Technological Unemployment: Implications of automation in Retail Banking and Small Accounting Firms

A dissertation submitted in partial fulfilment of the requirements for the degree of Bachelor of Science (Honours) in Business Information Systems.

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Declaration

I hereby declare that this dissertation entitled Technological Unemployment: Implications of automation in Branch Banking and Small Accounting Firms is entirely my own work (except when cited otherwise), and it has never been submitted nor is it currently being submitted for any other degree.

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Abstract

This dissertation explores whether automation poses significant risks to future job practices and employment in accounting and retail banking within 10 years, and whether any measures exist to limit the negative impact and benefit from a technological shift in labour. Using a questionnaire to survey 54 participants distributed between two small accounting firms and two bank branches, statistical analysis and ground theory found that jobs most susceptible to automation were repetitive in nature, with accountants and retail bank employees expected to gain exceptional soft skills and widespread versatility. Marketing, customer service, human resources and high skill managerial roles were deemed least susceptible, while bank tellers, accountants and auditors face the most probability of automation. Established literature in the field was used to validate the findings of this study.

Emphasis on education will be a necessary factor in preparing employees to find suitable positions. Within a decade, advancing technology will force bank branches to adopt an approach which cuts operational costs by automating repetitive tasks, and also encourages development of a sustainable competitive advantage of dedicated customer service. Small accounting firms will be expected to demonstrate their comparative advantage over software by broadening their expertise to include impactful technologies such as big data and cloud services. The progressive movement towards efficient banking means that failure to adopt new technology will limit an organisation’s success.

The information detailed will be useful because it gives an insight into future prospects for different jobs within retail banking and accounting, with an indication of skills that will be in demand. Those who may benefit from this study include making career decisions in finance and accounting, but also individuals who shape the labour market including educators, governments, policy makers and employers.

**Keywords:** Automation, Technological Unemployment, Retail Banking, Accounting, Artificial Intelligence
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1.0 Introduction

1.1 Title
Technological Unemployment: Implications of automation in branch banking and small accounting firms.

1.2 Introduction
This chapter will discuss the objectives and research questions posed by this research project. It will also outline the background of the research area, the motivational factors involved in choosing this topic and the aim of the dissertation.

1.3 Background
Artificial intelligence has been at the forefront of the modern day workplace advancement spanning a variety of industries including Finance and Accounting. However, it is important to understand the implications of continuous improvement and implementation of artificial intelligence such as machine learning and expert systems, to allow employees to plan accordingly and anticipate change in the future. According to Alan Tovey (2014) recent studies show that ten million British jobs could potentially be replaced by advanced artificial intelligence within two decades, eliminating around one in three roles. This presents a rather worrying outlook.

Several studies have been undertaken to understand the relationship between technology and unemployment.

1.4 Aim
To investigate the negative and positive implications of artificial intelligence and automation in finance (branch banking) and accounting (small accounting firms), and arrive at a conclusion based on these findings. ¹

1.4.1 Research Questions
1. Does the advancement of technology pose significant risks to future job practices and employment in small accounting and finance institutions?
2. Are there any measures which can be taken to prevent any such risks?

¹ Throughout the process of this dissertation, an emphasis on Branch Banking and small accounting firms will be adopted, and not necessarily corporate banking, investment banking etc....
1.4.2 Objective

1. To identify the work tasks which rely heavily on technology in a selection of companies using questionnaires.

2. To assess the results and compare with literature, examining possible trends showing gradual replacement of employees with automation.

3. To produce a well-informed prediction of the employment outlook within 10 years in branch banking and small accounting firms using the research found.

1.5 Motivation

As a final year university student, the researcher is preparing to enter the industry of Finance. Therefore, he is by nature weary of the potential risks faced in the future post-graduation, and feels it is within his best interest to further understand how to stay resistant to unemployment due to the progressive automation of office work. As Martin Ford (2009) suggests in his book Lights in The Tunnel, due to the advancements of Artificial Intelligence and other such technologies, automation could pose a disproportionate impact on entry level positions, and with 189,000 job cuts over five years between Lloyds, HSBC and RBS combined (Ford, 2015), the outlook currently seems questionable.

It has become a regular occurrence to see publications online reporting branch closures nationwide, which has prompted distress among many over fears of long term unemployment brought by technology. This opinion can often be misguided, and sometimes fails to contextualise all contributing factors (both long term and short term), as well as observing previous trends to make sense of the information. On the other hand, other publications will tend to oversimplify the discussion, citing an apparent lack of cognitive function with automation, failing to realise the notable advancements that technology has undergone. It can be confusing to parse through all this conflicting information to find a more succinct understanding of automation and its effect in the finance and accounting industries. This is therefore the purpose for this dissertation: to understand relationship between technology and unemployment based purely on quantifiable and observable information.

Initially, it is understandable to assume that automation of certain work roles is beneficial, given the advantages which will be further investigated. It is also possible that the opposite may be true, and that this time is different due to the level of computing power available, and past trends may not apply. However, considerations of unemployment possibilities in the future due to increased automation will be analysed respectively, using literature arguing different arguments to gain a better understanding of the issue.

The researcher is hopeful, that throughout this project, a well-informed understanding of core trends for automation in the workforce will be formulated, which will help to navigate towards an intended career path into the financial industry methodically, eliminating the risk of becoming employed into a role which is condemned to become automated.
1.6 Research Approach
Based on research gathered from Saunders’ Research Onion (2009:108) mainly quantitative methods will be utilised as a means for gathering information. A deductive pragmatic approach will be adopted.

2.0 Literature Review

2.1 Introduction
A key feature of the Industrial Revolution, was the direct benefit for both producers and consumers in the long run. The digital age presents a different problem however, with the benefits mainly in favour of consumers (Frey and Osborne, 2014). Deloitte, one of the largest professional services network carried out a survey on 100 London based organisations exploring new jobs that will be created, the skills required and the implications for current working practices as part of their London Features study in 2014. These results showed that “35% of UK jobs, and 30% in London, are at high risk of automation over the next two decades” (2014:7). This concept is considered Technological Unemployment.

2.2 Technological Unemployment
Technological unemployment is unemployment brought forward as a result of technological change and/or development as a means of economizing labour. The origins of the term have been extensively cited back to the British economist John Maynard Keynes (1963:359). It is argued that effects of (technological) unemployment affect society greatly, and not just those unable to find sustainable unemployment. As reported by Marchant et al (2014), it destabilises economies since the unemployed cannot participate as consumers. Despite this, (long term) technological unemployment remains a widely disputed concept.

Many arguments exist against current modelling of the effects of technology on employment, suggesting that markets respond differently to neutral and investment specific shocks, eventually balancing out productivity and employment (Canova et al. 2013; Atkinson and Miller, 2013). In this, then perhaps it is possible to theorises the current state of variable factors such as education and government policies imply that as time progresses, the recovery period from these shocks gradually increases.

Other economist are entirely dismissive of technological unemployment and cite the Luddite Fallacy concept.
2.3 Luddite Fallacy
Economising labour through automation has always been met with criticism, mainly fuelled by the fear of long term mass unemployment. This is now referred to by some as the Luddite fallacy. These 19th century textile workers feared that automated looms would provide an alternative to productivity with decreased human labour, resulting in mass unemployment. However, although automation temporarily made textile workers redundant, new jobs developed as a result. As outlined by Mokyr et al (2015), this technological progress resulted in jobs including accountants and mechanics to oversee the system, as well as product innovation, thereby creating entirely new sectors for the economy.

The Luddite Fallacy remains a basis for many to discredit the irrational fear of technology and its replacement of jobs. However, numerous professionals dispel this notion with criticism, and assert that technological unemployment is a serious threat which must be addressed (Ford, 2009)

In fact, a Pew Research by Aaron Smith and Janna Anderson (2014) surveyed 1,896 economists and technology professionals from several institutions including PayPal and European Union governments among others. They found a split opinion: 48 percent of respondents suggest that new technologies will displace more jobs (blue and white collar workers) than they would create by 2025. Most respondents felt that human ingenuity is expected to continue contributing to a rise in job creation. The results of this study alone highlight the difference of opinion with automation and its effect on employment.

One proponent of the idea that technological unemployment poses significant long term implications is Martin Ford, who claims that the Luddite fallacy is an outdated overview of the issue (2009). This claim holds relative value, considering the substantial advancements between technology’s limited abilities during the 19th century compared to what technology is capable of achieving in the 21st century. Furthermore, considering that economists have been inaccurate in predicting the full capabilities of technological advancement in the past, along with a significant difference in the growing spectrum of jobs between the 19th and 21st century essentially creating more opportunities for automation; this gives credit to his argument.

Ford has inspired several academic reviews. One of which is an Oxford University study by Carl Benedikt Frey and Michael A. Osborne (2012) which categorised 47 percent of total US employment as high risk, with associated occupations being automated in perhaps a decade or two. Automation is not a new concept in Finance and Accounting.
2.4 The Automated Teller Machine
A popular case study cited for technological unemployment and the consequences of automation is the advent of the Automated Teller Machine, as it represents a microcosm of arguments made regarding technological unemployment in general. According to James Bessen (2015), since its mainstream acceptance in the mid-1990s, the changes brought forward have never been entirely polarising.

Figure 2.1

(Bessen. 2015: 17)

As seen in figure 2.1, Bessen dispels the notion of long term technological unemployment, showing that rather than ATMs decimating the importance of bank tellers, the number of bank teller jobs did not decrease substantially. Rather, two key factors helped to preserve the importance of teller jobs:

1. ATMs reduced branch operating costs, thereby increasing employment opportunities for tellers. In addition, the quantity of tellers required to operate a branch in the average urban market fell “from 20 to 13 between 1988 and 2004” (2015:17). The response was to increase branch numbers to increase market share, with branch numbers increasing by 43 percent. Less bank tellers were necessary for individual branches, but more branches meant that tellers were still necessary.

2. The limitations of an automated system allow for only certain tasks to be automated. Therefore, the incomputable tasks create demand for capable employees. As banks continue to increase market shares, tellers remain an integral part of the “relationship banking team” (2015:17). Several in-branch customer needs (currently) cannot be handled by machines entirely, such as mortgage requests or opening savings and checking accounts. Forming personal relationship with customers can assist with selling additional financial services and products, in addition to branch promotion information.
It should be noted however that the trend of increase in branches is no longer being observed, with Timothy Edmonds (2015) reporting steady decline in the bank branch network for 30 years.

Regardless, skills required of bank tellers have shifted drastically from cash handling to an emphasis on human interaction. This leads to the consideration of whether automation does not replace human labour entirely, but reduces the need for human labour below full employment (Walker, 2014) by affecting skill demand to compensate for technological advancements.

2.5 Change in demand of skills

Bessen (2015) reports difficulties in recruitment due to a shortage of technical skill. Similarly, ManpowerGroup’s (2015) annual survey of 38,000 managers worldwide found that 35 percent reported difficulty hiring workers with necessary skills. A trend seems to be apparent. In Finance and Accounting, these skills would encompass the ability to understand specialised software, considering it is an ever-changing industry redeveloping new work practices to compensate for advancements in technology; exceptional cognitive and analytical abilities and sufficient communication skills among others.

Beaudry et al (2013) argue that skill demand is dependent on the stages of A.I adoption, reaching its peak during investment. While not many studies have been done to validate this, it seems reasonable. For example, in the early stages of implementing big data infrastructure, specialist technical skills will be sought after. Afterwards, however, analytical and logical reasoning skills will be needed to make sense of the information. This being said, skill supply does not always meet demand.

There are many possible explanations for a skill shortage; including economic shifts, labour market restructuring or decrease in skilled migrants, which according to Rienzo et al (2014) fell by 39% between 2011 to 2013. Furthermore, especially in a digital age, absent skills are often technology related and are acquired through experience, due the to the accessibility of necessary resources i.e. many specialised software and information systems utilised by corporations are bespoke, and even the best attempt at modelling them with off the shelf software will not guarantee competency.

Banks utilise bespoke systems to assist employees to carry out routine tasks. These include creating a customer’s bank account, cashing cheques and processing transactions. This also applies to many accounting firms which make use of specialised software to assist with auditing, payroll, tax returns and others. The selection of the system/software is largely dependent on the organisation.

A joint report by The Institute of Management Accountants and the Association of Chartered Certified Accountants (2013) predicts that finance and accounting professions will experience a 16% chance of total transformation, and a 53% chance of transformation to a great extent in the UK as a result of technology. The top technologies and their relative impact in towards the industry are seen in figure:
This information is necessary for professionals to internalise, and begin learning preparations for so as not to risk becoming unqualified when demand for competency with them rises.

In addition, one emerging technology to consider, is block chain technology to assist with security issues in banking services. This implies that the demand for technically adept employees will be sought after to understand the security implications, and implementation procedures of such technology.

Similarly, as retail marketing enters the digital market, this entails an increase in information unorganised customer information, essentially spiking an increase in analysts and cloud computing experts to support brand development.

These technologies create incentive for employees to embark on self-studying to remain informed on the current technical demands of the industry so as not to rely on potentially outdated resources. This is especially important for those applying for entry level positions into the industry, as competition is eminent and automation has become a prominent issue due to the relationship between entry level (low-middle wage) roles and automation.

2.6 Correlation between automation and low-medium skilled jobs

Technological change is mostly skill based, with Goldin and Katz (2008) drawing a correlation between increased demand for skills with technological advances raising productivity. Low technical skills generally translate into low-medium skilled jobs. This makes them a particularly exposed target for automation due to their perceived simplicity and repetitive nature.

To understand the areas where technological advancements in the branch banking and accounting are commonly utilised and where they are likely to occur in the future, it is important to investigate past trends. A main drive behind automation is cost effectiveness. This is why low and medium skilled workers are considered high risk, as it is within the best interest of companies to find cheap alternative methods to completing repetitive tasks to further maximise profit margins (Brown et al, 2015). One of these ways is to replace low skilled workers with automated processes. Data Entry Keyers are an example of this.
Kathryn Dill (2014) reports they experienced a 16% decline, with 43,000 employees losing their jobs during the 12 year period between 2002 and 2014: a seemingly negative result of automation.

However, going back to the idea that technology creates temporary unemployment but creates new opportunities in the future with different skills required, the growth of big data operations also created demand for medium skilled employees to interpret data during this period. Moreover, Market Research Analysts also added nearly 100,000 jobs, a 28% increase.

Given these trade-offs, the down fall lies in the issue of prediction. Economist are unable to accurately predict the sudden uptake and growth of technology and its effects on commercial adoption specifically (Walker, 2014). So understandably, this explains the complications which arise during economic transitions involving technological advancements, leaving many out of work and under skilled due to unpreparedness.

Considering that this occurred over a period of 12 years, the initial question posed was to investigate the implication in a decade. This case highlights that a significant amount of change can occur in a short amount of time.

Secretarial roles have also seen the effects of automation, showing steady decline in numbers (Frey and Osborne, 2013). These middle skill jobs have showed steady between 2000 and 2010. The job security they maintained was reduced by new software allowing administrators to field calls, arrange meetings and other secretarial duties. The result was that the secretarial roles thereafter were filled by technically skilled applicants with competence over the new prescribed software, and administrators were expected to be competent with utilising software which originally assisted secretaries with their duties, substantiating the argument of creation of opportunities due to automation.

The main reason for the low and medium skilled jobs being targeted with automation however, is due to the repetitive and systematic nature of the roles. Artificial Intelligence has allowed for advancements such as machine learning and expert systems which allows companies to use programs with the ability to learn and understand procedural techniques, and to apply them autonomously as required.

This is why it is considered unlikely that if technological unemployment is in fact an existing threat, high skilled jobs such as managerial roles will not be affected to the same degree, as in this current moment it is impossible to recreate software or automated processes with the ability to accurately compute several variable factors (often un-quantifiable) into decision making.

The Deloitte London Features study cited also emphasizes this correlation by stating that low paid jobs are eight times more likely to be replaced in London (2014).
This information further validates the 2013 Oxford University report (Frey and Osborne, 2013), which analyses the probability of computerisation based on different industries. The results showed that jobs within the management sector maintained a relatively low probability rating of 0 to 0.4.

Under this notion, it is argued that technology is, and will continue to create jobs for high skilled workers, while consequently reducing opportunities for the moderately skilled. As Ford highlights, this is the skill premium argument (2009). Here is where inequalities arise.

While theoretically, this creates a more competitive culture among employees, by increasing employment standards and creating a competitive economy: this is at the expense of fewer opportunities and income inequality. At this point, it is evident that the benefits and advantages of technological advancement are distributed unevenly, polarizing the work force with the high class benefiting most, and mostly low-middle class being impacted negatively (Ford, 2015; Autor, 2015).

This has been observed for decades, but is contested by Hsieh and Olken (2014), where they claim no hollowing out is observed using bimodal distribution. However, their study observed mainly low income developing countries, so it is not entirely dismissive of the concept in high income areas.

Organisations, depending on their resources, will adopt a range of approaches for automation. A foremost technological unemployment threat within artificial intelligence is machine learning and expert systems.

2.7 Machine Learning and Expert Systems

An automated system is a series of codes designed to carry out a set of predetermined tasks. Except in the case of machine learning, where pattern recognition and computational learning theory are used to predict and interpret data.

An industry which emphasises heavily on numerical values presents various opportunities to capitalize on identifying and manipulating familiar patterns. Repetitive patterns are the core mechanisms of machine learning and expert systems.

Reinforcement learning is the primary learning algorithm which poses the most potential for application in the industry, which entails machines that are trained to make decisions through exposure to a particular environment such as commercial banks or accounting firms: accumulating the necessary information to train itself continuously through trial and error (Marsland, 2015). The system learns by using information from past experience and attempts to capture the best possible knowledge to make accurate decisions.

This subset of artificial intelligence highlights the widespread advancement of data driven computing, which is a significant development from instruction driven computing comprising of fewer limitations and more application opportunities.

The advent of such systems is consistent with the notion that new technology creates niche opportunities for new jobs. For example, trade systems brought forward the demand for
experienced financial analysts to also become accustomed with the technical aspect of programming and data modelling in order to construct successful strategies to be implemented into these systems to discover profitable patterns.

One particular branch of machine learning which has been showing progressive advancement is deep learning (Andreopoulos & Tsotsos 2013; Marsland, S. 2015). This relies on smart algorithms to interpret key concepts in data by using multiple processing layers, and then adopts this information to self-learn problem solving techniques. The usefulness has already been observed, and pose serious contemplation of their applications in the next decade.

Software such as WorkFusion is already demonstrating deep learning functions in finance by managing executions of highly labour intensive projects, including allocating tasks and evaluating performance (Ford, 2015). The applications for this would be beneficial for productivity, since it can assume monitoring routine projects, and provide managers with more time to focus on other complex tasks.

Economist who reject the notion that machines could replace a substantial fraction of the work force often highlight the argument of comparative advantage (Ford, 2015). However, examples such as WorkFusion showcase machine learning’s versatile approach to problem solving, which raises significant implications for the job market, since adaptability, intellectual reasoning and cognitive capabilities were once comparative advantages in favour of human labour; all of which are no longer foreign to machines. As reiterated by Brynjolfsson and McAfee (2011) machines are slowly encroaching towards considerably human skills.

Through studying a record encompassing all related procedures of a particular work role, can it be easily learned to carry out the job by someone else based on these past activities? Furthermore, through basic repetition of tasks completed, could one similarly become proficient?

Ford (2015) believes these questions help define the probability of automation in a specified job role. Although this is a simplistic overview the underlying notion of it is repetitive tasks, which as previously stated, increases vulnerability of automation.

Another recent application of deep thinking, is the humanoid robotic bank teller NAO in Japan developed by SoftBank, which has been functioning in several branches since February 2015, and is anticipated to be fully adopted. This particular robot adds value, by providing key abilities which many a human bank teller cannot, such as proficiency in 19 languages and facial recognition based emotional intelligence. Adding value is a big factor.
2.8 Decision Support Systems
These are information systems which are programmed with the necessary information provided by programmers and experts of the industry, and apply this information accordingly to assist with problem solving. However, they are not without limitations. Bessen (2015) reiterates that computers can select stock portfolios, but financial advisors provide experience based assurance, especially when markets are down.

Similarly, accounting software can calculate basic budget distributions, but an accountant can investigate an individual/organisation’s spending behaviour, and correctly allocate budgets as appropriate. This implies that just because a portion of a job is seemingly computable, it does not necessarily mean it will be automated. It simply means that technology has the ability to do so.

Once again, these systems emphasize the view that technology is having a direct and indirect impact on an organisation’s requirements for a worker’s abilities to operate in unison with systems. Thereby not eliminating their roles entirely, but creating demand for these workers to adapt to the changing environment. The accounting sector has already observed the impact of these systems, with many accounting firms utilising specialist software such as QuickBooks and Sage One.

2.9 Advantages of Automation
2.9.1 Productivity
Campa (2014) suggests that high productivity coupled with minimal labour paid a minimum salary is the interest of every company.

As figure 2.2 depicts, productivity has been showing a steady increase, along with employment since 1947 despite brief moments of unemployment. Believers of technological unemployment argue that automation is causing more productivity with fewer workers.

Figure 2.3

2.9.2 Cost Effective
Saving money is a governing concept for organisations considering automation technologies, according to Brown (2015). In essence, automated systems require a one-time investment. In regards of human labour; employing a worker entails various expenses, including salary (including benefits and bonuses) safety programs (training) possible maternity leave, pension pay, dental and health insurance amongst other things. When these factors are taken into account, it is understandable why a business would aim to implement automation where possible, so as to optimize productivity while minimizing expenses.

2.9.3 Efficiency, accuracy and consistency
Automation increases accuracy standards to a higher degree due to the stringent set of procedures, essentially eliminating human error. Furthermore, it is important to note that these automated systems do not experience human related limitations such as sick days, fatigue, forgetfulness and instances of human error; suggesting that artificial intelligence offers a level of consistency and efficiency unmatched by human labour.

2.10 Disadvantages and limitations of automation

2.10.1 Lack of versatility
Automated systems or software functions on the basis of quantifiable information automating procedural activities using a series of calculations. This outlines a key limitation in automation of financial service roles. As previously stated this is the reason high skilled jobs and managerial roles are for the most part not considered to be high risk with automation.

Several factors must be considered within these roles that are not necessarily measurable, including decision making requiring outside factors to be considered including human interaction and intuition (Frey and Osborne, 2013). The majority of computerised processes are specialised to carry out certain protocol. This leaves little room for versatility.

As outlined in the Second Machine Age, computers are more than competent at following algorithm based rules, but this inherently implies that automation is less successful at pattern recognition in comparison to humans. One example suggested by Brynjolfsson et al (2014) is the concept of a mortgage request, where decisions are based on conditional if statements based on credit score and annual income.

This example shows that algorithms take into account the simplicity and broad aspects of a problem or a request, but similarly highlights the limitations of computerised processes to execute decisions based on limited knowledge. In this instance, it cannot be taken into account the various possible incomputable risk factors of the inability to pay back the amount requested in due time.
Therefore, this is the reason computerised software is used as part of a decision support system to aid with the preliminary information such as predicting payback rates, requiring professionals to incorporate their own intuition and apply a critical analysis of the situation at hand.

2.10.2 Unpredictable costs
Automation theoretically creates cost effective incentives. However, it does represent other costs which must be accounted for, that can offset the cost effectiveness (Ford, 2015). This includes research and development, which are essential if the business wishes to develop the system further in order to be capable of achieving more tasks efficiently.

Finances also have to be allocated for preventative maintenance costs, sometimes annually, or more frequently depending on the intensity of the system’s requirements and its importance within the office.

2.10.3 Interpersonal skills
Interactions between professionals and customers within the financial industry can be the key difference between a good or bad customer service experiences. Considering that strong customer focus is an approach actively being adopted by branch networks (Economist Intelligence Unit, 2015) this is important.

The rapid advancement of technology means that software is gradually becoming exposed to human activities which before were considered impractical to compute. Complex communication is one of them (Brynjolfsson and Mcafee, 2014).

Despite this progression towards computerised language processing, there is still a lot of work to be done before these can be industry approved alternatives. Cases such as Siri show that that natural language processing is still far from perfect.

This key differentiation between human and computers remains a primary argument against long term technological unemployment, and this is reiterated by Bessen (2015) as he highlights that human qualities will remain crucial in global commerce despite automation.

The importance of interpersonal relatability will vary depending on the department in question. For example, it is unlikely that automated software could encompass the intricacies of personal and empathetic reasoning of human resources within a financial organisation to resolve employee conflict and issues, since each case is inherently unique, and therefore requires rational thinking from trained professionals guided by their experience.

In this sense, a decision support system could be utilised which incorporates all the familiar human resources issues dealt with such as discrimination and handling basic employee queries with past case studies gathered from nationwide or organisation wide observation to formulate basic assistance for human resources to decide upon, and hopefully expand on
these suggestions using their own knowledge and the organisation’s code of practice. Or possibly even a machine learning software, which gathers data from crowd sourcing from experienced human resources professionals.

**Deskilling**

One argument against the adoption of technology is the substitution of employee skills for simplicity, leaving them unable to able to fully apply their abilities, also known as deskilling (Ford, 2015). This is evident in certain cases, such as accounting where easily accessible software has allowed individual companies with even limited accounting backgrounds to do basic bookkeeping tasks with no particular skills necessary except basic IT competency. However, it can be contested that accounting expert systems have also significantly decreased the demand for accountants to rely on lengthy manual practices, in turn not only increasing productivity and accuracy, but also broadening their skill set to include a merging of accounting and information systems knowledge.

As the literature has shown, this highly speculated field inspires disagreements regarding technological unemployment. One thing is for certain: retail banking and accounting should absolutely expect automation to become more common place in the next decade, as a primary source of maximizing profits in a competitive and challenging industry.

**2.11 Preparation for automation**

The Deloitte study (2014) mentions that 84% of London businesses will require their employees’ skill set to adapt over the next ten years, citing digital knowledge, management and creativity as skills remaining increasingly in need, and demand in processing, support and clerical work and foreign languages expected to decrease. So employees would be wise to take heed of this information, and understand how to diversify their skill set. Similarly, employers and policy makers should nurture prospective employees and instil these beneficial skills early on.

Identifying high risk job roles for automation is a necessary consideration for contemplating future employment choice implications, which the primary research of this research aims to accomplish.

Furthermore, the study reports that jobs with a salary of less than £30,000 a year have a 5:1 ratio of automation probability compared to those paying over £100,000 (2014). According to High Fliers Research Limited (2016), the average graduate salary is just around £30,000. The logic therefore suggests that recent graduates are 5 times more likely to be replaced by automation, given their generally low skilled entry into the work force by default.

Michele Loi (2015) claims that technology will assume control over considerably better jobs, leaving workers to make due with worse jobs than ones they have now, citing Moravec’s paradox of increased demand for high level reasoning requiring little computation. The issue with this argument is that technology has demonstrated abilities of high level reasoning, such as IBM’s Watson. Although not parallel to that of humans, examples like SoftBank’s NAO bank teller and Royal Bank of Scotland’s digital customer service assistant Luvo.
demonstrating human like ‘personality’, and therefore, this argument will likely not withstand technological advancement during a 10-year period.

Income distribution is also noted to be affected by automation. Autor (2015) suggests that main consideration is not that of labour scarcity, but economic distribution of income generated and who owns it (the revenue generated by automation), not of scarcity.

2.11.1 Education
Creativity and diversity of skills have emerged as essential attributes for any employee, with (Frey and Osborne 2015, Deloitte, 2014; Frey and Osborne, 2013) highlighting creativity as a bottleneck for computerisation. It is argued that school systems continue to implement curriculum standardisation, neglecting the necessity for cultivating a culture of individual minds (Hargreaves, 2003). Here lies the problem which spans further than simply employees and employees, but beyond political factors.

Education is important for providing employees with a solid understanding of the industry to become valuable members of the workforce. Frey & Osborne et al (2016:5) further reiterates this in Figure 2.3, showing that around 50% of industry professionals believe investment into education is the most likely effective policy to counterbalance the risks of automation negatively affecting human labour and wealth distribution.

Figure 2.4

This is a continuation of Smith and Anderson’s (2014) Pew study, which found that despite a difference in beliefs on the overall impact of automation, one shared concern among the 1,896 professionals and economists is the lack of preparation given by educational institutions for the necessary skill demands of the future. So it seems that education is the solution to all technological unemployment worries.

However, the issue with assuming that amending educational practices will better prepare employees for an industry susceptible to the perils of technological advancement is that technological advancement is rarely stagnant, and frequent progress is inevitable.
Theoretically, if students were taught a curriculum encompassing a current technological understanding of the financial industry, their skills, knowledge and abilities may prove to be outdated once they enter the workforce.

So while a revised approach to education is an essential step towards the right direction, it is not a solution. This is likely the reason many professionals are proponents of continuous self-education (Ford, 2015).

The positive news is that measures have recently been taken to address these concerns. Details from the UK Commission for Employment and Skills report (2014) called for:

- *employers to take a lead in improving skill levels*
- *more vocational pathways to work*
- *more integration between the worlds of work and education*
- *more apprenticeships*
- *work experience to become an integral part of education*

While it is still too early to conclude whether these have been enforced successfully, time and careful observation will tell if industries, unions, governments and educators are willing to work together to address this pressing issue.
3.0 Research Methodology

3.1 Introduction

The research questions initially set:

1. Does the advancement of technology pose significant threat to future unemployment in Accounting and Retain Banking?
2. Are there measures which can be taken to prevent any such risks?

A questionnaire was created to specifically address these questions, seeking out answers which will then undergo analysis to interpret the data, and provide a statistical basis for the conclusions found.

The research onion by Saunders et al (2009) was used to inform the methodology for this research. A deductive pragmatic approach was adopted.

Using information obtained from the past literature and research findings, a prediction for the state of financial and accounting automation during the next decade will be made, and any preparations to be taken.

3.2 Research Approach

Sternberg (2009) defines a deductive approach as a reasoning from one or more statements and arriving at a conclusion. If premises are true, terms are clear, and rules of deductive logic are followed; the conclusion reached is necessarily true.

He highlights that deductive reasoning is based on logical propositions which are either true or false. The hypotheses for this study are the following:

1. Automation creates a high demand for soft skills.
2. Low skilled jobs are at higher risk for being automation.

These hypotheses will be linked to arrive at a logical conclusion.

3.3. Research Philosophy

A pragmatic approach will be adopted since the researcher is not convinced that implications of artificial intelligence are either biased towards creating a more positive or negative outcome. Rather, both arguments will be investigated to allow for a realistic narrative and prediction for the future.

Saunders (2009) justifies the reasoning for choosing this particular research philosophy, since no single opinion can provide the entire picture, and other possibilities must be considered. Furthermore, he highlights the key aspect of this approach, where in the research design enables reliable, credible and relevant data to support subsequent action.
3.4 Methodical Choice
A quantitative data collection will be selected, followed by analysis. There is no qualitative method such as interviews, but an open ended question is included in the question help create a more well-rounded discussion. Graphs will be created to display findings from the questionnaire.

3.5 Research Strategies

3.5.1 Survey
Shaughnessy et al (2011) states that a questionnaire consists of a predetermined set of questions that is given to a sample. The main purpose behind this is to assess the collective thoughts, feelings and opinions towards progressive financial and accounting automation from employees and employers as well as the level of reliance on technology for certain work tasks.

3.5.2 Ground Theory and Thematic Analysis
This is a methodology involving identification of theories by analysing data (Martin and Turner, 1986). As suggested by George Allan (2003) patterns will appear in terms of repeated ideas and concepts through reviewing data gathered. These are then labelled with codes and extracted. Through continuous collection and review of data, codes can be grouped into concepts, and then into categories. Categories hold potential to serve as the basis for new theories.

For the open question which requires text input, the 6 phases of thematic analysis will be followed (Braun and Clarke, 2006). This will help to identify recurring patterns, thereby allowing the creation of themes to underline key revelations from the study which will aid in answering the research questions.

3.6 Ethical Considerations
Complying with the University’s regulations, all information gathered will remain confidential, and will be stored securely. A participant information sheet and a Questionnaire front page will be distributed, outlining the purpose of the study and requesting the participant’s voluntary informed consent (see appendix 2-7). The findings of the study will also be shared with all the relevant stakeholders. Finally, all participants will be made aware of the likely publication of the results gathered.

3.7 Time Horizon
Cross sectional has been selected primarily due to time constraints. Time constrained studies such as academic papers are limited to this option (Sanders et al, 2009), and this study only aims to observe the technological unemployment phenomenon at this particular time. A limitation to this kind of study is the inability to study development over a period of time. However, this approach also allows for a less costly and time consuming study.
3.8 Data Collection Methods

3.8.1 Purposive sampling

Non-probability form sampling has been selected because insight from professionals within the financial and accounting industries is the primary goal of this study, as this will provide a more realistic data set to work with based on experience and knowledge of the industry. The professions surveyed ranged from marketing, customer service, human resources. A full breakdown of these professions can be seen in Appendix 9.

The total sample size is 54 participants.

3.8.2 Questionnaires

An internet questionnaire seeking primarily ordinal and nominal data will be created using the online survey tool Qualtrics. Questionnaires will be distributed to two large banks and two relatively small accounting companies: Santander Bank, Lloyds Bank, Kilsby & Williams and Graham Paul Chartered Accountants. A copy of the questionnaire can be seen in Appendix 8.

3.9 Data Analysis

To ensure information is reliable, differential and inferential statistical analysis tests have been carried out. These include measures Pearson Chi Squared Test, coefficient of variation, confidence limits for the mean, confidence interval, spearman’s rank correlation coefficient/Kendall rank correlation and Pearson product moment correlation coefficient.
4.0 Findings

4.1 Questionnaire

**Research Question 1: Does the advancement of technology pose a relatively worrying risk in regards to future unemployment in accounting and finance?**

**Q1. What is the name of the company you work for?**

![Figure 4.1 Companies Surveyed]

Figure 4.1 shows a dissection of the survey participants. There were 11 participants from Graham Paul Chartered Accountants and 15 participants from Kilsby & Williams. Furthermore, Lloyds Bank contributed 14 participants and Santander had 14, providing a total of 54 participants.
Q4. How often do you rely on specialised software to aid your work?

Figure 4.2 helps to detail the dependency on specialised software to complete work tasks. These results have been categorised by level of dependency below:

- **High Dependency**
  
  *Bank branch operations:* According to the respondents, a majority of banking branch operations depend on software for routine tasks including opening accounts, processing routine account transactions and handling loan payments and cash checks unanimously requiring software assistance all the time.

  *Accounting services:* Similarly, reliance on software is evident in accounting, with responses showing software is relied on all the time for audit and assurance by 50% of accounting professional, while 36.3 rely on software often. 59% of respondents rely on software all the time for profit and loss, with almost a quarter using software often. For bookkeeping 56% rely on software all the time, while 37% use it often. 66.6% use software all the time for tax returns, and a quarter rely on software often.

  *Payroll:* 54% of professionals surveyed rely on software all the time, with 38% using software often. Never and rarely received 0%.
• **Medium-high dependency**

*Allocating budgets*: 80% of respondents rely on software often when allocating budgets, with 20% using software occasionally or all the time.

*Recruitment*: A majority (88.8%) rely on software often for recruitment purposes, with 11.1% using software all the time.

*Consulting*: 29.6% of respondents rely on software often, while 22.2% use it all the time for consulting. 18.5% use software rarely and 15% either never use software, or only occasionally.

*Market research*: 31.25% use software all the time for market research, while another 31.25% use it occasionally, while 1 in 4 uses software ‘rarely’ for market research, while 12.5% use software often.

*Human resources*: 45.4% use software often for all encompassing human resources. 9% never use software, and 9% use it all the time, whereas 18.1% will use it occasionally.

• **Medium-low dependency**

*Proof reading*: Surprisingly, only 48% rely on software for proof reading documents all the time.

*Customer service*: 36.6% of respondents never rely on software for customer survival tasks, while 36.6% use software occasionally. 1 out of 5 employees use software rarely for customer service, and 6.6% use it often.

*Devising marketing plans*: 37.5% use software for coming up with marketing strategies and plans, while another 37.5% use software occasionally. A quarter rely on software often for marketing plans.

• **Low dependency**

*Promoting company services/products*: The results show that this task is very interpersonal and customer based. As a result, 52% of those surveyed said they never rely on software to promote company products, while 26% use software rarely.

*Employee relations*: 57% Never, and 43% rarely, 0% everything else

*Sourcing and securing sponsorship*: 50% rarely, 20% never and 20% occasionally, 10% often, 0% all the time.

*Sourcing and securing sponsorship*: Similarly, 57.1% never rely on software for employee relations purposes, and while 42.9% use software only rarely.
Q14. Is it a realistic prediction to make that automated services will compliment employees in their work tasks more so than substituting them entirely?

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<thead>
<tr>
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<th>Mean</th>
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<tbody>
<tr>
<td>Total</td>
<td>1.14</td>
</tr>
<tr>
<td>Finance</td>
<td>1.14</td>
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<tr>
<td>Accounting</td>
<td>1.15</td>
</tr>
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</table>

Figure 4.3 shows that 87.7% of financial professionals were optimistic that technology will primarily assist professionals as opposed to making them redundant, where as 84.6% of accounting professionals also agreed with. The results show no significant difference between the two sectors.
Q7. Do you believe that the fear of technological unemployment is irrational?

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<tbody>
<tr>
<td>Total</td>
<td>1.57</td>
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<tr>
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<td>1.67</td>
</tr>
<tr>
<td>Accounting</td>
<td>1.44</td>
</tr>
</tbody>
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In total, Figure 4.4 shows that 64.1% of all participants felt that technological unemployment is irrational, while 15.09% said no and 20.7% were not sure. The results suggest a slight variance, with 47% of finance professionals voting yes compared to 53% of accounting professionals.

85% believed automated services will compliment employees rather than replacing them, whereas 15% were not sure.

A correlation can be seen in the data between a lack of belief in technological unemployment and a positive outlook for employees.

When combined, q14 and 7 create a clear picture of the general attitude towards technological advancement. One would assume that if the prediction of the future is optimistic in terms of automation assisting and not replacing human labour, then one is also likely believe that technological unemployment is irrational, since the two concepts contrast each other. This is consistent with the findings.
Q 8. What overall effect do you believe automation has in the finance industry (e.g. ATMs, computerised accounting systems?)

![Figure 4.5. Effects of automation](image)

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<tbody>
<tr>
<td>Total</td>
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<tr>
<td>Finance</td>
<td>1.85</td>
</tr>
<tr>
<td>Accounting</td>
<td>1.75</td>
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Figure 4.5 shows that 61.1% of respondents believed that the overall effect of automation in the finance industry is mostly positive, followed by 22.2% who were not sure, 12.9% who felt that the effects are evened out and 3.8% felt that overall impact is mostly negative.

Furthermore 60.7% of finance professionals were mostly positive, while 61.5% of accounting said mostly positive. Once again, no significant difference can be observed between the two sets of data.
Q9. In your opinion, what will be the implications of automation in the financial industry for the future?

Figure 4.6 highlights that 46.2% respondents predicted that in the next decade, automation will result in more specific job opportunities where special skills are emphasized. This is followed by 20.07% who believe there will be fewer job opportunities. 11.1% think that there will be no significant difference, with another 11.1% believe there will be more job opportunities in general. 7.4% were not sure.

50% of finance professionals believed more specific job opportunities will be created, compared to 45.8% of accounting professionals who share a similar belief, showing a slightly more optimistic view.
Q10. What do you believe is the main limitation of automation?

Figure 4.7 shows that Lack of versatility was considered the main limitation of automation by 44.4% of respondents. This was followed by limited cognitive processing at 27.7%.

54.1% of finance professionals believe lack of versatility, where as 45.9% accounting said lack of versatility. Once again, a slight, but not significant observation. However, % (75%) of those who believed unpredictable costs were a serious issue were finance professionals.

73.3% of participants who selected cognitive processing were Accounting professionals, compared to 26.7% of finance professionals, showing a significant difference.
Q11. What do you believe is the main advantage of automation?

![Figure 4.8. Main advantage of automation](image)

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<tbody>
<tr>
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</tr>
<tr>
<td>Finance</td>
<td>2.10</td>
</tr>
<tr>
<td>Accounting</td>
<td>2.11</td>
</tr>
</tbody>
</table>

48% of respondents felt that efficiency and accuracy was the most beneficial aspect of automation, while 31.4% felt increased productivity was most important and 20.6% benefit most from cost effectiveness of automation.

65.3% of accounting professionals rely heavily on efficiency and accuracy benefits, compared to just 34.7% of finance professionals. Conversely, 64.7% of financial professionals benefit from increased productivity, compared to 35.5% of accounting professionals. Finally, 72.7% of finance professionals ranked cost effectiveness highest, compared to 27.3.5% of accounting professionals. It is evident that finance and accounting professionals seek different benefits from automation.
Research Question 2: Are there any measures which can be taken to prevent any such risks (of technological unemployment)?

Q5. Have you ever received any company aided training to utilise any specialised software?

![Figure 4.9. Company Aided Training](image)

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<thead>
<tr>
<th>Data</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
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</tr>
<tr>
<td>Finance</td>
<td>1.17</td>
</tr>
<tr>
<td>Accounting</td>
<td>1.82</td>
</tr>
</tbody>
</table>

Results in figure 4.9 show that 61.1% of participants have received some form of company assisted training to use software, while 38.9% have not.

69.6% of finance professionals have reportedly received company aided training, while only 30.4% of accounting professionals received company aided training.
Q12. What range of jobs do you feel are most susceptible to technological unemployment in 10 years?

Figure 4.10 highlights that 75.9% of respondents (53.6% of which are from accounting, and 46.4% from finance professionals) overwhelmingly believe that low skill jobs are at high risk of automation. A minor difference can be observed here, while 24.1% believe low skill, low wage jobs will face medium risk.

Figure 4.11 reports that 70.3% believe that medium skilled jobs are at high risk of automation, while 27.7% feel that they face medium risk, with 2% of financial professionals selecting low risk. There is a notable result to be drawn here, since 55.2% of finance professionals selected high risk, compared to 44.8% of financial professionals.
Figure 4.12 depicts that 79.6% of respondents felt that high skill jobs will be at low risk, while 20.4% believed they would be at medium risk.

There were no significant observations to be drawn from this question, since 51.1% of accounting professionals and 48.9% of finance professionals selected low risk. However, a significant difference is seen where 63.3% of finance professionals feel that high skill jobs will be at medium risk of automation in 10 years, compared to 36.7% of accounting professionals.

**Q13. What skills do you believe are most beneficial for employees to acquire that cannot be replicated as effectively computers? (Please select 2 main skills.)**
One participant only selected one skill, instead of two.

Figure 4.14 demonstrates that soft skills were ranked the most beneficial at 52.3%. Versatility followed at 37.3%. Experience based cognitive processing accounted for 3% of all the results and common sense rationalisation received 7.4% (which was interestingly only selected by accounting professionals).

An interesting observation is that 71.5% of finance professionals selected soft skills, compared to just 28.5% of accounting professionals. Inversely, 35% of finance professionals chose versatility as an important skill, compared to 65% of accounting professionals. Notable differences can be observed here. Experience based cognitive processing was seemingly not as important for either, being selected by one finance professional and twice by accounting professionals.

Q.15 Do you believe the retail banking/small accounting firm industry is more susceptible to technological unemployment than any other industry? Feel free to emphasize on your particular department/job and address how professionals can deal with a potential threats of technological advancements. Please explain your answer openly and truthfully.

Theme one: Diversity of skills

Out of the 54 questionnaires received, 37 responses (68.5%) highlighted that maintaining a diverse range of skills was an essential attribute for employees to obtain. This entailed keeping up to date with the current technical skill requirements of the industry. A sample of these answers can be seen in Appendix 10.

Sub theme: emphasis on soft skills

By dissecting this information, the results show that 13 of those 37 respondents (35.1%) emphasised the importance of acquiring and sufficiently being able to demonstrate soft skills in the workplace (referred to within a wide spectrum of subcategories including communication, interpersonal skills and critical thinking). A sample of these answers can be seen in Appendix 11.

Sub theme: Willingness to learn

Four responses (10.8%) highlighted the importance of independent thinking and the drive to engage in constant learning to adapt to new technology and environments. These can be seen in Appendix 12.

Theme two: Demand for human labour due to technological limitations

26 responses (48.1%) out of 54 underlined the issue of both job elimination and creation as a by-product of automation, and the subsequent demand for employees to address the job tasks not met by technology. A sample of these can be seen in Appendix 13.
Outliers:

The majority of answers provided suggested that respondents felt confident that financial and accounting industries were not more susceptible than most industries, with others being unsure. However, three respondents (5.5%) felt that the financial industry did in fact face more threatening risks. Two of these respondents were from a financial background, while the other was from an accounting background. These responses can be seen in Appendix 14.
5.0 Discussion

5.1 Fear of technological unemployment
Both accounting and finance professionals essentially contest the notion of technological unemployment. With accounting professionals being 3.9% more dismissive. While this is a small difference, the result is illustrative of the idea that sectors such as finance offering numerous services pose greater opportunities of automation (Ford, 2015) as opposed to accounting which has a more limited range of services, and therefore creates limited opportunities.

Furthermore, finance professionals surveyed include personal bank advisors (bank tellers) and customer service workers, which are two significant departments that have already seen the effect of automation in their profession. This factor likely affects their response to the question. However, this finding cannot be taken in confidence alone. As with other results discussed, further analysis involving a larger sample sizes would be necessary to validate this claim.

5.2 Employment outlook
Drawing on previous literature, the results of the survey correlate with the predictions of Frey and Osborne (2013), as they calculated the following probabilities of automation for the professions relevant to this study:

Table 5.1

<table>
<thead>
<tr>
<th>Profession</th>
<th>Probability (0 – least likely, 1 – most likely)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Resources Managers</td>
<td>0.0055</td>
</tr>
<tr>
<td>Marketing Managers</td>
<td>0.014</td>
</tr>
<tr>
<td>Financial Managers</td>
<td>0.069</td>
</tr>
<tr>
<td>Human Resources, Training, and Labour Relations Specialists, All Other</td>
<td>0.31</td>
</tr>
<tr>
<td>Customer Service Representatives</td>
<td>0.55</td>
</tr>
<tr>
<td>Bookkeeping, Accounting and Auditing Clerks</td>
<td>0.93</td>
</tr>
<tr>
<td>Tax Examiners and Collectors, and Revenue Agents</td>
<td>0.93</td>
</tr>
<tr>
<td>Budget Analysts</td>
<td>0.94</td>
</tr>
<tr>
<td>Accountants and Auditors</td>
<td>0.94</td>
</tr>
<tr>
<td>Payroll and Timekeeping Clerks</td>
<td>0.97</td>
</tr>
<tr>
<td>Loan Officers</td>
<td>0.98</td>
</tr>
<tr>
<td>Tellers</td>
<td>0.98</td>
</tr>
<tr>
<td>Tax Preparers</td>
<td>0.99</td>
</tr>
</tbody>
</table>

(Frey and Osborne, 2013:57-72)
The reliance on software for work tasks reflects their findings, considering that the more dependant professionals are in utilising software for particular tasks, the higher their probability of being replaced by automation was suggested by Frey and Osborne (2013).

This validates the initial expectations of the researcher that the professions with higher probabilities of automation in 10 years are those which consist of highly repetitive tasks.

The UK Commission for Employment and Skills (2014) also predicts an 11% decrease of bank tellers and bookkeepers by 2024, which validates the findings of this study.

5.3 Effects of automation
Though a minimal difference of 1.7% in favour of financial professionals exists, both sectors agree that the benefits of automation outweigh the downfalls. This result was not what was expected. However, it coincides with the idea once a benefits and disadvantages from automation eventually even out (Canova et al, 2013).

5.4 Implications of automation
Professionals from both sectors unanimously agreed that automation brings more specific jobs for the gaps that it inevitably creates. 3.5% difference in favour of finance. This result is was expected, considering extensive literature (Bessen, 2015; Canova et al, 2013; Atkinson and Miller, 2013, Autor; 2015, Beaudry et al, 2016) showing this to be the case.

5.5 Benefits of automation
Brown et al (2015) report that top incentives for automation excluding cost saving include: Reduced error rates, better management of repetitive tasks, effective standardisation of process workflow, reduced reliance on numerous systems, and reduced friction (makes processes flow easily).

Results from the survey found that finance relies on increased productivity more so than accounting. This is likely due to a higher volume of customers. Furthermore, accounting professionals ranked efficiency/accuracy as most important, understandably because precise calculations are necessary in accounting to eliminate human error. Both sectors believe efficiency/accuracy and productivity are more important than cost effectiveness.

It is understandable that ¾ of those who chose cost were in finance, considering the many cases of banks to fix faulty IT infrastructure, with RBS as an example (Ford, 2015).

The algorithmic construct of automation means that high standards are set for accuracy and consistency. Accounting relies heavily on analytical and mathematic abilities. This explains why the benefit of accuracy takes precedence for accounting over finance, due to the precise calculations necessary to eliminate human error.

Furthermore, accounting companies on average will have fewer employees, due to budgets constraints, and a relative supply and demand relationship between customers who now
manage their own accounting needs. So this also explains the results further, since a limited work force cannot afford to be inactive.

The results showed that finance professionals rely more on the increased productivity benefits of automation more than anything. This is likely due to the higher volume of customers relative to accounting professionals, who mainly cater to business needs, and the wider spectrum of general services offered compared to the often bespoke services of accounting. Furthermore, many finance services (especially those carried out in banks) occur on a daily basis. Accountants are usually contracted with deadlines for their services.

As a result, decisions are made to simultaneously maximise the frequency of services being provided and decrease wasted time on routine tasks, hence the implementation of ATMs (Bessen, 2015) and online banking applications.

Interestingly, both sectors believe that efficiency/accuracy and productivity take precedence over cost effectiveness. This substantiates the opinion of an organisation’s desirer for high productivity (Campa, 2014). The justification behind this is that effective automation offers a high return on investment. Despite the costly implications of implementation and maintenance, financial and accounting institutions can engage in application portfolio management to ensure that financial benefits outweigh the costs in the long run.

Both finance and accounting ranked lack of versatility as the highest limitation of automation. As previously mentioned, services offered in the financial sector are expansive, and to meet demands, professionals are expected to do a range of jobs with a broad collection of skills. This is also a similar expectation of accounting professionals, especially considering the limited work force in many companies as stated before (Association of Chartered Certified Accountants et al, 2013)

Walker (2014) cites the replacement of horses with internal combustion engines during the Industrial Revolution, drawing a parallel with automation and human mental capacity. In both cases, cheaper labour alternatives with similar (or improved) output. However, this argument implies that human labour is valued for a single contribution to the workforce, which is not the case. As this discussion has shown, mental capacity also encompasses soft skills, an increasingly in demand attribute for employees. Retail banking and accounting rely heavily on customer interaction, so this argument does not necessary stand in this particular context.

Limited cognitive processing is the second biggest limitation of automation for both finance and accounting. It’s possibly that the broad definition of cognition has led some participants to not fully understand what it encompasses. One of the limitations of this study is professionals surveyed were not in a highly technical department such as IT and therefore it’s likely they underestimate the potential benefits of cognitive computing.

Training and unpredictable costs both received the least concern for both accounting and finance. As explained previously, the long term return on investment is a key deciding factor, and costs/time spent implementing and learning to use automation has to be compared to ongoing projected profit margins. So these costs are usually accounted for.
However, it is vital to notice that of those who selected unpredictable costs, 75% were finance professionals. This is understandable, considering several cases of IT infrastructure undergoing costly routine and maintenance, such as the case of RBS in 2012.

5.7 Employee training

The 39.2% difference in results between accounting and finance is consistent with the researcher’s predictions. Considering that retail branches are a subset of big organisations banks, they rely on strict formality to uphold their service quality, and education is the primary method of ensuring approved procedural processes and confidence in the accepted software/technology in use. Accounting firms however do not depend as heavily on uniform software/technology. Larger institutions in finance also have the necessary resources to facilitate such education, allowing for paid vocational training and courses.

5.8 Correlation between skill level and automation

These results would need substantial heterogeneity across firms in the employment size of such high capital-intensity firms in order to avoid generating bimodality in the firm size distribution (Hsieh and Olken, 2014).

5.9 Necessary skills for professionals

Middle-skill occupations in the future will require technical tasks coupled with soft tasks in which workers hold a comparative advantage. These will include interpersonal interaction, adaptability, and problem solving (Autor, 2015; Association of Chartered Certified Accountants et al, 2013). This is once again due to the hollowing of the middle class (Ford, 2015), emphasis the demand for employees to add value.

The reason finance professionals on average received company assisted training, is likely due to the budget and resources available to invest in education for employees (Certifications, online courses etc..), while accounting firms often rely on employees to be familiar with software used currently implemented due to together financial constraints.

Furthermore, results show that soft skills are heavily relied upon amongst financial professionals in branch banking, compared to accountants. The reason is due to the fact that accounting can often work individually, but finance is a team centric department, requiring frequent communicating. Furthermore, this reiterates Bessen’s (2015) relationship banking team concept that branch employees, regardless of position, are expected to be customer focused to build and maintain relationships with consumers. This is essential, considering that 46% of banking professionals believe that changing customer behaviour and demands will have the biggest impact on retail banking (Economist Intelligence Unit, 2015), and the best way to understand the customer and their consumer behaviour is to know them intimately.
5.10 Comparison between open and closed questions in the questionnaire

Since there was no qualitative research undertaken for this study, the open question provided an opportunity to consolidate the quantitative information gathered. It did so accordingly, as previously cited, showing that many professionals expressed the importance of soft skills and versatility, which was consistent with the results of the quantitative results.

5.11 Limitations and Future Research

The researcher acknowledges the unreliability of a study mostly being by quantitative means, as this fails to add integrity to survey results and does not present a conclusive understanding of the issue. Rather, adopting a triangulation data collection method using qualitative data would have benefited the overall dependability of the results. The reason for this decision was time limitations, and the difficult processes of gaining consent for interviews. In the future, beginning preliminary research planning would be ideal to allow for sufficient time to locate participants and begin gathering data for analysis. Furthermore, reaching out to a larger sample of professionals would likely increase the chances of gaining consent.

The sample for this dissertation was limited, in terms of the size in correlation with the population of branch banking and accounting professionals: both in terms of quantity and the range of professions. As outlined by Hsiegh and Olken (2014) studies should sample a variety of participants across first to avoid bimodality and sampling error.

The reason small accounting firms and retail banking were chosen was mainly due to the difficulty of sourcing willing participants in larger financial institutions. However, it would be interesting to expand this research further into the realm of other banking sectors such as central offices, investment and risk banking, considering that these sectors are heavily reliant on technology, (more so than retail banking), and the sample would also be expanded to include professions which are more reliant on technology such as those in IT departments. This would likely present very interesting findings.

For further analysis into the effects of automation in, an investigation into how wage is affected would be an interesting research topic.
6.0 Conclusion

The key findings from this research aligned with the expectations of the researcher, and coincide with previous academic literature. Roles in retail banking and small accounting firms with a high degree of repetitive tasks hold the highest probability for automation. The observation of technological advancement will create a period of extended inequality before levelling out, but regardless, the overall implications of technology are mostly positive, offsetting perceived disadvantages.

Furthermore, the research shows there is still demand for professionals with expert knowledge where technology is limited, so the notion that technology can entirely replace a particular department or job in retail banking or accounting is unreasonable. Tasks with little dependence on technology including marketing, customer service, while those more reliant on technology such as basic bank teller services and bookkeeping will see a decline, and increase in competition.

Automation is beneficial for organisations seeking to operate at lower costs while obtaining profit maximisation and high standards of consistent quality of work, but this has to be balanced with the needs of the consumer, (considering their substantial buyer power), which often entails interpersonal skills. As a result, this creates a difficult decision for organisations to contemplate how to balance the two. Extensive SWOT analysis must be carried out to outline the effects of implementing automation. Technology is unlikely to eliminate the accounting and branch banking sectors, but a 10 year progression in technology will inevitably see these professions continue to see a decline, as the move towards frictionless banking and convenience persist. Similarly, branches are faced with the option of becoming significantly more productive or significantly lowering operations. In other words, decrease in size and level of operation is inevitable.

While certain differences regarding automation between accounting and retail banking sector can be observed, the overall consensus is similar. Technological unemployment does not seem to cause long term unemployment, but effects are certainly observed in the short term, with middle skill jobs being impacted the most in the next decade. This will see a displacement of jobs to meet customer demand. Factors which contribute to this include the discrepancy between rising tuition prices with fewer job opportunities: creating an unstable economy. An unstable economy undergoing rapid technological shifts in 10 years will understandably create complications. Thus, technology is evidently a cause of healthy growth in productivity, but also a cause of weak grown in jobs simultaneously.

Technological advancements seem to constantly restructure the business model for organisations in finance and accounting. The progressive direction of retail banking heading towards digital means has resulted in heavy demand for versatile employees. Organisations are advised to invest in their employees (providing education and training to utilise emerging technology), because the return is an added value benefit for the customer’s
experience, but also the organisation. This calls for creativity and ingenuity to be nurtured to better understand how to restructure the banking strategy in an ever growing digital market to distinctly appeal to mass markets who utilise digital banking, especially millennials.

Accountants will also be expected to continuously diversify, becoming more technically adept at understanding the usefulness of big data for clients for example, because software allows some small companies to take care of their own accounting needs such as bookkeeping, so accountants need to add value by specialising in a variety of accounting disciplines. Furthermore, continued decrease in job opportunities prospects are expected to decline, since (small) companies can now hire one or two accountants to utilise these technologies to adopt a greater work load than a contracting team of accountants.

The research results which have been obtained play an important role, because amidst the apprehension of technological unemployment, it consolidates what is already known in literature, and attempts to extend this reality into the future. Furthermore, this paper contributes insight into the effects on smaller branches of the finance and accounting industry, contributing the idea that recovery, which has potential for further research. It consolidates what is already known in literature, and attempts to extend this reality into the future,

While it would have been ideal in insightful to gather information and analyse it based on job title and department, the sample distribution was not extensive enough to arrive at conclusive representations of the industry. As noted in the limitation section, this is potential for further investigation into this research topic in the future. The observation of technological advancement will create a period of unprecedented extended inequality before levelling out, unlike that ever observed before, long term but technological unemployment is unlikely.
7.0 References


Perspectives. 28 (3), 89-108.


Tovey, A. (2014). *Ten million jobs at risk from advancing technology*. Available: http://www.telegraph.co.uk/finance/newsbysector/industry/11219688/Ten-million-jobs-at-


## Appendix 1

### DEVOLVED ETHICS APPROVAL APPLICATION SUMMARY

<table>
<thead>
<tr>
<th>To be completed by student and supervisor before submission to Ethics Approval Panel</th>
<th>Student Signature;</th>
<th>Supervisor Signature;</th>
</tr>
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<tbody>
<tr>
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<td>Yes</td>
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</tr>
<tr>
<td>Application for ethics approval</td>
<td>[ Y ]</td>
<td>-</td>
</tr>
<tr>
<td>Participant information sheet</td>
<td>[ Y ]</td>
<td>[ ]</td>
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<tr>
<td>Participant consent form</td>
<td>[ Y ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Pilot interview/s</td>
<td>[ Y ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Pilot questionnaire/s</td>
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<td>[ ]</td>
</tr>
<tr>
<td>Letter/s to participating organisation/s</td>
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<td>[ ]</td>
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First Submission | [ ] | Resubmission | [ Y ] |

Date: __________

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### For use by the devolved ethics approval panel:

<table>
<thead>
<tr>
<th>Panel Members</th>
<th>Name</th>
<th>Signature</th>
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<tr>
<td>Module leader:</td>
<td></td>
<td></td>
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<tr>
<td>Supervisor:</td>
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<td>CSM Ethics Committee Representative:</td>
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Date: __________ Date of Reassessment: __________

### Outcome:

| Project Approved | [ ] | Reference number: | __________ |
| Project Approved in Principle | [ ] | |
| Application not ready/ incomplete | [ ] | (Decision deferred) |

Comments for projects not fully approved:

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When undertaking a research or enterprise project, Cardiff Met staff and students are obliged to complete this form in order that the ethics implications of that project may be considered.

If the project requires ethics approval from an external agency (e.g., NHS), you will not need to seek additional ethics approval from Cardiff Met. You should however complete Part One of this form and attach a copy of your ethics letter(s) of approval in order that your School has a record of the project.

The document *Ethics application guidance notes* will help you complete this form. It is available from the [Cardiff Met website](http://www.cardiffmet.ac.uk). The School or Unit in which you are based may also have produced some guidance documents, please consult your supervisor or School Ethics Coordinator.

Once you have completed the form, sign the declaration and forward to the appropriate person(s) in your School or Unit.

**PLEASE NOTE:**

Participant recruitment or data collection MUST NOT commence until ethics approval has been obtained.

**PART ONE**

<table>
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<tr>
<th>Field</th>
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<tr>
<td>Name of applicant:</td>
<td>Wycliff Onuonga</td>
</tr>
<tr>
<td>Supervisor (if student project):</td>
<td>Dr Jason Williams</td>
</tr>
<tr>
<td>School / Unit:</td>
<td>CSM</td>
</tr>
<tr>
<td>Student number (if applicable):</td>
<td>St20041741</td>
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<tr>
<td>Programme enrolled on (if applicable):</td>
<td>BSc Business Information Systems (Hons)</td>
</tr>
<tr>
<td>Project Title:</td>
<td>Technological Unemployment: Investigating the implications of automation in Branch Banking and Small Accounting Firms.</td>
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<tr>
<td>Expected start date of data collection:</td>
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<tr>
<td>Approximate duration of data collection:</td>
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<td>Funding Body (if applicable):</td>
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<tr>
<td>Other researcher(s) working on the project:</td>
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<tr>
<td>Will the study involve NHS patients or staff?</td>
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</tr>
<tr>
<td>Will the study involve taking samples of human origin from participants?</td>
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Does your project fall entirely within one of the following categories:
In no more than 150 words, give a non-technical summary of the project

An investigation into employment opportunities and challenges existing or due to arise as result of advancements in technology and its replacement of job roles in the workplace. This project will focus specifically on the financial and accounting industry, emphasizing on retail (branch) banking and small accounting firms. It will focus on roles such as accountants, auditors, consultants, marketing, retail bankers/clerks, customer service and human resources employees. The significant work tasks will be identified which are currently under or heading towards automation in a selection of companies using observation. A informed prediction of the employment outlook within 10 years will be developed using the research gathered a combination of primary research using questionnaires and secondary information using books, journals and other academic publications. The results will be assessed and possible trends will be highlighted. These findings will be examined in conjunction with past correlations, allowing for similarities and differences to be drawn.

DECLARATION:
I confirm that this project conforms with the Cardiff Met Research Governance Framework

I confirm that I will abide by the Cardiff Met requirements regarding confidentiality and anonymity when conducting this project.

STUDENTS: I confirm that I will not disseminate any material produced as a result of this project without the prior approval of my supervisor.

<table>
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<tbody>
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<tr>
<td>Practice based not involving human participants (eg curatorial, practice audit)</td>
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</tr>
<tr>
<td>Compulsory projects in professional practice (eg Initial Teacher Education)</td>
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</tr>
<tr>
<td>A project for which external approval has been obtained (e.g., NHS)</td>
<td>No</td>
</tr>
</tbody>
</table>

If you have answered YES to any of these questions, expand on your answer in the non-technical summary. No further information regarding your project is required. If you have answered NO to all of these questions, you must complete Part 2 of this form
PART TWO

A RESEARCH DESIGN

A1 Will you be using an approved protocol in your project?
No

A2 If yes, please state the name and code of the approved protocol to be used
N/A

A3 Describe the research design to be used in your project
This dissertation mainly uses quantitative questions in the online questionnaire for collection of primary data. These questions will be developed from the analysis of current literature within the given domain.

The research philosophy undertaken will be pragmatism, as no single viewpoint can provide the entire picture and multiple realities are possible following the research gathered.

The online questionnaires will be created using Qualtrics, and will be distributed through e-mail to department heads of Kilsby & Williams Accountancy, Graham Paul Chartered Accountants, Lloyds Bank and Santander by e-mail, who will then forward them to employees in their department to gain information on the current work tasks under automation and outlook on employment, as well as an overall employee opinion on the subject matter of technology in the workplace.

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2 An Approved Protocol is one which has been approved by Cardiff Met to be used under supervision of designated members of staff; a list of approved protocols can be found on the Cardiff Met website here
The research strategy undertaken will be inductive, since a logical conclusions to the technological unemployment issue will be reached by investigating the data gathered.

**Sample**
- A purposive sampling technique will be taken, only surveying participants employed in bank branches and small accounting firms.
- There will be sample of 54 participants in this study. Approximately 6,962 accountancy firms registered in the UK, and approximately 9,500 bank branches in the UK.
- Employees at all levels of the organization.
- The following range of departments will be sampled: Accountants, marketing executives, retail bankers/clerks, customer service and human resources.

**Participants**
- Participant information sheet will be distributed to the companies that I intend to investigate, outlining the nature of my research, and requesting permission to engage with their employees.
- A questionnaire front sheet will also be provided, outlining the reason behind the questionnaire.
- All data will remain confidential and will be stored securely in a password protected computer system.
- All participants will remain anonymous; any data provided will not be traceable back to specific people.

**Analysis**
- Quantitative data will undergo statistical analysis, with graphs to support findings, and qualitative data from open questions will be analysed on a thematic basis using grounded theory to analyse text response and underpin themes.

<table>
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<tr>
<th>A4 Will the project involve deceptive or covert research?</th>
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<tr>
<td>A5 If yes, give a rationale for the use of deceptive or covert research</td>
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<tr>
<td>A6 Will the project have security sensitive implications?</td>
<td>No</td>
</tr>
<tr>
<td>A7 If yes, please explain what they are and the measures that are proposed to address them</td>
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</tr>
</tbody>
</table>

**B PREVIOUS EXPERIENCE**

B1 What previous experience of research involving human participants relevant to this project do you have?

In the Developing a Business Module (HLT5006), primary research was carried out in the form of online questionnaires in order to gain useful information for the demand and potential success of a video game store start-up. This was intended to gage opinions of
the most popular video game genres, consoles, purchase frequency, interest in loyalty schemes amongst other things.

**B2 Student project only**

What previous experience of research involving human participants relevant to this project does your supervisor have?

Dr Jason Williams has over 15 years of student dissertation and research supervision experience at both undergraduate and postgraduate level.

**C POTENTIAL RISKS**

**C1 What potential risks do you foresee?**

1. Risk of not receiving enough responses
2. Collection of personal information must be taken into account in accordance with the Data Protection Act
3. Participants may find the questionnaire intrusive into the company’s processes, and as a result may become defensive and offended, declining to complete it truthfully.
4. Some participants may lie when presented with questions; providing the answers they assume I would like to hear, instead of their honest opinions.
5. Risk of not meeting research deadlines

**C2 How will you deal with the potential risks?**

1. Distribute questionnaires to all employees to ensure a sufficient return sample size of at least 50.
2. Precautions will be taken to ensure that questions are worded in a respectful manner, and reiterate to the participants that the information they provide will be held confidentially.
   
   All data will be held on a secure password protected external hard drive and paper copies will be kept in a locked cupboard. Access to the data will be restricted to the contributor and supervisor. Questionnaires will have no trace back to the contributor.
   
   A letter will be provided to the organization briefing them on the project and participant information sheet intended to outline clearly that the information provided will be kept strictly confidential in compliance with the university’s regulations. If participants feel uncomfortable during the research gathering process, they can withdraw from the process.
   
   3. Importance of honesty will be emphasized in order for this primary research to be useful for the project, and highlight that there are no right or wrong answers.
   
   4. A pressure free and inviting approach will be provided during the process of gathering questionnaires; making sure that the participant is comfortable with the questions being asked, once again highlighting the importance of honesty for this project.
   
   5. Every effort will be made to complete the research phases in accordance with the anticipated research deadlines by utilising a Gantt Chart.
Appendix 2
PARTICIPANT INFORMATION SHEET

Technological Unemployment: Implications of automation in Branch Banking and Small Accounting Firms.

Project summary
The purpose of this research project is to identify the job tasks currently under automation in a selection of companies using observation and questionnaires to produce a conclusion of the effect of automation in the finance and accounting industry, to gain a better understanding of the correlation with automation and employment. Your participation will enable the collection of data which will form part of a study being undertaken at Cardiff Metropolitan University.

Why have you been asked to participate?
You have been asked to participate because you fit the profile of the industry being studied: that is you are employed by company in the financial industry and likely are familiar with utilising automated facilities to aid you with work tasks. Your participation is entirely voluntary and you may withdraw at any time.

Project risks
The research involves the completion of a questionnaire which will be analysed. We are not seeking to collect any sensitive data on you; this study is only concerned with work related questions. However, if you do feel that any of the questions are inappropriate then you can stop at any time. Furthermore, you can change your mind and withdraw from the study at any time – we will completely respect your decision.

How we protect your privacy
All the information you provide will be held in confidence. We have taken careful steps to make sure that you cannot be directly identified from the questionnaire form; there is no information on these questionnaires that will identify you. Your personal details (e.g. signature on the consent form) and your questionnaire will be kept in secure locations by the research team. When we have finished the study and analysed all the information, all the documentation used to gather the data will be destroyed. The recordings of the focus groups/interview will also be held in a secure and confidential environment during the study and destroyed when it is complete.

YOU WILL BE OFFERED A COPY OF THIS INFORMATION SHEET TO KEEP

If you require any further information about this project then please contact:
Wycliff Onuonga, Cardiff Metropolitan University
CMU email: st20041741@cardiffmet.ac.uk
Supervisor: Jason Williams
jjwilliams cardiffmet.ac.uk
Appendix 3

To whom it may concern

I am currently a 3rd year Computing and Information Systems student at Cardiff Metropolitan University. The title of my thesis is “Technological Unemployment: Investigating the implications of automation in branch banking and small accounting firms.” Its aim will be to identifying key roles currently reliant on or entirely under office automation in a selection of companies using observation, hopefully developing a well-informed prediction of the Industrial and employment outlook within 10 years using the research. I also intend to assess the results and correlate them with past trends showing the gradual replacement of employees and new opportunities for employment which arise as a by-product of automation.

As part of my research I would like to undertake research with people who are employed in a service industry company at supervisory level and below. I am writing to you because Graham Paul Chartered Accountants fits the profile of this type of organisation and also employs a sufficient number of employees so as to provide a large enough number of potential participants. This research project has received approval from Cardiff Metropolitan University and all data collection will be in accordance with the university’s ethics code of practice.

My purpose in writing is to ask if you would permit me to issue a questionnaire to your employees. Their participation would be entirely voluntary, neither they nor the company would be identified in the research and it would only take 10 minutes for each employee to complete a questionnaire. I would hope to gain 20 responses from your employees.

The areas which would be covered by the questionnaire include:

- Length of service
- Services offered by the company
- Employee work related responsibilities
- Office software/programmes utilising for everyday work tasks
- Training offered/required to use such applications (if any)
- Personal opinion on the implications of automation (benefits, disadvantages, limitations)

I shall be very happy to make the results of my research available to all participants in the research when completed. If you would like to participate in this project or are interested in discussing it further please contact me on st20041741@outlook.cardiffmet.ac.uk

My supervisor can also be contacted with the following details:

Dr Jason Williams
jjwilliams@cardiffmet.ac.uk

Thank you in advance.
Yours sincerely
Wycliff Onuonga
Appendix 4

To whom it may concern

I am currently a 3rd year Computing and Information Systems student at Cardiff Metropolitan University. The title of my thesis is “Technological Unemployment: Investigating the implications of automation in branch banking and small accounting firms.” Its aim will be to identifying key roles currently reliant on or entirely under office automation in a selection of companies using observation, hopefully developing a well-informed prediction of the Industrial and employment outlook within 10 years using the research.
I also intend to assess the results and correlate them with past trends showing the gradual replacement of employees and new opportunities for employment which arise as a by-product of automation.

As part of my research I would like to undertake research with people who are employed in a service industry company at supervisory level and below. I am writing to you because Kilsby & Williams fits the profile of this type of organisation and also employs a sufficient number of employees so as to provide a large enough number of potential participants. This research project has received approval from Cardiff Metropolitan University and all data collection will be in accordance with the university’s ethics code of practice.

My purpose in writing is to ask if you would permit me to issue a questionnaire to your employees. Their participation would be entirely voluntary, neither they nor the company would be identified in the research and it would only take 10 minutes for each employee to complete a questionnaire. I would hope to gain 20 responses from your employees.

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- Length of service
- Services offered by the company
- Employee work related responsibilities
- Office software/programmes utilising for everyday work tasks
- Training offered/required to use such applications (if any)
- Personal opinion on the implications of automation (benefits, disadvantages, limitations)

I shall be very happy to make the results of my research available to all participants in the research when completed. If you would like to participate in this project or are interested in discussing it further please contact me on st20041741@outlook.cardiffmet.ac.uk

My supervisor can also be contacted with the following details:

Dr Jason Williams
jjwilliams@cardiffmet.ac.uk

Thank you in advance.
Yours sincerely
Wycliff Onuonga
Appendix 5

To whom it may concern

I am currently a 3rd year Computing and Information Systems student at Cardiff Metropolitan University. The title of my thesis is “Technological Unemployment: Investigating the implications of automation in branch banking and small accounting firms.” Its aim will be to identifying key roles currently reliant on or entirely under office automation in a selection of companies using observation, hopefully developing a well-informed prediction of the Industrial and employment outlook within 10 years using the research. I also intend to assess the results and correlate them with past trends showing the gradual replacement of employees and new opportunities for employment which arise as a by-product of automation.

As part of my research I would like to undertake research with people who are employed in a service industry company at supervisory level and below. I am writing to you because Lloyds Bank fits the profile of this type of organisation and also employs a sufficient number of employees so as to provide a large enough number of potential participants. This research project has received approval from Cardiff Metropolitan University and all data collection will be in accordance with the university’s ethics code of practice.

My purpose in writing is to ask if you would permit me to issue a questionnaire to your employees. Their participation would be entirely voluntary, neither they nor the company would be identified in the research and it would only take 10 minutes for each employee to complete a questionnaire. I would hope to gain 20 responses from your employees.

The areas which would be covered by the questionnaire include:

- Length of service
- Services offered by the company
- Employee work related responsibilities
- Office software/programmes utilising for everyday work tasks
- Training offered/required to use such applications (if any)
- Personal opinion on the implications of automation (benefits, disadvantages, limitations)

I shall be very happy to make the results of my research available to all participants in the research when completed. If you would like to participate in this project or are interested in discussing it further please contact me on st20041741@outlook.cardiffmet.ac.uk

My supervisor can also be contacted with the following details:

Dr Jason Williams
jjwilliams@cardiffmet.ac.uk

Thank you in advance.

Yours sincerely
Wycliff Onuonga
Appendix 6

To whom it may concern

I am currently a 3rd year Computing and Information Systems student at Cardiff Metropolitan University. The title of my thesis is “Technological Unemployment: Investigating the implications of automation in branch banking and small accounting firms.” Its aim will be to identifying key roles currently reliant on or entirely under office automation in a selection of companies using observation, hopefully developing a well-informed prediction of the Industrial and employment outlook within 10 years using the research.

I also intend to assess the results and correlate them with past trends showing the gradual replacement of employees and new opportunities for employment which arise as a by-product of automation.

As part of my research I would like to undertake research with people who are employed in a service industry company at supervisory level and below. I am writing to you because Santander fits the profile of this type of organisation and also employs a sufficient number of employees so as to provide a large enough number of potential participants. This research project has received approval from Cardiff Metropolitan University and all data collection will be in accordance with the university’s ethics code of practice.

My purpose in writing is to ask if you would permit me to issue a questionnaire to your employees. Their participation would be entirely voluntary, neither they nor the company would be identified in the research and it would only take 10 minutes for each employee to complete a questionnaire. I would hope to gain 20 responses from your employees.

The areas which would be covered by the questionnaire include:

- Length of service
- Services offered by the company
- Employee work related responsibilities
- Office software/programmes utilising for everyday work tasks
- Training offered/required to use such applications (if any)
- Personal opinion on the implications of automation (benefits, disadvantages, limitations)

I shall be very happy to make the results of my research available to all participants in the research when completed. If you would like to participate in this project or are interested in discussing it further please contact me on st20041741@outlook.cardiffmet.ac.uk

My supervisor can also be contacted with the following details:

Dr Jason Williams
jjwilliams@cardiffmet.ac.uk

Thank you in advance.
Yours sincerely
Wycliff Onuonga
Appendix 7

Technological unemployment: Investigating the implications of automation in branch banking and small accounting firms

I am a final student at the Cardiff School of Management. The aim of my research is to analyse retail banks and small accounting firms to investigate the work tasks which are currently under automation. By doing so, the findings will arrive at a conclusion in regards to the outlook of employment in a decade and the subsequent opportunities and problems automation provides, based on previous trends. Please complete each question by either putting your answer in the space provided or circling the appropriate response. At the end of the questionnaire you will be asked to submit your responses. Submission will be taken as voluntary informed consent. All your responses are confidential and will only be used for the purposes of this research. Thank you in advance for taking the time to complete this questionnaire.

Disclaimer: Submission of a completed questionnaire will be taken as informed consent.

Researcher: Wycliff Onuonga

Cardiff School of Management
Cardiff Metropolitan University
Llandaff Campus, Western Avenue,
Cardiff, CF5 2YB

Supervisor: Dr Jason Williams
jjwilliams@cardiffmet.ac.uk
Appendix 8

Online Questionnaire (Qualtrics)

1. **What is the name of the company you work for?**
   
2. **What is your current job title?**
   
3. **How long have you worked at the company? (Please tick one)**
   - Less than a year
   - 1-3 years
   - 4-6 years
   - 7-9 years
   - 10 years or more

4. **How often do you rely on computer software to aid your work?**
   (Please tick the appropriate boxes that apply to your job)

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<th>Rarely</th>
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<th>Often</th>
<th>All the time</th>
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</table>
5. Have you received company aided training to utilise any specialised software?
   - Yes
   - No

6. What are the main software programmes which help you to carry out work tasks? E.g., Sage, Trello (Optional)

7. Do you believe that the fear of technological unemployment or technophobia is irrational? (Please tick one)
   - Yes
   - No
   - Not sure

8. What overall effect do you believe automation has on employment in the finance industry? E.g. ATMs, Computerised Accounting Systems (Please tick one)
   - Mostly positive
   - Mostly negative
   - Both
   - Not sure

9. In your opinion, what will be the implications of automation in the finance industry in the next decade? (Please tick one)
   - More job opportunities
   - Fewer job opportunities
   - Both
   - Not sure
10. **What do you believe are the main limitations of automated systems/software?**
   *(Please select two)*
   - [ ] Training required to utilise or maintain
   - [ ] Limited cognitive processing
   - [ ] Lack of versatility
   - [ ] Unpredictable costs
   - [ ] Other
     Please specify: ____________________________

11. **What do you believe is the main advantages of automated systems/software?**
    *(Please select two)*
    - [ ] Cost effective
    - [ ] Efficiency/accuracy
    - [ ] Improved consistency
    - [ ] Increased productivity
    - [ ] Other
      Please specify: ____________________________

12. **What range of jobs do you feel are most susceptible to technological unemployment (being replaced by technology) Rank accordingly. 1= high risk 3 = low risk**

   - [ ] Low skill
   - [ ] Medium skill
   - [ ] High skill

13. **What skills do you believe are most beneficial for potential employees to acquire that cannot be replicated as efficiently by computers?** *(Please select 2 main skills)*

   - [ ] Soft skills (e.g social intelligence)
   - [ ] Flexibility
   - [ ] Experience based cognitive processing
   - [ ] Common sense rationalisation
   - [ ] Other
     Please specify: ____________________________

14. **Is it a realistic prediction to make that automated services will compliment employees in their work tasks more so than substituting them entirely?**

   - [ ] Yes
   - [ ] No
   - [ ] Not sure
15. Do you believe the retail banking/small accounting firm industry is more susceptible to technological unemployment than most industries? Feel free to emphasize on your particular department/job and address how professionals can deal with a potential threats of being replaced by technology. Please explain your answer openly and truthfully.

### Appendix 9

<table>
<thead>
<tr>
<th>Job Title</th>
<th>Number of responses</th>
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<tbody>
<tr>
<td>Business Services (Client) Manager</td>
<td>8 (14%)</td>
</tr>
<tr>
<td>Tax (client) Manager</td>
<td>7 (18%)</td>
</tr>
<tr>
<td>Branch Manager</td>
<td>2 (4%)</td>
</tr>
<tr>
<td>Marketing Executive</td>
<td>6 (11%)</td>
</tr>
<tr>
<td>Personal Bank Adviser</td>
<td>8 (14%)</td>
</tr>
<tr>
<td>Human Resources Director</td>
<td>3 (5%)</td>
</tr>
<tr>
<td>Director of Outsourcing Services</td>
<td>1 (1%)</td>
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<tr>
<td>Corporate Finance Director</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>Head of Business Planning</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>Director of Human Resources</td>
<td>2 (4%)</td>
</tr>
<tr>
<td>Chartered Accountant</td>
<td>6 (11%)</td>
</tr>
<tr>
<td>Recruiter</td>
<td>3 (5%)</td>
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<tr>
<td>Customer service adviser</td>
<td>4 (7%)</td>
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<tr>
<td>Head of Digital Customer Experience</td>
<td>1 (1%)</td>
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<tr>
<td>Head of Customer Insight</td>
<td>1 (1%)</td>
</tr>
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</table>

*For consistency purposes, some jobs have been merged with other similar titles. For example Telephone Adviser and on call customer adviser are included as Customer Service Adviser; Marketing Director and Head of Marketing Strategy and Planning are included as Marketing Executive; Head of Personal tax is included as Tax Manager; Senior partner is included as Chartered Accountant; Head of Digital Customer Experience is included as Head of Customer Insight; Head of Sponsorship and Events is included as Marketing Executive; Consultant is included as Chartered Accountant; Payroll manager is included under Director of Human Resources; Talent Director is included under Recruiter; Bank teller is included under Personal Bank Adviser, Customer Service Assistant is included under Customer Service Adviser. Audit Associate is included as Chartered Accountant.*
### Appendix 10

<table>
<thead>
<tr>
<th>Respondent 48</th>
<th>“It depends on what skills individuals have to offer. The more abilities you have (soft or technical), the more opportunities you create for employment”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respondent 46</td>
<td>“Advanced technology is beneficial in the sense that it offers more opportunities for people with technical skills to use it in their work for accuracy, but impacts people with a limited range of skills that can be automated”</td>
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<tr>
<td>Respondent 52</td>
<td>“Professionals need to be able to carry out a variety of tasks which are not simply repetitive, since these are the ones which are automated first.”</td>
</tr>
<tr>
<td>Respondent 26</td>
<td>“...As long as prospective employees continue to diversify in terms of the skills they offer to companies, they can remain in demand, regardless of the threats of automation. This means that their skills may not be directly in line with their job specification, but can still prove to be useful in the long run”</td>
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<tr>
<td>Respondent 34</td>
<td>“... there are many intricacies involved, sometimes requiring little to no technology assistance, and solely dependent on the relationship between workers such as handling complaints, hiring and firing etc... This is a factor which I don't believe is likely to be completely replaced by technology, hence the reason “lack of versatility” is the key limitation. Workers should continuously improve their soft skills which can't be replicated as successfully by technology.”</td>
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<tr>
<td>Respondent 16</td>
<td>“…can’t speak for all jobs in the financial industry, but bank telling requires human skills to achieve tasks which can't be done through an ATM e.g. communication to create a new account... employees should enhance their social skills to be more employable, and not rely purely on the technical side of the job's requirement.”</td>
</tr>
<tr>
<td>Respondent 43</td>
<td>“Understanding how to relate to customers is a valuable asset for anyone, and probably one of the main reasons it deters companies from completely automating certain processes”</td>
</tr>
</tbody>
</table>
### Appendix 12

| **Respondent 22** | “I think technology will only continue to play a significant role in the majority of jobs in the financial industry. It’s within a worker’s best interest to adopt an inquisitive nature in regards to new technology, to understand how to use it to assist them without necessarily having to be taught. This level of autonomy will be valuable to any organisation. But I don’t think that technology will ever completely replace workers in the financial industry.” |
| **Respondent 23** | “In terms of recruitment, one way in which employees can ensure they are a valuable asset to any organisation is through their transferable skills. Since the industry is constantly changing, subsequently with new demands from employers, the ability to teach oneself to become accustomed with new industry processes and technology creates an invaluable trait beneficial to the worker and organisation, by eliminating the need for educational courses funded by the company. Needless to say, this emphasises the importance of initiative to embark on further studies to improve competency with new software without falling behind.” |
| **Respondent 10** | “Professionals in the financial industry are only at high risk of being replaced if they do not continuously learn and re-learn industry practices and skills.” |
| Respondent 54 | “With branch management, one of the most important requirements is diversity and flexibility since the responsibilities form a wide spectrum. Communicating with other departments, making decisions, motivating staff and so on. This is where technology is limited. It's usually tailor made for specified tasks, and isn't as good at responding to situations on the spot.” |
| Respondent 32 | “Software can be unable to pull relevant information from experience to provide useful recommendations for clients, limiting its usefulness. This is where professionals are required to bridge that gap, and work alongside the software using their experience and logic to ensure efficient and reliable services.” |
| Respondent 35 | “A bank teller offers transactions with the addition of interaction, providing good quality service and a reputation for the bank as a whole through the feedback they receive. Some people don't feel comfortable or safe using online banking/ATMs or simply prefer the experience of interacting personally.” |
### Respondent 18 – Finance

“Yes, but as long as professionals remain current on the changing trends and requirements from employers to stand out and add value to the organisation, they should not be any more susceptible to being unemployed due to technology in comparison to any other profession.”

### Respondent 20 – Finance

“Since the financial industry is one of the many which relies heavily on computers and software programs to assist with many work related tasks, I would say it’s understandable to think it is more susceptible than others. But the effects of this are not likely to have too heavy of a bearing until least the next few years, where demands from employees may change substantially.”

### Respondent 37 - Accounting

“Possibly, because of the emphasis of accuracy. One advantage of technology automating tasks is the efficiency, and ability to eliminate human error. When dealing with numbers, human error can be a big issue when dealing with the stock market, accounting, and bank transactions and so on. So it's within the best interest to automate the more simplistic/routine tasks in finance to ensure minimal mistakes. This opens up many opportunities. But I don't feel it is something to be worried about for workers with other complex soft or technical skills.”
Appendix 15

1. What is the name of the company you work for?
   
   Santander

2. What is your current job title?

   Recruiter

3. How long have you worked at the company? (Please tick one)
   
   - Less than a year
   - 1-3 years
   - 4-6 years
   - 7-9 years
   - 10 years or more

4. How often do you rely on computer software to aid your work? (Please tick the appropriate boxes that apply to your job)

<table>
<thead>
<tr>
<th></th>
<th>Not Applicable</th>
<th>Never</th>
<th>Rarely</th>
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<th>Often</th>
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5. **Have you received company aided training to utilise any specialised software?**
   - Yes
   - No

6. **What are the main software programmes which help you to carry out work tasks? E.g., Sage, Trello (Optional)**
   - **Company issued software**

7. **Do you believe that the fear of technological unemployment or technophobia is irrational?**
   (Please tick one)
   - Yes
   - No
   - Not sure

8. **What overall effect do you believe automation has on employment in the finance industry? E.g. ATMs, Computerised Accounting Systems**
   (Please tick one)
   - Mostly positive
   - Mostly negative
   - Both
   - Not sure

9. **In your opinion, what will be the implications of automation in the finance industry in the next decade?**
   (Please tick one)
   - More job opportunities in general
   - More niche job opportunities with special skills required
   - Fewer job opportunities
   - No significant difference
   - Not sure
10. What do you believe are the main limitations of automated systems/software?  
(Please select two)
- Training required to utilise or maintain
- Limited cognitive processing
- Lack of versatility
- Unpredictable costs
- Other  
  Please specify: 

11. What do you believe is the main advantages of automated systems/software?  
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- Cost effective
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- Other  
  Please specify: 

12. What range of jobs do you feel are most susceptible to technological unemployment (being replaced by technology) Rank accordingly. 1 = high risk 3 = low risk

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13. What skills do you believe are most beneficial for potential employees to acquire that cannot be replicated as efficiently by computers? (Please select 2 main skills)

- Soft skills (e.g social intelligence)
- Flexibility
- Experience based cognitive processing
- Common sense rationalisation
- Other  
  Please specify: 

14. Is it a realistic prediction to make that automated services will compliment employees in their work tasks more so than substituting them entirely?

- Yes
- No
- Not sure
15. Do you believe the retail banking/small accounting firm industry is more susceptible to technological unemployment than most industries? Feel free to emphasize on your particular department/job and address how professionals can deal with a potential threats of being replaced by technology. Please explain your answer openly and truthfully.

Not quite because many people rely on the financial expertise of professionals with experience to ensure their needs are being taken care of appropriately. Being in HR, technology makes my job easier, because with recruitment for example, instead of physically reading all job applications, i'm able to use software to minimize my work load. But because a sense of judgement is required on my part, this is why i think technology isn't likely to completely assume recruitment roles.
1. **What is the name of the company you work for?**

   Kilsby & Williams

2. **What is your current job title?**

   Business Services Senior Manager

3. **How long have you worked at the company? (Please tick one)**

   - [ ] Less than a year
   - [ ] 1-3 years
   - [ ] 4-6 years
   - [ ] 7-9 years
   - [ ] 10 years or more

4. **How often do you rely on computer software to aid your work?**

   (Please tick the appropriate boxes that apply to your job)

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5. Have you received company aided training to utilise any specialised software?

- Yes
- No

6. What are the main software programmes which help you to carry out work tasks? E.g., Sage, Trello (Optional)

   - Sage One

7. Do you believe that the fear of technological unemployment or technophobia is irrational? (Please tick one)

   - Yes
   - No
   - Not sure

8. What overall effect do you believe automation has on employment in the finance industry? E.g. ATMs, Computerised Accounting Systems (Please tick one)

   - Mostly positive
   - Mostly negative
   - Both
   - Not sure

9. In your opinion, what will be the implications of automation in the finance industry in the next decade? (Please tick one)

   - More job opportunities in general
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1. Low skill
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Professionals in the financial industry are only at high risk of being replaced if they do not continuously learn and re-learn industry practices and skills.
# Appendix 17

1. **What is the name of the company you work for?**
   - Graham Paul Chartered Accountants

2. **What is your current job title?**
   - Director of Outsourcing Services

3. **How long have you worked at the company? (Please tick one)**
   - 
     - [ ] Less than a year
     - [ ] 1-3 years
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4. **How often do you rely on computer software to aid your work?**
   - (Please tick the appropriate boxes that apply to your job)

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<td>Employee Relations (e.g handling conflict)</td>
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<td>Market research (Tracking trends and monitoring completion)</td>
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<td>Allocating budgets</td>
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<td>Devising marketing plans</td>
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<td>Proofreading documents</td>
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<td>Sourcing and securing sponsorship</td>
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</table>
10. What do you believe are the main limitations of automated systems/software? 
(Please select two)
- Training required to utilise or maintain
- Limited cognitive processing
- Lack of versatility
- Unpredictable costs
- Other
  Please specify: 

11. What do you believe is the main advantages of automated systems/software? 
(Please select two)
- Cost effective
- Efficiency/accuracy
- Improved consistency
- Increased productivity
- Other
  Please specify: 

12. What range of jobs do you feel are most susceptible to technological unemployment 
(being replaced by technology) Rank accordingly. 1= high risk 3 = low risk
- Low skill
- Medium skill
- High skill

13. What skills do you believe are most beneficial for potential employees to acquire that 
cannot be replicated as efficiently by computers? (Please select 2 main skills)
- Soft skills (e.g social intelligence)
- Flexibility
- Experience based cognitive processing
- Common sense rationalisation
- Other
  Please specify: 

14. Is it a realistic prediction to make that automated services will compliment employees in 
their work tasks more so than substituting them entirely?
- Yes
- No
- Not sure
15. Do you believe the retail banking/small accounting firm industry is more susceptible to technological unemployment than most industries? Feel free to emphasize on your particular department/job and address how professionals can deal with a potential threats of being replaced by technology. Please explain your answer openly and truthfully.

It depends on the level of skill required for the particular job roles, for example, bank tellers are likely more at risk at being replaced than accountants due to the complexities required for the job. It also depends on the feasibility of automating certain roles, and whether it is a key position for the organisation to operate efficiently.
Word count

Abstract: 286
Introduction: 739
Literature Review: 4979
Methodology: 886
Findings: 1989
Discussion: 1597
Limitations and Future Research: 278
Conclusion: 750
Total: 11231 (excluding Abstract)