The future of professional work: Will you be replaced or will you be sitting next to a robot?

In this article Ian Herbert and Aravindhan Dhayalan from Loughborough University and automation specialist Andy Scott, take on the myths to present a vision of what the future might look like in lights-out, driven decision-making environment.

There has been much talk about the use of robotics within professional functions such as finance, HR, procurement, etc especially when change is driven by the shared services model. This article explores the often overlapping concepts of work automation and robotic technology before considering the possibilities for transforming the way professional work might be carried out in future.

Introduction

Once the domain of science fiction and then advanced manufacturing, robotic process automation (RPA) is rapidly becoming 'business as usual' in a wide range of service sectors from health care to transport & logistics. Not surprisingly, there is a lot of hype, both in terms of our relationship with 'humanoid' machines and the likely extent of job losses. The main assumption is that it will be the low-level jobs that disappear first, although this assumes (perhaps mistakenly) that automation will be based on how are currently performed and the context of the present workplace. Alternatively, our research suggests that new technology has the power to disrupt work and the way in which work is performed and lead to fundamental change in the underlying service delivery proposition; in some cases even in the established business model. A good example of how a combination of new technologies can fundamentally challenge a well-established business sector is the new approach to taxi services being provided by companies such as Uber and Hailo. The next section will explain the basic ideas and the possibilities of disruption.
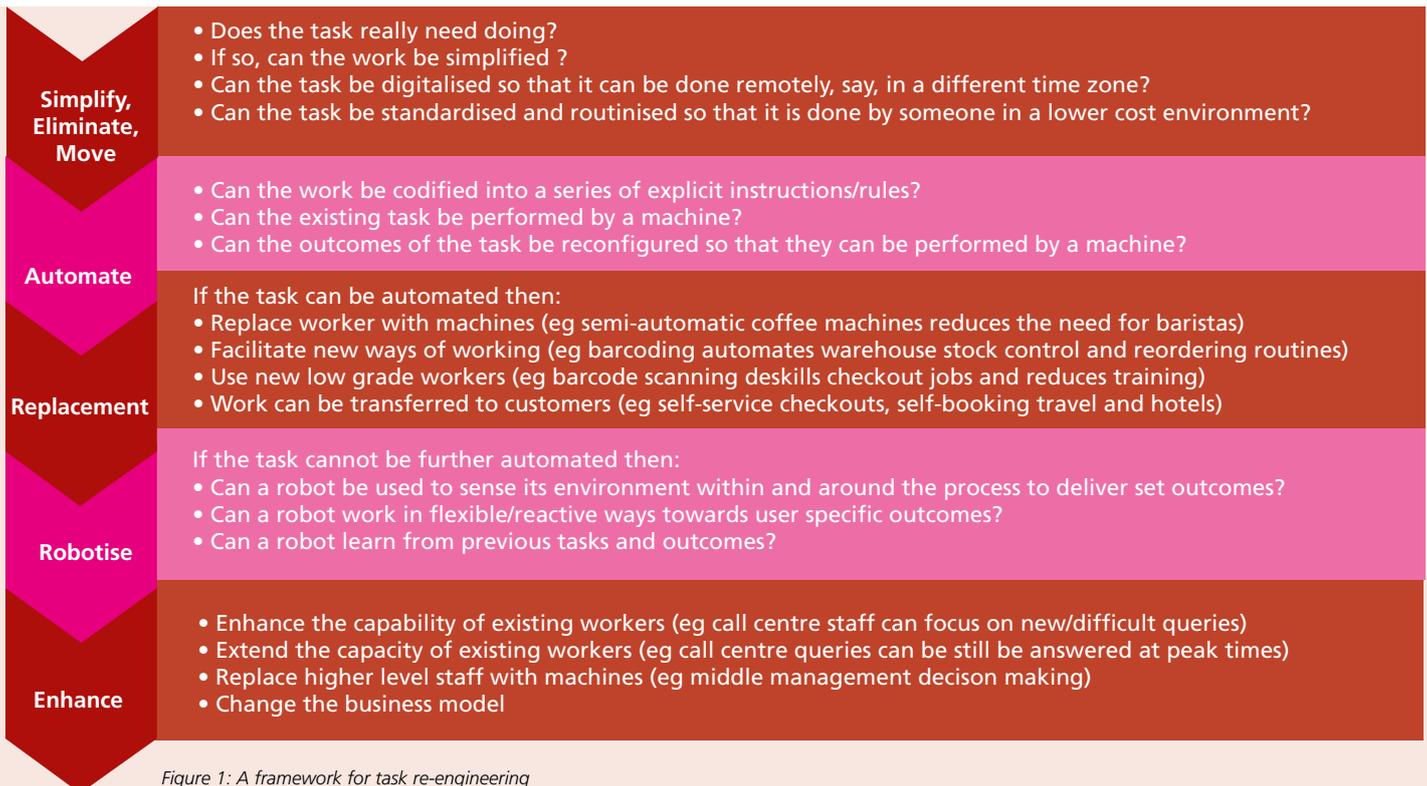
Simplify, Eliminate, Move	• Does the task really need doing? • If so, can the work be simplified ? • Can the task be digitalised so that it can be done remotely, say, in a different time zone? • Can the task be standardised and routinised so that it is done by someone in a lower cost environment?
Automate	• Can the work be codified into a series of explicit instructions/rules? • Can the existing task be performed by a machine? • Can the outcomes of the task be reconfigured so that they can be performed by a machine?
Replacement	If the task can be automated then: • Replace worker with machines (eg semi-automatic coffee machines reduces the need for baristas) • Facilitate new ways of working (eg barcoding automates warehouse stock control and reordering routines) • Use new low grade workers (eg barcode scanning deskills checkout jobs and reduces training) • Work can be transferred to customers (eg self-service checkouts, self-booking travel and hotels)
Robotise	If the task cannot be further automated then: • Can a robot be used to sense its environment within and around the process to deliver set outcomes? • Can a robot work in flexible/reactive ways towards user specific outcomes? • Can a robot learn from previous tasks and outcomes?
Enhance	• Enhance the capability of existing workers (eg call centre staff can focus on new/difficult queries) • Extend the capacity of existing workers (eg call centre queries can be still be answered at peak times) • Replace higher level staff with machines (eg middle management decison making) • Change the business model

Figure 1: A framework for task re-engineering

Automation and/or robotics

There is a considerable overlap between the concepts of automation and robotics. One way of distinguishing between the two is to see automation as a largely technical capability, focused on replacing human mechanical actions. On the other hand, robots can tackle relatively cognitive tasks which require the capability to sense the surrounding environment and react flexibly towards an overall outcome. As an example, a satellite navigation system automates the process of a navigator, reading out a set of directions along the route. But if you miss the turn the system suggests corrective action. If the route is blocked unexpectedly, say, by roadworks or traffic jams, then the system will suggest an alternative route to the original destination.

Both automation and robotics can consist to a greater or lesser extent on combinations of software and hardware. Satellite navigation is principally about the processing of data from four sources; the motorist, the preloaded map data, the satellite positioning system and the environment ahead of the journey. These are continually combined into real-time advice by the software of the operating programme. By contrast, the type of 'robots' typical in car factories is principally hardware devices that have been programmed to carry out a relatively limited series of operations on a certain model or model(s) of vehicle. We tend to call these mechanical arms 'robots' because we can see them and they tend to be hugely expensive, but they are more akin to advanced automation, whereas in-car navigation systems, whilst cheap and portable, are more accurately robotic as they can make sense of a dynamic environment and interact with humans as appropriate.

The manufacturing robot replaces repetitive human labour, whereas navigation systems augment human endeavour (see Davenport and Kirby, 2015).

Figure 1 takes a wider look at automation and robotics by first challenging whether the task needs to be done that way or even done at all?

We will now apply the framework to the process of getting to the office by driving a car

Eliminate – An alternative to driving might be to call a taxi (frees time for reading for the cash rich/time poor executive). Car sharing saves some cost but compromises flexibility. Alternatively, we might avoid the need to travel altogether by working from home.

Automate – If driving, then an automated transmission system (hardware) will automatically select the correct gear and change gears, maybe 50-100 times on journey of even just a few miles (reduces tiredness or enables driving, say, if you have a broken leg).

Replacement – In the vehicle analogy, drivers cannot be fully replaced at the automation stage, because driving is essentially a cognitive process. However, advanced automation might be able to help with the tricky job of steering into an otherwise tight car parking space at the office. An on-board robot might do the 'clever' bit of sensing the environment and, planning a path but critical tasks, deciding when/where to park and then safely applying the accelerator and the brakes is down to the driver.

Robotise – Satellite navigation systems enhance the driver experience and allow less experienced (navigationally) drivers to get to new destinations. When combined with mobile phone technology it can also allow a new business model, for example, the Uber taxi model. This allows a new workforce of self-employed drivers who can operate without the normal requisite years of experience in a particular locale. Self-service and automatic billing systems augment the driver operations to provide an otherwise 'lights-out' system. Just think of all the data that the 'system' is capturing about journeys and customers? That could be sold to city authorities to plan future transport strategy in real-time to signal traffic snarl-ups.

Augment (present human tasks) – There are now adaptive cruise

control systems that will maintain a set distance from the vehicle in front, not only reducing fatigue, but potentially enhancing safety. In the future this form of human augmentation may be a hybrid form of driverless vehicle when road conditions are not suitable for driverless vehicles. Those people that argue that the drivers of 40-ton vehicles will always be safe from robotisation may have a point to some extent, but much bigger trucks are already operating driverless in some quarries, and many people might be surprised to know that robot lorries are already running on UK roads. The key here again is 'augmentation' not 'replacement' of human labour. Lorry 'platoons' can have up to ten vehicles robotically following a lead unit with a driver. Close 'virtual coupling' reduces wind resistance and allows the following 'drivers' to rest/sleep until they get to their allocated motorway exit, when human drivers can perform all of the more complex operations involved in the 'last mile' of the journey. This is a good example of how concerns about labour losses might be balanced by positive benefits for the environment?

New business models (change the ground rules) – The ultimate robot is the 'driverless' vehicle (eg Google, Bezo and similar prototypes). Once programmed with a destination a car can drive itself by sensing its immediate road environment (including other cars) in conjunction with other data such as satellite data on road and travel conditions. These cars will also have the ability to learn from their environment and thus, optimise regular journeys and communicate with other driverless cars. Whilst, the obvious advantage is that it frees driver time for relaxing, thinking and working there are other important advantages that will create new business models around driving. For example, city parking will change when cars can drive themselves to the outskirts ready for recall; some parking lots will close, new ones will open. It will also enable 'driving' without skill or training. If the family car is able to do the school run once it has dropped mum and dad off at their respective workplaces, then family career planning might have new possibilities and perhaps the two car family is no longer the norm?

A further new business model might be to use driverless vehicles as the basis for the self-drive, casual hire, car system that operates in Berlin. This might one day be another level of Uber? In a co-ordinated planning system, a number of cars might drive themselves back to popular pickup places at different times during the day to optimise traffic flows, eg to railway stations in the morning and back to workplace areas in the afternoon. For those sceptics who think that driverless vehicles will never work with, say, European traffic islands, there are already examples of how environmental limitations can be overcome. In Milton Keynes (UK), there is a pilot programme involving special two-seater vehicles driving on the pavements.

The future of management work

The point we are making is that automating routine tasks and applying robotic technology to more cognitive or less routine tasks has limitations if only in terms of cost versus the benefits, however, there are new possibilities for new ways of human working and new business models IF adaptive changes are made in the operating environment. The big wins will occur as robotics and automation are combined together (robotic process automation).

Predicting the future in any detail is difficult. For example, it has been assumed traditionally that it is low level, repetitive, jobs that will automated and unemployment will occur at the bottom of the labour market. But, the point about the self-parking cars is that

rather than being 'mundane' low-level jobs that are the target for robotics, it may be the more cognitively demanding, middle-level jobs (which require skill training and practical experience) that are reconfigured into lower level jobs?

In the 1970s automatic car wash stations were a visible sign of progress on the high street. Forty years later, many are closing and being replaced with groups of workers operating on land vacated by closing bars and petrol stations.

It may be that even those jobs that require experienced middle management judgment may be among the early casualities. We are now starting to see sophisticated algorithms being able to make trading decisions in fast moving financial markets. The principle here is that the robot doesn't have to be better than the best trader, it just has to be at least as good as the average but it can do things cheaper and quicker and without getting fatigued or needing holidays.

Even basic applications of self-tuning algorithms are starting to shape new business models such as automated reservation systems. These lights-outs processes can handle all aspects of routine customer administration and set prices dynamically for air/bus/rail tickets and for online retailers like Alibaba, Amazon, eBay etc. Online retailers take the process a stage further by employing sophisticated algorithms which automatically serve up appropriate suggestions to customers. Such automation tools mimic the actions of a 'human store retailer', ie when a customer comes in they evaluate the customer's background and stated preferences before making sensible suggestions on what products a particular customer might be interested in, noting any opportunities for upselling.

RPA needs to be seen as a part of longer term journey towards lights-out processing, which is first enabled by total digitalisation, sensible self-service systems and appropriate standardisation - all of which may create the possibilities for automation to: eliminate manual operations, enhance present operations, augment information flows and management decision making capability, and/or provide further options for robotic management and decision making.

It is the ability to respond to situations which enables 'computer code' to act in a human manner in terms of decision-making capabilities. This is what we classify as a robotics process even though the system is neither, anamorphic (with arms legs, head, etc) nor limited to slavishly following predetermined instructions in a dumb manner.

Robotic computer programmes are in a position to replace many of the decisions that middle managers used to make (with management accounting support). For example, in the hotel sector, making decisions such as – how to optimise occupancy versus yield? short-term and long-term? what prices to charge? what promotions to run? what discounts to give to frequent guests? how to balance cash flows? etc, etc. But, crucially it is the system that makes decisions about how and when to signal performance exceptions and suggest further decision making opportunities to management.

Whilst, all this activity would be done traditionally by experienced managers, in a digital world driven by internet self-service, most of these decisions can now be performed by robotic software that learns from past experience and interacts with wider information sources on a 24/7/365 basis. For example, searching for upcoming sports and entertainment events in the locality – eg will the local football team be playing home or away? What twitter activity is happening around the hotel and its neighbourhood?

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What is the weather forecast? In addition, web crawling robots could be checking out local hotel best rates? This might seem science fiction but recent stock market falls have exposed the significant amount of robotic trading that is being done each day.

In the next section Andy Scott, an independent advisor on financial automation, talks about how finance and accounting work is being reshaped by robotic process automation.

Q: Andy, what trends do you see in accounting?
A: There's an incredible amount happening, there's also a lot of further possibilities both in terms of financial and management accounting but I'll answer the question by saying that for most organisations the new mantra is simplification, standardisation, compliance and unbundling.

The first two are driven by the need to cut costs and improve transparency so as to improve central control and the way in which individual business units can work together by harmonising protocols, procedures and systems. Compliance is driven by higher governance expectations on the part of regulators and shareholders. Nowadays, simply reconciling accounts at balance level is not acceptable – firms have to demonstrate that they have tight controls in place to ensure the integrity of their financial operations. These controls have to drill down to transaction level, and extend to touch all points of a corporation's financial tentacles.

By unbundling, I mean that organisations recognise the benefits of moving back-office functions like accounting to varying degrees of automation shared service centres (SSCs) and/or the third-party business process outsourcers (BPO) and this development is enabling a level of rapid change that was inconceivable perhaps only 20 years ago.

Q. You seem to be highlighting a greater concern for process control
A. Implementation of more compliance controls is a significant overhead to business, and does not directly increase productivity or efficiency in the core business, although it could be argued that lower corporate risk lowers the cost of capital. What the changes have led to is a new focus on financial process improvement and standardisation. Both standardisation of IT systems and standardisation of human behaviour – that is where the business

process improvement and financial transformation expertise is key. They improve and standardise the process, then blend the human and automation elements.

Finance functions expanded significantly in the 1990s when the imperative was to cope with the complexity being caused by decentralisation. Important lessons have been learnt. Now firms want the best of both worlds, nimble, empowered, business units supported by a transparent, rock, solid, corporate systems platform. Now that's a tough call. I guess that was a long answer?

Q: Not at all, you nicely captured some big issues. How do you see the opportunities for robotic process automation in this new landscape?
A. 2015 saw a significant increase in the showcasing of robotics on the finance shared service and outsourcing circuit. An extension of the 'standardise ERP and human behaviour' theme; programme a computer to retrieve data, enter it into the ERP system, and then work all the hours, and days available, irrespective of where the clocks are. Never take a sick day or a holiday or make a mistake. Now that destroys the labour arbitrage arguments completely and keeps a close eye on which BPO providers are technically evolving and which are not.

There are some great robotics companies beginning to shine through, and it is fantastic to hear how the innovative financial leaders in some of the world's leading organisations are getting on with implementation of their robotic process automation projects. But before we jump on the robotics gravy train, let us look back at how well we really did in the standardisation age.

Of course, there are limitations to human processing, studies estimate that 90% of errors or accidents are caused by human error. And 'yes' standardising on a single ERP solution vastly reduces the opportunity for error. But we should not forget whom we seek to benefit from our continuous improvement. And how can we standardise on automation of a process or a task that an ERP system does not do very well, if at all?

The research shows that only 5% of organisations have successfully filled this gap. However, in the next 3-4 years there will be a significant (40%) number of companies that will automate the bridging of this gap. Of this 40%, it is estimated that around a fifth of companies will go to their ERP providers to attempt to build the bridge, or have their own internal resources develop an in-house solution. The vast majority will implement what is being increasingly referred to as 'enhanced financial control automation'. This involves the integrated components of rules-based transaction matching from multiple sources; an account reconciliation solution (giving full visibility of all accounts as they go through the attestation process) and a financial workflow tool to give real-time visibility of truly compliant progress in the financial close process, and internal controls. Standardising human behaviour and making it easy for people to do what you want them to do, and difficult to deviate from the compliance path a business, its auditors and the authorities have determined.

Standardising automation by providing a purpose built solution suite for financial close, irrespective of which ERP system or systems an organisation chooses to deploy.

Q: But how might RPA actually work in finance? We hear a lot of talk but very little detail.
A: Let's take a relatively straightforward accounting task, matching between two sources, say, the cash book and the bank statement, or the good received notes and purchase orders. These are essential

rules-based processes. They should be automatic but of course in real life things are never that straightforward. For example, can a purchase order be classed as complete if the total delivered was 5kg short? The answer of course it depends. On 10,000kg of bulk cement the order is complete, if 20kg of titanium were required then the order is classed as 'outstanding'.

Q: So how can automation work?
A: First we need to view this as different levels of; automation, exceptions, human intervention and control.

Say, there are 10,000 sets of transactions to be matched. 80% might be matched automatically at the first pass, 20% might be rejected but 2000 is still a lot of queries for clerks to work through. Let's tackle the problem in a systematic manner.

1. Simplify the system – perhaps the base documents are complicated, or the instructions to suppliers are not straightforward? Perhaps buyers are ordering one specification but doing a 'handshake' with suppliers to deliver a slightly lower quality for a loyalty discount. Also, rationalise the number of suppliers.

2. Standardise the system - perhaps each division has slightly different PO formats and these get confused when they use the same suppliers? Perhaps the US division uses different measures?

3. Eliminate tasks that do not need to be done if the systems have improved, eg move from 3-way to 2-way matching.

4. Digitise all source documents and work with all suppliers to only use EDI documents. Perhaps handwriting issues cause a percentage of problems and circulating manual paperwork for approval causes delays and incomplete information.

5. Automate the exception handling routines. Perhaps only 1000 exceptions (10%) remain after steps 1 to 3, then a set of further rules and routines can be established of which software might be able to handle 80%? For example, is the difference less than 1%. Is the cumulative difference across that supplier's deliveries over the past four weeks less than 0.5%?

6. Augment the clerks' ability to resolve the remaining exceptions by routing unresolved issues to specialist clerks or making decisions to automatically send back queries to purchasing (say, if the problem involves a new supplier? Or else, a common issue with one supplier?) OR to the purchasing division if the shortage needs to also trigger a chase for the remaining goods to the supplier).

7. Robotise the process to deal with, say, 80% of the remaining difficult queries. For example, by a robot learning from a skilled clerk how actual outstanding queries are resolved. Data analytics can further optimise the system and robot software can learn automatically from this.

The point about the process above is that it is a constant circle of action, feedback and learning. Steady-state never last long, suppliers will change; group companies will be acquired and sold, etc.

By scheduling automatic download of data from a variety of sources in finance, applying business rules to automatically match transactions; deploying analytics, artificial intelligence, cognitive or human learning to enhance matching all means that our accountant is now arriving at work knowing what doesn't meet the rules, and properly add value by managing and recording details on exceptions. That level of RPA has been going on for several decades in some organisations.

Q: So it's like a pyramid approach?
A: Yes – though I like to think of a Prism approach – where we think of the various dimensions of our evolutionary path in finance, and the impact and implications of innovation on its critical foundations. As we all know – process, people, governance and technology are the four main pillars of financial transformation – harmonising these to the greater good of the pyramid!

Q: In your opinion, what might the future of work look like?
A: The RPA world looks like it will grow steadily over the next few years. The robot providers will continue to enhance the way they automate standardised and repeatable tasks. The sound of the "BUZZ" will get a little louder, then it will quieten as the robot becomes just another option in the way things are done. The accountants will do less repetitive, number-crunching tasks, and increasingly focus on the value-add contributions of their profession. BPO service providers will need to assess the appropriate levels of automation which they need to offer in their client solutions. And the shared service centre leaders also need to take a step back from their standardisation briefs to look at what tools best deliver which jobs.

Conclusion
For business partnering such as management accounting we suggest that to balance the challenges, there are significant opportunities in working towards a vision of 'lights out processing' which then enables 'data–driven decision making'. However, we also caution that without a carefully thought-out and co-ordinated strategy at an organisation level, there is a significant risk that opportunities for new business models will not be grasped. For management accountants, there is a risk that many present jobs will be eliminated unless they can create new ways of leveraging the new data rich environment that is rapidly enabling a new approach to management information control and decision making.

Reference
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About the authors
Ian Herbert and Aravindhan Dhayalan are with the Centre for Global Sourcing and Services at the School of Business and Economics, Loughborough University.

Andy Scott is launching a new venture specialising in financial process automation, following several years in business development and channel management for leading automation providers, including Adra Limited.