% larger. An idea of the kind of benefits that can be obtained via these processes has also been given by Guttridge (2015), as reported in Cranfield and White (2016), where it is pointed out that in less than two years 10 automated processes within the insurance business had been introduced. This led to processing time reduction, including one process by over 90%, uninterrupted operations with multi-skilled robots working on processes 24 hours a day, seven days a week. Automation allowed to free resources who worked on customer focused tasks. Another important benefit has been the lack of human errors in processes.

5.2 AI/Cognitive computing

Insurance applications such as bespoke products for individual clients would require an intelligent virtual agent/broker and a high degree of cognitive computing, with the caveats we presented in the introduction. It is not really clear whether machines will attain human-level interaction capability in the next few years. Optimists say we already have the technology that is needed for this, but the reality is that human-level interaction is still quite limited. As we observed in the introduction, Douglas Hofstadter (Herkewitz 2014) argues that popular cutting-edge vocal applications and translation/game-playing programs that are routinely exalted by the press and commentators as proof that AI is advancing, do not contain any real AI. We will have to wait and see if the technology really attains credible human interaction capabilities. When this happens, we could indeed have personal bespoke virtual brokers for tailored life and car driving insurance policies, for example, with an enlargement of the insurers' services to a much broader population and for a much broader range of risks. Another area where AI could be used, potentially, is on claims validation. While RPA can considerably simplify the operations around claims management, the approval of a claim still requires judgement and evaluations beyond the RPA grasp. In this sense a sufficiently advanced AI, having access to the claim-related data via drones, sensors or preferred news channels, could pre-validate or pre-approve claims by verifying the claimant information and data, potentially using drones if further investigation is needed. We will introduce drones and sensors below. Another application of AI to insurance could concern customer services and call centers: both could benefit from an AI approach once AI reaches a sufficiently advanced level. A hybrid approach could also be used: an AI system augmented with human intervention when needed. AI algorithms could also use social data to design fraud indicators that could predict to some extent the risk of a fraud from a given entity. Currently, machine learning algorithms are being used for fraud detection, see for example Guha et al (2015). As AI advances, these algorithms could attain higher predictive power and could become crucial in the management of fraud risk.

5.3 Drones/Sensors

Drones are vehicles that can move with a degree of autonomy. The typical drone is an unmanned aerial vehicle (UAV), namely an aircraft that does not have a human pilot aboard. It may be piloted at a distance by a human via remote control, or it may be fully/partly autonomous via an internal computer. Although drones originated for military applications, to deal with situations that may be too dangerous for humans, they are currently deployed also for civil usage, typically for data collection, aerial photography and agriculture. A possible use for insurers would be a dangerous site inspection for claim validation, as we hinted above. As regards sensors, they are devices that can be used to assess the behavior of insureds in relation to the risk being insured. Meek (2014) presents the important example of a sensor device that can be connected to a car port to measure and send signals on the car braking, turns, acceleration, and what time of day the insured is driving. The sensor device uploads the related data to the relevant company, which can use the data to rate drivers and offer a potential discount incentivizing safe drivers. The data on speed and location may not be collected, although they may be made available to the insureds. More generally, drones and sensors offer a number of opportunities and challenges (EY 2016b, Johnson 2014). We already considered the use of drones for claim validation above. Similarly, sensors would measure the insured person/property/vehicle risk-sensitive parameters, allowing the insurance company to tailor the insurance offer to the specific client risks, and verifying that the risk profile the client has in mind corresponds to the actual risks measured in reality. Sensors could also create a positive feedback effect on clients. A client who is aware that their car or property contains a number of sensors will be more careful in driving and managing the property, being aware that sensors will record a number of parameters. Speed excess with a car is less likely if the insured person knows a sensor is present in the car, and that their next insurance premium could increase in case of risky behaviour. The whole area of usage-based insurance is based on the possibility to maintain and improve a sensors-based approach. However, it is the combination with AI that could make sensors and drones really revolutionary. The possibility to automate evaluation and judgement on claims and policies based on drone and sensors collected data would extend the sensors-based insurance approach to a much broader base, with potentially lower premia for clients and reduction in risk for insurers. Given current limitations of AI this is still tentative, but it is definitely an area where insurers are investing relevant resources (EY 2016b).

6. Conclusions

In this paper we highlighted the current challenges and opportunities in applications of Robotics to financial services and to insurance in particular. Combined RPA and software approaches have been already implemented with considerable benefits in cost reduction and efficiency, and we highlighted the general benefits of RPA and the related implementation challenges in detail. More advanced AI applications depend on the general advancements of AI, and human-level interaction agents are not there as yet. Nonetheless, we can foresee the great potential for these applications and have discussed some initial examples.

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