

# The Evolution of Accountants: Adapting to Big Data Analytic and Enterprise Resource Planning Systems in Accounting

Master of Science in Accounting

**Research Project** 

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(August 2024)



#### National College of Ireland

#### **Project Submission Sheet**

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#### Abstract

There have been several studies on the use of advanced technology of ERP and Big data analytics in the field of accounting, however, they mostly focus on its use providing details of benefits and challenges. This study evaluates the skill set, roles and responsibilities of modern accountants for adapting to Big Data analytics and ERPS in accounting for its effective, efficient and smooth working in organisations. With technology acceptance theory as a theoretical underpinning, the study collected data with the help of conducting semi-structured interviews for collecting qualitative data. The collected data is analysed with the help of subject matter analysis and the sample size is 5 accountants.

The research findings from the analysis suggested that the use of big data analytics and ERP systems in accounting helped improve the system's efficiency. ERP system helps in collecting and integrating data from various departments and platforms which can be analysed with the help of big data analytics. Moreover, it can be concluded that accountants face difficulties due to the requirement for technical skills. Therefore, it is recommended that accountants should acquire technical skills, programming knowledge, problem-solving and analytical skills.

The purpose of this research project is to contribute valuable information from literature sources on the subject of using big data analytics and ERP systems in accounting processes and the skills required by accountants for using these technologies. The study encourage the accountants to develop technical, programming and analytical skills to enable them to work with advanced technology. For the management of organisations and educators, findings help in providing promoting technical training to make accountants work with advanced technology

### Declaration

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### Abbreviations

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Enterprise resource planning System (ERPS), Systems, Applications & Products in Data Processing (SAP), Information technology (IT), Artificial Intelligence (AI) and Machine Learning (ML)

#### **Chapter 1: Introduction**

#### **1.1 Research Background**

Accounting as a profession has gone through considerable changes or transformations over the previous few decades mainly due to the overall technological advancement and development. The emergence of technology and innovation within the accounting industry has transformed the way traditional accounting practices are carried out. Traditional accounting practices were mainly based on paper-based systems and manual processes which with the emergence of technology and innovation have evolved into automated, data-driven, sophisticated methodologies (Bistra, 2023; Vasarhelyi et al., 2015). This overall technological shift has been accompanied by the emergence of ERPS or Enterprise Resource Planning System and Big Data analytics that have transformed the way financial information is analysed, used and managed. Further, big data analytics could be understood as the overall complex procedure of evaluating varied and large datasets for uncovering hidden trends, correlations, patterns and various other insights. In accounting, the use of big data prompts accountants to evaluate an extensive number of financial data accurately and efficiently (Abdelhalim, 2024). This ability allows for highly robust decision-making, enhanced predictive analysis and better risk management.

On the other side, ERPS could be understood as the set of integrated software channels which controls the core business procedures of an entity on a real-time basis. These systems consolidate multiple functions like human resources, finance, CRMS, and supply chain activities into a particular unified system (Chuang and Shaw, 2008). Further, the integration of ERPS in the light of accounting makes the overall process streamlined, offers real-time visibility and improves data accuracy in the financial operations. This has enabled accounting professionals to analyse and access data rapidly for accurate financial reporting and greater efficiency (Sardo and Elvas, 2018). Thus, the emergence of ERPS and Big Data analytics has not just increased the effectiveness and efficiency of accounting practices but also demanded a transformation in the overall skill set needed for accountants. Moreover, the overall evolution of the accounting profession based on ERPS and Big Data marks a considerable departure from orthodox accounting practices. In this relation, the research tries to understand such evolution which is highly essential for comprehending the ongoing and future scenario of the accountants should undertake in the transforming technological era.

#### **1.2 Research Problem**

The rapid use or integration of ERPS and Big Data analytics into accounting has prompted to considerable opportunities and challenges. While such technologies offer the possibility for increased data accuracy, greater efficiency, and improved decision-making, their use and adoption also require a considerable shift in the roles and skill sets of accountants. Thus, this evolution raises important questions regarding the overall readiness of the ongoing accounting workforce to align with such technologies and innovation and the overall effectiveness of current training and educational initiatives in preparing future accountants with the required qualities and skills. Hence, the research problem in the presented research lies in the possible skills gap among the accountants who lack the innovative expertise needed to use or align ERPS and Big Data analytic systems in the most effective and efficient manner. Orthodox training programs and accounting education have mainly focused on basic accounting principles and rules with limited targets on ERPS and data analytic proficiency. Similarly, there exists an extensive requirement to evaluate how adequately such initiatives align with the transforming scenario and to detect any gas that could be present in the current accounting profession curriculum. One another identified problem is based on using such technologies and innovation within organisations and is related to the issues of system integration, data security and adaptation expenses. Thus, the research target is to analyse the overall extent to which such challenges influence the successful application of ERPS and Big Data analytics in the accounting profession and how they impact the responsibilities and roles of modern enterprise accountants.

#### **1.3 Research Aim and Objectives**

The background and research problem have assisted in highlighting how technology and innovation and transforming the accounting profession and the overall industry. However, there are some associated opportunities and challenges that emerged due to the use of such technologies in accounting, Thus, in this context, the aim of the presented research is to evaluate the skill set, roles and responsibilities of modern accountants for adapting to Big Data analytic and ERPS in accounting for its effective, efficient and smooth working in organisations. Based on the aforementioned research aim, the research objectives are as follows:-

- To evaluate the impact of big data on the accounting practices carried out by accountants in companies
- To analyse the way ERPS is integrated into the accounting processes of companies
- To determine skills or knowledge needed by modern accountants for effective and efficient use of big data analytics and ERP in accounting practices

• To recommend a proper set of skills and qualities suitable for accountants to grasp the opportunities and overcome the associated challenges from accounting companies

#### 1.4 Significance of the Research

The presented research is highly significant and essential as it considers the extensive transformative influence of ERPS and Big Data analytics on the accounting profession. The knowledge of this evaluation is important for various stakeholders, especially accounting professionals, organisations, and others. This study is likely to assist accounting professionals through showcasing the requirement of learning new skills and aligning to overall technological advancements for remaining effective and relevant in their roles and responsibilities. The research will highlight the criticality of regular professional advancement and lifetime learning in the scenario of rapid technology and innovative transformation. For companies, the research offers an extensive understanding of the challenges and benefits related to aligning such technologies in accounting practices. By evaluating the influence on data accuracy, efficiency and overall decision-making, the research can assist companies make informed decisions regarding investing in and using such technologies. In addition, the research is likely to offer guidance on solving possible challenges associated with system integration, workforce training and data security. Eventually, the research targets to contribute to the current discourse of the accounting profession's future through offering practical suggestions for navigating the issues of technological alignment and making sure the continued relevance and growth of the accounting profession.

#### 1.5 Key Literature Findings and Methodology

The key literature findings assisted in determining the overall criticality of the application of big data analytics and ERPS in the accounting profession. However, the overall studies evaluated carry minimal data or information about the skill required by professional accountants to use such technologies efficiently and effectively. In addition, the secondary data sources also lacked detailed information about the way such technologies could be used by the companies adequately and overcome the potential challenges. Based on the identified research gap, the further chapters try to bridge the gap by gathering relevant primary and secondary data with the help of interviews and a structured literature review respectively. A mix of primary and secondary qualitative data is likely to assist in carrying out an in-depth investigation of the required skills by the professional accountants to use big data analytics and ERPS for greater efficiency and effectiveness as well as the way companies especially accounting companies can use the technologies to adequately manage the overall

Chapter	Introduction	The first chapter is the introduction that highlights
1		the research's background, key aims and objectives
		and the overall justification of conducting it.
Chapter	Literature chapter	The second chapter is the literature review chapter
2		in which secondary sources have been evaluated to
		gain extensive insights into already conducted
		research work in the light of the research objectives.
		This chapter also highlights the main research gap
		and conceptual framework of the study

#### **1.6 Overview of the Research**

Chapter	Research	The third chapter is research questions which have
3	Questions	been formulated after the detection of key literature
		gaps in the journal articles and framing questions to
		narrow down the overall research aim to better
		inferences
Chapter	Research	The fourth chapter is research methodology in
4	Methodology	which the process to gather and analyse the data has
		been mentioned. This chapter is critical as it
		evaluates the way data has been gathered to bridge
		the research gap. Ethical consideration has also been
		shown as the research involves primary data
		collection through interviews.
Chapter	Findings, results	This is the most essential chapter in the research as
5	and data analysis	it highlights the gathered findings and results which
		have been used to analyse to analyse the data for
		getting proper inferences in the light of set research
		questions and objectives
Chapter	Discussion	This chapter discusses the overall data gathered
6		from primary and secondary sources to gain
		adequate inferences.
Chapter	Conclusion and	This chapter is the last chapter of the research and
7	Recommendations	highlights the final conclusions of the research
		based on which adequate recommendations have
		been provided for emerging accountants and
		companies.

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#### **Chapter 2: Literature Review**

#### **2.1 Introduction**

In the contemporary world, the use of technology helps in performing tasks with a higher level of expertise and cost-effectiveness. The traditional way of working is facing changes due to the use of advanced technology in every field and accounts are also one of the fields that are integrating big data analytics and Enterprise Resource Planning Systems (ERP) in order to increase the efficiency of the work and provide better outcomes (Arnaboldi, Busco and Cuganesan, 2017). However, the use of technology has certain setbacks that can pose issues in performing tasks such as lack of adequate infrastructure or inability of the current workforce to cope with the change in the technology. In this concern, the literature review focuses on critically discussing the evaluation of accounting with a special focus on the adoption of big data analytics and ERP systems in the field of accounting.

#### 2.2 Evaluating the Influence of Big Data Analytics on Accounting Practices

The profession of accounting has a growing and large set of data known as big data. Arnaboldi, Busco and Cuganesan (2017) define big data as a wide variety and high-velocity information assets which require innovative and cost-effective information processing systems to improve insights and in turn decision-making capabilities. Big data can consist of large volumes of unstructured or structured data generated from sources like social media content, videos, photos or administrative data. Big data analytics, involving various applications, tools and methods, has emerged as a valuable approach to gathering, processing as well and generating useful insights from significant, high-velocity and high-volume data. Saeed and Husamaldin (2021) explained that the variety, velocity and volume, also refer to 3Vs, as key characteristics of big data. Big data requires it to be analysed, evaluated and processed in an effective

and innovative manner for the purpose of developing fruitful decisions. In accounting literature, big data is often performed with the help of data analytics or predictive analytics software. Alles and Gray (2016) have noted that big data in accounting refers to the collection of a mix of non-financial and financial data, blogs, sensor data, emails, social media data, telephone calls and other types of external and organisational data. Most accounting firms invest in data analytics to study the large amount of data collected about competitors, customers or the external environment. The main benefits of using big data analytics in accounting are that it facilitates performing a higher number of transactions, improves accounting and audit quality by offering deeper insights and makes it easier to detect fraud as accountants can leverage technologies and tools effectively.

It has further been stated by Gepp *et al.* (2018) that big data analytics in accounting is often used for financial fraud modelling, financial distress modelling, quantitative modelling and stock market prediction. The application of these advanced analytical techniques strengthens the ability of accountants and auditors to interpret large sets of data in a quick, accurate and convenient manner and help reach more timely and accurate financial decisions. Adding to this, Appelbaum *et al.* (2017) argued that traditional accounting data consisted of reported and structured data like purchase orders, sales, orders, personnel information, inventory, timesheets, receivables and shipments. These data were familiar, orderly and predictable to businesses. However, in recent years, data for companies keeps coming from varied sources, remains unstructured and seems overwhelming because of the large volume, data types and variety. Big data as well as analytics affects almost all aspects of strategic analysis, decision-making and forecasting of major companies. It has provided opportunities for businesses to create, collect, extract, analyse and process millions of data from internal

and external sources for the purpose of developing and maintaining competitive advantage. For instance, descriptive analytics helps accountants determine what happened in the past, while predictive analytics forecasts what will happen in the future.

Therefore, it can be inferred from literature findings that big data analytics has improved the reporting and operational practices of accountants by offering comprehensive and decision-related information.

#### 2.3 Analysing the Integration of ERP Systems in Accounting

The rapidly evolving business environment and global economy have forced organisations to consider and implement ERP systems. As discussed by Galani, Gravas and Stavropoulos (2010) ERP is an integrated software package which allows businesses to merge different organisational units such as finance, sales, production, human resources or marketing to develop strong, secured and robust integrated systems facilitating information flow across the business. ERP system, as discussed by Françoise, Bourgault and Pellerin (2009), is the most advanced technological solution to manage organisational information in the most effective and efficient manner. Noudoostbeni *et al.* (2010) stated that ERP ensures all operational systems remain entirely integrated. It provides access to real-time financial and operational data and in turn, helps companies to make their management structure more streamlined, flexible, and democratic. Madanhire and Mbohwa (2016) conferred ERP as the main business that offers opportunities to organisations to effectively and efficiently manage their resources. ERP's main function is to consolidate entire operational data into a single software module necessary for facilitating business processes.

Chou and Chang (2008) added that ERP systems are becoming highly popular as they help increase operational and business efficiency by offering real-time integrated data to organisational managers and consequently improve their ability to

make effective decisions required for improving operational efficiency. Technology acceptance theory asserts that system design features, perceived usefulness and ease of use often form positive affective responses for individuals to use technology. In alignment with this theory, companies perceive ERP implementation as a solution to outdated and inadequate systems, integration of internal resources, enhanced productivity as well as financial cycle, which make them motivated to integrate the system into the organisation. Tsai *et al.* (2010) have conducted statistical analysis to determine the effect of ERP systems on business processes. The findings reflect that ERP implementation brings positive productivity, satisfying customer demand, gaining competitive advantage and improving response capabilities. It also improves flow efficiency, minimises cycle time, generates financial information on a quick basis and in turn allows managers to make informed decisions. However, implementing an ERP system is long and complicated, requiring significant time, cost and expertise, hence many ERP projects fail.

Kanellou and Spathis (2013) examined the benefits of ERP implementation on accounting practices by collecting questionnaire data from 96 IT professionals and 175 accountants from a total of 193 companies operating in Greece. The findings reflect accounting benefits from ERP adoption from four dimensions: organisational accounting benefits (competitive advantage), IT accounting benefits (time), operational accounting benefits (cost) and managerial accounting benefits (informed decisionmaking). Its implementation facilitates gathering and processing data in a quick and easier manner and hence provides organisations, especially accounting departments, an increased level of flexibility. In support of the aforementioned argument, Stevcevska Srbinoska and Donovska (2023) also discussed that ERP implementation helps reduce the service time of accounting tasks. It minimises time associated with account closure and issuing payroll.

Nguyen, Nguyen and Vu (2021) have collected data from 225 accountants from 42 construction firms in Vietnam to determine the effect of the ERP system on accounting benefits. The results show that information generation, real-time information and application integration as three critical motivates encouraging construction firms in Vietnam to use ERP. The major accounting benefits achieved by implementation include construction firms from ERP enhanced internal communication, access to reliable and timely accounting information and improved financial decisions and quality of financial reports. Adding further, Odoyo and Ojera (2020) also mentioned accounting benefits as critical factors that encourage ERP adoption and user satisfaction. Accountants find ERP highly valuable as it assists them in completing financial activities in an easier, more convenient and accurate manner by using different types of information systems.

## 2.4 Assessing the evolution of skill set for accountants for effectively and efficiently using ERP and Big Data Analytic

The implementation of advanced technologies such as ERP and Big Data Analytics has brought substantial changes in the company's procedures and operations including job nature and the accountant's role. The literature published by AHMAD SUHAIMI, NAWAWI and PUTEH SALIN (2016) has recognised the ERP effect to be influenced largely by accountant knowledge, expertise and skills. The author suggests the successful use of ERP requires accountants to have effective data collection and data compilation skills to prepare financial statements. Besides, accountants are also required to have enhanced communication and analytical skills and abilities to collect, analyse and evaluate data. In contrast, Akhtar *et al.* (2019) have pointed out the benefits of having specific skills and capabilities related to big data for overall organisational success. The findings of the survey data collected from a total of 240 big data professionals from global agrifood networks reflect that the success of an organisation depends on the capabilities of a big data savvy team in statistics, business domain knowledge, machine learning, computing and mathematics. These unique skills and capabilities allow big data professionals to transform business operations by gaining modern and real-time data-driven insights.

According to Vassakis, Petrakis and Kopanakis (2018), the tremendous data generation is about to hit 180ZB by the end of 2025. This huge amount of data generation makes data play a prominent role in the growth and change of the first century and shaping the advanced digital universe by bringing transformation in businesses and markets. Consequently, businesses are looking for people with expertise and skills to capture valuable insights from data and in turn support decision-makers and managers in developing effective business strategies. Big data analytics has become a key part of organisations to support enterprise and decision-making moves to develop analytics-constructed products as well as services to meet rapidly changing customer and market demand. Wongsim (2016) has further highlighted the importance of IT skills in the accounting profession. It is demonstrated that accountants should excel in IT competencies such as the ability to make databases or spreadsheets for particular reasons. They also need technical skills such as programming language, computer applications systems, operating systems, data communication and base, advanced applications are also needed to run and manage ERP systems. Beyond IT and technical skills, the research also discusses organisational skills (information organisation, priority, and time management), people skills (business management, interpersonal

communication) and conceptual skills (strategic planning, problem-solving) as important skills and competencies of professional accountants.

Daff (2021) has adopted a qualitative method for exploring employers' views on hiring accounting professionals. As per the findings, technological skills remain crucial in shaping the professional identity of accountants. The research highlights employers often look for accounting professionals with professional skills, technical competence, professional ethics, attitude and values. More specifically, recruiters expect candidates to have knowledge of business graphics, financial spreadsheets, tax preparation software, audit software and word processing. However, many recruiters struggle to find candidates with sufficient ICT competency and skills needed to perform financial transactions digitally. Human capital theory suggests that individuals can improve their capabilities to produce by higher skill training and education (Peers, 2015). Hence, graduates can be offered education and on-the-job training by educational institutions and companies on accounting and data analytics software uses and be prepared for rapidly changing workplaces characterised by ITC (Daff, 2021).

Adding to the aforementioned argument, Blount *et al.* (2016) discussed that teaching staff need to give training to graduates on both ERP software uses as well as its implementation in an effective manner. Graduates can also be introduced to business processes, business functions, implementing case studies, and exposure to ERP which can prove valuable skills for facilitating the growth of the organisation.

## **2.5 Evaluation of Challenges and benefits with adaptation of such technologies** by the accounting companies

According to Mikalef *et al.* (2019), the use of big data depends on the use of the huge volume of structured or unstructured data that is collected from a large number of sources. It is vital that the use of this data can provide an advantage for an organisation.

A limited understanding of the factors that can help in proving the gain from the use of big data analytics is a major problem that prevents organisations from gaining full benefits from its implementation. On the other hand, Vasarhelyi, Kogan and Tuttle (2015) have stated that auditors face issues in determining the areas where the risks of fraud are high and due to this reason they require huge efforts in determining the risk or fraud in the data. The use of big data analytics provides the gain of evaluating the accounting practices and providing the details of the possible areas that can have issues in the form of raising red flags. This technique helps save time and effort for the auditors so that they can invest in important tasks.

From the viewpoint of Angrave *et al.* (2016), the challenge with the use of big data is the lack of skill and expertise for the employees who use big data analytics to support accounting operations. The current working of the organisations required restructuring in current working practices to align them with the big data analytics procedure. In this process, the lack of expertise in making changes in the current working of the organisations poses a challenge in the path of gaining benefits from the implementation of big data analytics in accounting practices. However, Hilbert (2016) has stated that the use of Artificial Intelligence (AI) and Machine Learning (ML) provides advantages of determining patterns and anomalies in the dataset that provide the advantage of improving the performance of the organisations by addressing the accounting needs. The tracking nature of big data analytics provides the advantage of reducing errors in accounting practices by flagging the errors and providing the details of the possible solutions that can be adopted to overcome the issue.

It is evaluated from the overall discussion that the limited understanding of big data analytics and lack of expertise among the employees are the major issues that are causing problems in gaining proper benefits from implementing big data analytics in

accounting (Angrave *et al., 2016*). On the other hand, the use of big data in accounting provides benefits of raising red flags in the case of disturbance in accounting practices saving time and efforts of the auditor.

Mahmood, Khan and Bokhari (2020) have suggested that the lack of support from the top management is one of the major issues in the process of implementing ERP solutions in accounting practices. Top leadership support is required to implement ERP solutions in accounting practices. The changes in an organisation can only be implemented or successful in the condition of getting support from the top management or leadership and lack of support causes challenges or failure of the system. However, Heinzelmann (2017) has stated that the use of ERP provides the advantage of making uniformities in business processes that help in improving the coordination between different departments. The use of similar types of accounting practices and improved coordination between different departments of an organisation due to the use of an ERP system helped in improving the overall effectiveness of the accounting practices. The implementation of ERP can also help differentiate the accounting inside and outside of the firm.

According to Venkatraman and Fahd (2016), the use of ERP helps in providing the right information at the proper time when it is needed to make it relevant and effective for the organisations. Its use in accounting practices can help in providing the data related the business operations in order to increase operational efficiency and provide positive outcomes in the form of saving cost. Using important information developed by ERP systems can be used for big data analytics that can improve acting practices and operational efficiency. The use of ERP poses a challenge in the customisation of the process that requires changes in the standard process. However, Choi, Wallace and Wang (2018) have stated that the use of ERP and big data analytics

requires to manipulate and store a huge amount of data that is highly heterogenous in nature and includes unstructured and structured data that requires processing at speed. The diversified nature of the data makes it difficult to process and due to this reason sometimes it is not possible to gain meaningful insights from the data collected with the ERP system and big data analytics.

It is inferred that the use of an ERP system provides the advantage of making accounting practices unform which helps in improving coordination between different departments of an organisation. On the other hand, the implementation of ERP required support from top leadership and a huge amount of data in different formats caused issues in its use.

## 2.6 Examining the real-world case studies where Big Data Analytic and ERP Systems technologies are used by the accountant for decision-making

Yoon (2020) has stated that WebCash which is a Korean accounting program developer as per the needs of the clients with the help of cloud technologies helps its clients in taxation, accounting, payment, receipt management and remittance. It has large data centres that handle large volumes of clients' data eliminating the need for making datacentres of their own by the organisations. In addition to this, Bizplay is another application that eliminates the need for performing repetitive accounting tasks. Moreover, Ibrahim, Elamer and Ezat (2021) have stated that the use of big data provides the advantage of creating and processing huge volumes of data shortest possible time and due to this reason, it is used by several major companies such as Walmart, Royal Bank of Scotland and Amazon. The adoption of big data analytics and ERP helped these companies in the process of huge volumes of data and enabled them to publish financial reports in a short period of time. According to Bose, Dey and Bhattacharjee (2023), management accounting practices are focusing on using big data analytics to develop theories for making judgments based on the facts and validate the decisions made by the management. Netflix and Airbnb are the companies that are using big data analytics in order to make decisions that are beneficial for the company. The use of big data analytics is helping companies perform their accounting functions and improve decision-making capabilities of the form to gain advantages from advanced technology. In addition to this, Betia *et al.* (2023) have stated that Cebu Pacific formed a partnership with Navitaire in order to use several platforms such as digital solutions and revenue accounting platforms. Nandu's Chicken is another company using advanced technology such as blockchain, big data analytics and AI to improve operational accountability and implement transparency in the business process.

#### 2.7 Research Gap

From the overall literary findings, it is found that a significant number of studies have been conducted in the field of ERP and big data analytics. These studies provide comprehensive information related to the uses, applications, challenges and opportunities of ERP and big data analytics. However, limited studies have explored the evolution of accountants in adapting to big data analytics and ERP systems within the profession of accounting. This in turn creates a knowledge gap in specific areas and raises the need for further exploration. Examination of this topic becomes essential to improve understanding and knowledge of how advanced technologies are adopted by accounting professionals and in turn developing new methodologies and practices within accounting professionals.

#### 2.8 Conceptual framework

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Figure 1.0: Conceptual Framework

#### Source: Self- made

The conceptual model describes the benefits and challenges of using big data analytics and ERP systems in the field of accounting. The figure suggests that the use of big data analytics and ERP systems provides various advantages such as improving the level of coordination between different departments and bringing uniformity in accounting practices. However, there are some issues that arise in the use of data analytics and ERP systems in accounting such as a lack of support from the leadership that causes issues in the management of tasks. The limited understanding of the technology is also one of the major factors that is causing problems, as auditors are unable to perform their tasks properly. One of the main issues with organisation's usage of technology is the lack of expertise in using ERP and big data analytics.

#### 2.9 Summary

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Existing research indicates that the role of accountants and accounting tasks will change significantly as a result of technological innovation. Big data analytics has provided opportunities for accountants to analyse and evaluate huge amounts of data in an effective, quick and cost-efficient manner. It has allowed them to perform a large number of transactions, improve the quality of audits and enhance fraud detection capabilities. In a similar manner, ERP provides real-time access to data in a cost and time-efficient manner and helps accountants to make informed decisions. However, the successful use of big data analytics and ERP systems requires accountants to have a certain set of unique skills and capabilities such as data collection skills, data processing skills and data compilation skills, IT skills, and data communication skills.

#### **Chapter 3: Research Questions**

Research questions are important in a study because they give direction and explain the scope of the investigation, research questions also form the foundation of the study. Thus, it provides the researcher with crucial direction in determining a particular study subject or area from which significant discoveries may be obtained. Moreover, research questions are mostly created to investigate various facets of the selected study issue or to fill in any information gaps that may exist about a certain research topic. The following list of enquiries is intended for the current study in order to ascertain how big data analytics and business intelligence are used in organisations:

## **RQ 1-** What are the overall influences or impact of big data on the accounting practices carried out by accountants in companies?

1.1 In what ways the utilisation of big data affect decision-making of processes of accountants in organisations?

1.2 What changes have big data-driven tools brought to traditional accounting practices?

1.3 What challenges do accountants face when integrating big data into their accounting systems?

1.4 How big data improved the accuracy and efficiency of financial reporting?1.5 How has the role of accountants evolved with the increased reliance on big data analytics in companies?

**RQ2-** How ERP systems or accounting software are integrated into the accounting processes in a company?

1.1 What are the key steps involved in implementing ERP systems or accounting software within a company's accounting processes?

1.2 How does the integration of ERP systems impact the workflow and efficiency of accounting tasks?

1.3 What challenges and obstacles are commonly encountered during the integration of ERP systems into existing accounting processes?

1.4 In what ways does ERP system integration affect data accuracy and financial reporting in a company?

1.5 How do companies train and support their accounting staff in adapting to the new ERP systems or accounting software?

**RQ3-** What skills or knowledge is required by the accountants for effective and efficient use of big data analytics and ERP in accounting practices?

1.1 What specific technical skills are necessary for accountants to effectively utilize big data analytics in their work?

1.2 How important is knowledge of ERP systems for accountants, and what areas of expertise are most critical?

1.3 What role does data literacy play in the ability of accountants to interpret and analyse big data?

1.4 How can accountants develop and enhance their skills in using big data analytics and ERP systems?

1.5 What challenges do accountants face in acquiring the skills needed for big data analytics and ERP, and how can these be overcome?

#### **Chapter 4: Research Methodology**

#### 4.1 Introduction

Research methodology could be called the overall systematic way used for collecting, evaluating and analysing data. Research methodology is a key dimension within the research study which makes sure that the entire research procedure is reliable, valid and structured. The criticality of research methodology is based on its capability to offer a transparent path for the researcher and guide through the overall investigation complexities (Quinlan, 2019). In relation to the study, a strong methodology is important for identifying the way accountants adapt to ERP systems and big data analytics. Through deploying adequate qualitative methods, the research targets to detect insights into the changing role of accountants and the influence of technology and innovation on accounting practices. Hence, the adopted research methodology will help extensive knowledge of the subject areas, which will likely enable the development of evidence-based inferences and key recommendations.

#### **4.2 Research Model**

A research model could be called the overall tool or framework within which the research was conducted. In other words, a research model covers the entire process to reach the desired outcome of the research in a systematic manner (Collis and Hussey, 2014). In relation to the presented study, the Saunders Onion model has been used to systematically streamline the overall research procedure. The model includes a set of multiple layers which show distinct stages of overall research design beginning from the out-most segment of research philosophy to the innermost layer of data-gathering techniques (Saunders *et al.*, 2019). Each segment of the model narrows down the research based on the research aim and objectives. This segment-based approach makes a coherent and thorough methodology that aligns with research objectives and offers strong and evidence-based findings to overall inferences.

#### **4.3 Research Philosophy**

Research philosophy could be referred to as the overall system of assumptions that highlights the knowledge of the nature of understanding, reality and the procedure. It is segmented into several parts like realism, interpretivism, positivism and pragmatism (Miles et al., 2019). Each research philosophy carries a different set of nature. For instance, realism identifies an objective relative but highlights the impact of human interpretation; whereas, positivism is related to the scientific approach that targets quantitative data and objective reality. However, for the presented research, interpretivism philosophy has been used as it targets the subjective interpretation of social patterns that assist in identifying that reality is built by people through their communications and experiences. Moreover, this research philosophy is adequately aligned with qualitative approaches that seek to gather knowledge about the meaning behind an individual's perceptions, actions and behaviours (Fisher, 2010). Hence, the interpretivism research philosophy is adequate for the research as it aims to identify the way accountants adapt to the changing innovative landscape, particularly ERP systems and big data analytics. This philosophy supports a contextual and rich understanding of the experiences of accountants that offers deeper insights to accomplish the research aim and objectives. By targeting on the subjective interpretations of the people, the research has offered a robust and narrower understanding of the overall adaptation procedure within the accounting practices.

#### 4.4 Research Approach

Research philosophy could be called the overall elaboration of the process and plan for doing it. It guides the way data is gathered, evaluated and interpreted. The

research approach is segmented into two parts deductive and inductive. The former approach begins with a hypothesis or theory and then formulates a research approach to test it. However, on the contrary, the inductive approach relates with data gathering and observations then formulated patterns or theories from the data. Deductive is generally used with quantitative methods as it aims to refute current theories with the help of empirical studies or testing, whereas, an inductive approach is closely associated with a qualitative approach that focuses on the development of new theories instead of studying or testing already existing hypothesis (Wallace and Wray, 2021). In the presented research, an inductive approach has been used to gain knowledge about the evolution of accountants adapting to ERP systems and big data analytics. The inductive approach assists in a deeper identification of the way accountants interpret and navigate the transformations brought by technological innovations. By gathering qualitative data with the help of interviews, the research uncovers emerging patterns and theories in the experiences of the accountants.

#### 4.5 Research Choice

Research choice could be referred to the overall section of a particular method or combination of methods for collecting and evaluating data. Research choice could be segmented into three broad categories which are mono, mixed and multi-methods (Fisher, 2010). The initial or mono method includes using a specific research method either quantitative or qualitative. On the contrary, the mixed method includes the combination of both quantitative and qualitative approaches for offering an extensive analysis. Lastly, multi-method as a research choice utilizes multiple quantitative or multiple qualitative techniques in a research study to grasp different perspectives (Rugg and Petre, 2006). For the current research work, the mono-method qualitative approaches as a research choice have been selected and include an exclusive focus on interviews as a qualitative research method. This choice is highly aligned with the exploration of subjective and nuanced experiences of accountants adapting to ERP Systems and big data analytics. The choice assists in graphing an extensive understanding or knowledge of people's perspectives and the light of adapting to the changes from the viewpoint of accountants. Hence, mono-qualitative research ensures a robust and systematic exploration of the research aim and objectives that facilitates the overall discovery of new patterns and themes that can be missed while using quantitative methods.

#### 4.6 Research Design

Research design could be called the complete strategy showing the way a research work has been conducted by ensuring that the framed research problem is adequately addressed (Yin, 2018). The key types of research design involve explanatory, descriptive and exploratory. Explanatory research tries to evaluate the connection between different variables generally utilizing a theory-driven approach, whereas, descriptive research tries to adequately evaluate phenomena or characteristics generally involved in quantitative methods. Exploratory research is utilized when the research problem area is not adequately understood or when there exist no or few past studies based on the research topic (Žukauskas *et al.*, 2018). In the presented research study on the evolution of accountants adapting to ERPS and big data analytics, the exploratory design has been selected as it focuses on identifying new knowledge and generating ideas. Moreover, this design is adequate as it offers an open-ended identification of the way accountants look and respond to such technological transformations (Žukauskas *et al.*, 2018). As, the research area is changing frequently and there could be limited current research, the use of exploratory design offers the

overall flexibility to investigate the latest areas and form hypotheses for future research work.

#### 4.7 Research Method

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Research methods could be referred to as the processes and techniques utilised in order to collect and evaluate data. Such methods could be segmented into two key types which are primary and secondary (Bell *et al.*, 2019). Primary research includes gathering first-hand data directly from areas present to address research questions. Generally, primary research methods involve surveys, observations, interviews and focus groups. Moreover, the key benefit of choosing primary research is that it offers data which is completely specific and relevant to the research objectives but can be resource-intensive and time-consuming (Ajayi, 2017). On the contrary, secondary research includes the utilization of already available data presented by authors and other secondary relevant sources generally journal articles, books, government databases and reports. Secondary reports are generally highly cost-effective and less time-consuming as the data is already available but the researcher carries less authority over the accuracy and relevance of the data and could be typically to related with the research questions (Ajayi, 2017).

However, in the presented research, primary research with the help of interviews has been selected as interviews are especially well-defined for qualitative research and allow an extensive exploration of experiences, perceptions and thoughts of the people. Interviews enable the researcher to go deeper into the way accountants analyse and respond to technological innovations that offer detailed and rich insights which are not adequately gathered through other research methods. In addition, interviews offer flexibility which allows the researcher to probe further into unexpected or interesting responses that could prompt innovative discoveries (Adeoye-Olatunde and Olenik, 2021). Moreover, the decision to utilize interviews is related with the overall research design and allows open-ended questions for the generating of new ideas. Through directly communicating with the accountants, the research could reveal nuanced patterns in the opportunities and challenges they encounter in adapting to ERP Systems and big data analytics thereby offering an extensive understanding of the changing roles of accountants in the current technological landscape.

#### 4.8 Time Horizon

The time horizon could be referred to as the overall time period over which the researches study has been conducted and is an essential area of the overall research design. The key two types of time horizon includes longitudinal and cross-sectional. Longitudinal research includes gathering data over a larger period that allows changes in observation and developments with time. This is ideal for learning long-term impacts, trends or the overall influence of time on the interest variables. However, on the contrary, cross-sectional research includes gathering data at a particular time period or over a short term that offers an overview of the situation or condition. It is especially utilized for detecting patterns, themes, differences, and relationships among variables at the specific moment (Dobrow *et al.*, 2018). In the presented research, the cross-sectional time horizon has been selected as this approach allows for the overall examination of current experiences and adaptations of accountants to ERP Systems and big data analytics.

#### 4.9 Data Collection Method

The data collection method could be referred to as the overall procedure of collecting information from multiple dimensions to address research objectives or questions. Moreover, the data collection method is a major step within a research study as the overall relevance and quality of the gathered data directly and indirectly

influences the study's findings and inferences (Miles and Huberman, 2019). The presented research obtained relevant data from primary sources compared with the key literary findings to have adequate inferences. Moreover, within the overall dimension of primary data, semi-structured interviews have been undertaken as they offer a balance between unstructured and structured approaches that offer a greater level of flexibility to explore the research topic (Adams, 2015). Semi-structured interviews contain several predetermined questions but they offer the chance for the interviewers to alter the script and probe more into the interesting reviews or track new lines of questions as they emerge during the interview.

Further, the choice of semi-structured interviews is adequately related to the research work as it allows for an extensive exploration of the perspectives and experiences of the accountants on adapting to ERP Systems and big data analytics. This approach lets the researcher gather detailed and rich information while keeping an adequate level of comparisons across distinct interviews (Kallio *et al.*, 2016). Moreover, this flexibility of semi-structured interviews is especially valuable in exploratory research in which unexpected knowledge could prompt new understanding and contribute to the formation of theories and patterns.

#### 4.10 Sampling Technique and Sample Size

Sampling could be referred to as the overall procedure of choosing a subset of the population from large individuals to show the entire people involved in the research (O'Leary, 2017). Random sampling is a type of sampling technique in which each person of the entire population has a similar chance of getting chosen. Random sampling is essential for decreasing bias and ensuring the sample is population representative (Emerson, 2015). However, on the contrary, purposive sampling includes choosing people on the basis of particular features or criteria related to the
research. Purposive sampling is essential in qualitative research where the target is on gathering detailed and rich understanding from people who have specific experience, insights or expertise in the research topic (Rai and Thapa, 2015). In the presented research work, purposive sampling has been undertaken to choose accountants who are especially knowledgeable in the adaptation to ERP Systems and big data analytics. Thus, the aim of the research is to gather extensive insights from those people who have related experiences and could offer meaningful information within the research.

Initially, 15 accountants were contacted to participate in the interview but 10 among them were denied or found unsuitable for the interview which eventually limited the responses from 5 accountants working in big accounting globally. Despite the small sample size, the selection of the participants makes sure that the data gathered will be relevant and rich to the research aim and objectives. The sample size of 5 accountants is adequate or sufficient to understand specific changes rather than to generalize the findings. The target on quality instead of quantity allows for a greater exploration of the way such accounting professionals are adapting technological advancements in the accounting profession.

# 4.11 Development of Interview Questions

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When formulating or developing the interview questions, some key factors were considered that are aligned with the research aim and objectives and the research questions are open-ended to motivate detailed responses and boost the perspectives and experiences of the participants. Questions are clear, free from technical jargon, and concise to avoid any kind of conduction. Moreover, the development of questions has covered multiple dimensions of the topic like benefits, challenges and influences of adapting to innovative technologies. Probing questions have been included to identify deeper insist and grasp underlying themes and patterns. Hence the target is to collect extensive data that completely addresses the research questions.

#### 4.12 Data Analysis

Data analysis could be called the procedure of systematically using logical or statistical tools to illustrate, describe and evaluate the gathered data. It is a highly essential layer within the research as it enables the change of raw data into meaningful understanding that supports the overall framed research questions (Creswell and Creswell, 2017). There are multiple ways to analyse the data but the selection of the analysis tool is based on the type of data that has been gathered like qualitative, quantitative or mixed. Some tools to analyse quantitative data include statistical techniques for detecting relationships, connections, trends and patterns, and some are ANOVA, regression and descriptive analysis. However, on the contrary, quantitative analysis focuses on images or text to understand underlying patterns, themes and meaning and some techniques involve disclosure analysis, content analysis and thematic analysis. In the presented research thematic analysis has been selected as it is especially well-suited for qualitative research. The thematic analysis involves detecting, evaluating and reporting trends or themes which make it flexible to target both the implicit and explicit meaning of the data (Clarke and Braun, 2017). Thus, the use of thematic analysis makes it adequate to explore the way accountants are adapting to ERP Systems and big data by facilitating an extensive understanding of the nuanced and complex experiences of the people thereby enabling the research work to adequately draw meaningful understanding that related with the objectives of the study.

# 4.13 Reliability and Validity

Reliability and validity are important segments to ensure overall research quality. Reliability could be referred to the repeatability and consistency of the overall research findings. Moreover, a study is said to be reliable if outcomes the similar results under consistent situations. Besides, validity is closely associated with the truthfulness and accuracy of the gathered findings making sure that the overall research computes what it desires to (Mohamad *et al.*, 2015). In the presented research work, reliability has been ensured with the help of a systematic way of data gathering and analysis, whereas, reliability is maintained by adequately formulating interview questions which relate with the research aim and objectives and by triangulating findings to validate the finding's accuracy.

# 4.14 Ethical Consideration

Ethical considerations could be referred to as the entire set of moral and ethical principles within which a research work must be carried out. Moreover, ethical considerations are essential as they make sure that the entire formulated steps and processes relate with the generally accepted ethical standards or principles (Arifin, 2018). In the presented research work, the entire ethical practices have been followed adequately in which the major part was to get informed consent from the participants or accountants. This process involved offering comprehensive and clear information regarding the research aim and objectives, possible risks, benefits and methods that allowed individuals to make an informed decision regarding their participation. Besides, anonymity and confidentiality have been ensured and the entire data gathered has been stored at a safer place with access to the researcher only and once used it will be deleted permanently.

### 4.15 Limitations

One key limitation of the presented study is that the size is relatively small as just five accountants have undertaken participation which may lack the generalizability of the gatherings to broader participants. Further, the use of interviews from primary

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sources assisted in offering in-depth insights but is prone to subjectivity as the responses are impacted by the personal experiences of the participants and the overall interpretations.

# 4.16 Summary of Research

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In summary, the research methodology chapter has highlighted the way the entire research has been narrowed by using interlinked research philosophy, research design, research approach, data collection and analysis techniques and others for gathering reliable and accurate data for analysis. The research to identify the way accountants adapt to the changing innovative landscape particularly ERP system and big data analytics require relevant participants for which interviews are undertaken from a couple of accountants working in big accounting companies. Ethical standards have been ensured through taking informed consent from the participants and ensuring privacy, confidentiality, anonymity and other factors for the smooth flow of the research study.

### **Chapter 5: Analysis and Findings**

# **5.1 Introduction**

The analysis and conclusions chapter assesses information gathered on integrating ERP systems and big data analytics into accounting procedures, placing a particular focus on roles, duties, and skill sets necessary for an efficient organisation. The method used for collecting data is conducting semi-structured interviews that provided the transcripts of interview which are analyse with the help of thematic analysis. Interview transcripts align with the research study's aim and objectives. The skills required for the use of big data analytics and ERP in the accounting processes are evaluated with the help of analysing interview transcripts of accounting executives.

# **5.2 Thematic Analysis**

# Theme 1: Impact of ERP systems and big data on the accounting practices carried out by accountants in companies

This theme was formulated based on the first, second, and third interview questions. The key emphasis of these questions was to determine the perception of respondents about the impact of ERP and big data on their accounting practices. Different respondents had unique perspectives regarding the substantial returns provided by both technologies; however, most of them agreed that the implementation of ERP and big data improves decision-making capabilities and business efficiency by centralising data, analytics and backed processes. In this regard, Respondent A stated that "*ERP systems help standardise and automate processes, identify fulfillment of ordering tools, improve decision-making, and allow enhanced support and training. On the other hand, big data analytics helps in gaining important insights, estimating future possibilities, and automating financial duties*". Respondent D in addition said "*ERP and big data analytics provides accountants access to real-time accounting data and* 

which help them to make timely corrections, and improve efficiency as well as save money and time". These two answers suggest that enhancing accountants' decisionmaking skills is the main advantage of incorporating ERP and big data analytics into accounting procedures. By using ERP, data analytics and visualisation software, accountants are able to analyse financial data in a more effective manner. These technological systems allow accountants to spot anomalous patterns and trends in financial data, anticipate future possibilities, and develop valuable financial decisions for growth.

Respondent C argued that "It has become important for larger organisations to provide increased emphasis on risk identification and their management. In financial services, the most common risks occur from frauds, mergers and acquisitions or supply chains; however, ERP and big data technologies improve the risk management capabilities of accountants by improving their insights of huge amounts of financial data coming to the organisation from different sources". From these responses, it has been inferred that adoption of technological advancements such as big data analytics and ERP benefits accountants by increasing their accuracy and efficiency in accounting. These systems increase the capabilities of accountants for powerful data analysis by allowing them to analyse and evaluate large amounts of data in an accurate and quick manner. However, Respondent B stated "The use of ERP and big data analytics minimises human errors and inaccuracies and helps accountants prepare more accurate error-free financial reports and records. These technologies allow the automation of time-consuming and repetitive tasks like the generation of reports or calculations and hence save valuable time for strategic activities. But most small businesses struggle from the implementation of ERP and big data analytics because of the higher cost of software". Further, it has been discussed by Respondent E that "The

successful running of ERP and big data analytics requires time, money and valuable assets. Also, technical issues might occur from power outages or system failure which can interrupt the accounting practices. There might also be possible that lack of adequate skills and experience on the software usages to inadvertently lead to errors".

These responses highlight that ERP and big data have made the roles and responsibilities of accountants easier by offering a significant number of advantages like accuracy, simplicity and better efficiency. Nevertheless, the firm can also experience the negative impact of integrating these systems due to the high cost of implementation, software compatibility issues and lack of adequate skills and knowledge among accountants. Overall, the interview responses reveal both the positive and negative impact of implementing ERP and big data analytics on accounting practices. Positively, these technologies provide advantages like better financial analysis, faster processing of data, enhanced accuracy and efficiency, and cost-effective operations. In contrast, the ERP and big data integration for accounting practices are adversely affected by the high implementation costs, the need for specialised skills, support, and training, as well as software compatibility issues.

# Theme 2: Way ERPS is integrated into the accounting processes of companies

Theme two is developed in alignment with the objective of analysing the way ERPS is integrated into companies' accounting processes. In relation to the theme Respondent A has highlighted the role of data in the current business scenario and stated "I think that data is one of the major elements of the current working system and use of AI made it a prominent tool for performing business. The field of accounting is also affected by the use of data and the implementation of ERP and big data analytics in accounting signifies the role of data in the accounting field." In addition to this, Respondent B stated that the "ERP system helps consolidate the data from various sources and departments and thus helps streamline the process of accounting. The processing of real-time data helps in the prevention of errors and frauds in the accounting system." In relation to the use of data and ERP systems in accounting processes, Respondent E has provided one example and stated that "The ERP works in the accounting field in a unique way that is different from the traditional as it makes the entry similar time a transaction happens." The Respondent further stated that "Suppose you purchased a chair or processed a sales order the ERP system at once make the entry of accounts receivables or payables and helps in reducing the manual input to a great level."

The challenge of the difference between the traditional working of accounting systems and ERP systems poses a major issue in the use of ERP and big data analytics in the accounting processes. Respondent A stated, "It is necessary to redefine working processes in order to make the current working processes work with the accounting system." On the other hand, the issue of data compatibility and data migration is also a major challenge that can pose a challenge in the use of big data analytics in accounting. Respondent C has stated "I think that the issue of data migration causes accountants as the historical data should be required to align and transferred to the new system." In addition to this, Respondent D has stated that "There is a need for custom API due to which the integration of ERP and big data analytics is also a major element that is highlighted by Respondent E as the routine tasks such as invoice processing, journal entries and reconciliation are automated providing benefits to the accountants.

The use of ERP systems and big data analytics helps save data from different departments to assist the accounting department in storing it on a single platform so that

the accountants can analyse it to determine future trends. Respondent A has stated that "integration of big data and ERP system in accounting helps a company in analysing understanding behaviour of customers." However, Respondent D has stated that "Realtime financial analysis can be performed by enabling the accountants to get the information on every transaction so that they can track revenues, expenses and financial metrics. It also helps in compiling data from a large number of modules such as accounts receivables, account payables and general ledger." Moreover, the use of predictive analysis can also be performed by collecting the data of accounts and is analysed with the help of big data analysis to provide details of trends that are popular in the market.

The use of customer profitability analysis can also be performed in order to support accountants in making financial decisions for a company. In this relation, Respondent E has stated that "*ERP systems and big data analytics can help in the collection of data of customers demographic information and customer behaviour in order to access the lifetime and profitability of a company*." The implementation of the ERP and big data analytics is performed by integrating the data of different departments and analysing it to get the trends and performing accounting tasks. Big data analytics helps in analysing the issues and wrong entries in accounts and raising red flags. Accountants can easily manage the accounts of a company by automating the process eliminating the process of accounting and making it more accurate.

# Theme 3: Skills or knowledge needed by modern accountants for effective and efficient use of big data analytics and ERP in accounting practices

The literature revealed many skills that modern accounts possess to use ERP and big data effectively and efficiently. Hence, to enhance this understanding, the sixth and seventh questions of the interview focused on asking respondents about their perception of the skills needed to effectively and efficiently use big data analytics and ERP. In this regard, Respondent B stated that "Accountants are required to have current and updated understanding and knowledge of the latest technologies and accounting software such as reconciliation software and spreadsheet software. As the ERP and big data systems are evolving consistently, with regular updates in technologies and software, accountants are required to be capable of these changes on a quick basis and learning new technologies and systems as required".

Adding further, Respondent D mentioned that "Successful use of big data analytics and ERP requires accountants to have reporting and visualization, analytical, collaborative, interpretative and predictive skills. More specifically, in big data analytics, visualization skills become critical". From these responses, it could be inferred that the role of accountants is still the same that is reporting business results. However, technological advancements have mandated accountants to perform their roles and responsibilities using technologies like ERP and big data analytics. Also, as the source data have been diversified, they require to be proficient in discovering, visualizing as well as displaying patterns. These skills are important to offer deeper insight into the business "health status". Hence, there has been a significant need for accountants to be aware of different ERP and big data software and techniques available in the market assisting accounting practices.

However, Respondent A further argued that "Most managers have limited accountancy skills and accounting knowledge which make them unable to effectively use modern technologies like ERP and big data analytics. Hence, in my opinion, accountants should first develop their knowledge and understanding of accounting practices such as Generally Accepted Account Principles (GAAP), International Financial Reporting Standards (IFRS), general ledger management, financial statements, tax compliance and accounts receivable and payable". This highlights the successful implementation and running of modern accounting systems such as ERP and big data analytics not just requiring accountants to be skilled in technological proficiency but also a strong understanding of financial fundamentals. This knowledge is important to accountants to configure the ERP and big data analytics systems and software to address the needs of the company for financial management and adequately analyse and interpret financial data produced from the system.

In the same context, it has been stated by Respondent C that "Technological tools such as ERP and big data analytics do not eliminate the requirement to the primary role to be played by accountants that involves forecasting the trends as well as making financial budgets. Hence critical thinking and problem solving are important skills to be needed in accountants. Rather the successful use of ERP and big data analytics requires accountants to have effective critical thinking and problem solving to address reporting errors, ethical dilemmas and unbalanced spreadsheets, reconciliations and to identify innovative ways to reach best solutions". Therefore, the interview responses highlight that along with possessing advanced technological knowledge, accountants also should have effective critical thinking and problemsolving skills to make accurate predictions, determine risks and create effective strategies for addressing identified problems and help their organisation move forward. In contrast, Respondent E discussed that "Accountants need to have advanced analytical skills because massive raw data provided by ERP and big data analytics systems cannot provide any values unless accounting professionals can produce meaningful analytical output. Therefore, it can be inferred that accountants should have strong analytical skills to search, organize as well as present data derived from ERP and big data analytics".

Overall, different professionals have provided different perspectives and opinions regarding the knowledge and skills required by modern accountants for using ERP and big data analytics effectively and efficiently in accounting practices. One of the common themes among respondents is the presence of technological knowledge and understanding. This involves updated knowledge regarding ERP software and big data systems. Along with this knowledge, accountants need effective predictive, collaborative and visualization skills to manage these technologies in an effective manner. However, some respondents also feel only knowledge and understanding of ERP and big data cannot provide meaningful results unless and until accountants' solid foundation of accounting practices such as knowledge related to IFRS, GAPP, tax compliance and other aspects of financial management.

# Theme 4: Recommendation of skills and qualities suitable for accountants to grasp the opportunities and overcome the associated challenges from accounting companies

The theme is developed in alignment with the fourth objective of recommendation skills and qualities suitable for accountants to grasp the opportunities and overcome the associated challenges from accounting companies. In this relation, the factors of acquiring technical and analytical skills by the accountants are highlighted. Respondent A has stated that "In order to work properly with big data it is required by the accountants to acquire technical skills so that they can efficiently use various technical platforms such as SAP, Microsoft Azure and SQL." The ability to properly use ERP system is highlighted by respondent C as the respondent stated that "Expertise to use ERP systems such as Oracle, SAP and Microsoft Dynamics is vital so that the accountants can properly use them in the accounting operations. One more thing, the knowledge of ERP systems only is not sufficient and an accountant should

also have to understand the ways the modules of these platforms work with the financial and accounting tasks." The ability to use these platforms properly is required as it can help in improving efficiency by reducing the chances of error in accounting operations. It also helps reduce the time required by the accountant to search for suitable operations for the accountants' processes.

In addition to the use of ERP systems, it is also required by the accountants to use Big data analytics properly and due to this reason, it is vital that they should have proper skills in using tools of big data analytics. In this alignment, respondent B has stated that "AN accountant should have proper skills to use big data analytics platforms such as Spark, Hadoop, Hive and H-Base in order to be capable of handling databases with huge volume." Moreover, the requirement for programming skills is also highlighted by Respondent E due to the requirement to make changes in the module and customize it as per the needs of an accountant. Respondent E has stated that "Sometimes there is a requirement for making changes in the system and make it suitable as per the needs of the company as every organisation works in different domain and scale due to which the requirements are different. Thus, accountants are required to have some skills and understanding of programming languages such as Python, Java, and R so that they can analyse complex data and integrate scripts as per their needs." The use of technical skills helps an accountant to make effective use of various features of the platforms and perform accounting tasks with a higher level of efficiency.

There are some other technical skills highlighted by the respondents in the interview such as database management, data integration tools and cloud computing. In this relation, respondent C has stated that "*Knowledge of the cloud platforms such as Azure, and Google cloud is required as most of the ERP systems are ERP based.*"

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Moreover, the respondent further stated that "Knowledge of data integration tools are also required by an accountant, some big names are Apache Nifi and Informatica to perform tasks of data integration between big data systems and ERP." In addition to technical skills the need for accounting skills is also highlighted in the transcripts of the interview as Respondent D has stated that "An accountant should also have strong accounting skills along with the technical skills to perform accounting functions effectively with the use of ERP and Big data analytics. The knowledge of IFRS and GAAP is needed in order to make sure that data analysis and accounting is performed as per the regulations."

The need of knowledge regarding financial recording and cost management is also required to perform accounting operations with advanced technology. The requirement of analytical skills is also highlighted as Respondent E has stated "*The data analysis and interpretation skills, statistical analysis and data modelling skills so that the complex financial scenarios can be integrated with the ERP system*." Furthermore, problem-solving and project management skills are also vital in the process of using ERP and big data analytics in accounting as respondent A has stated that "*an accountant may face several challenges related to accounting functions and due to this reason problem-solving skills and project management skills are required to integrate the advanced technology in the accounting operations*." Respondent B has highlighted the role of training and stated that "*It is vital to provide proper training to the accountants so that they can manage the accounting operations effectively*."

## 5.3 Summary

It can be summarised from the above discussion that the implementation of ERP systems and big data analytics in accounting helped in increasing the efficiency of the operations. It is integrated by collecting data from various departments through the ERP

system and making the entries in accounting format. Moreover, it is also evaluated that accountants should acquire technical, analytical and problem-solving skills along with the knowledge of programming language.

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### **Chapter 6: Discussion**

The research has aimed at evaluating the roles, responsibilities and skill set required in accountants for adapting ERP and big data analytics systems in accounting. This was explored through three research questions using the interview method. In alignment with the first research question that seeks to determine the overall impact of big data on the accounting practices carried out by accountants in companies, it has been found that the integration of big data analytics brings a positive impact on accuracy, efficiency and decision-making capabilities of accountants by improving their insights on financial data from different sources and allow them to anticipate and manage future challenges in a timely manner. Big data refers to a large number of consistently growing information received by organisations on daily basis and big data analytics is a software that facilitates the collection, storage, and processing of these data in an accurate and effective manner to generate valuable insights. Most accounting practices today are performed with the help of big data analytics as it allows firms to study huge amounts of data related to customers, competitors and other external factors. Big data helps develop predictive models and facilitates anticipation of future outcomes of the financial transaction with higher accuracy. This technology improves the risk management abilities of accountants and in turn helps them avoid issues arising from frauds, supply chain and mergers and acquisitions. In this regard, the literature published by Arnaboldi, Busco and Cuganesan (2017) and Saeed and Husamaldin (2021) states that big data analytics processes large amounts of data including both structured and unstructured data from coming to the organisation different sources such as administrative records, social media or organisational databases and allow processing and analysis of these in high-volume data to reach informed decisions.

Another study by Alles and Gray (2016) also argued that the integration of big data analytics helps perform a significant number of transactions at a time, provides indepth insights needed to determine fraud and consequently helps improve accounting quality. Hence, both the research findings and existing literature support the same argument that big data analytics provides a positive impact on accounting practices by allowing accountants to collect, store as well analyse every transaction from internal and external sources. Accountants also use big data analytics to detect fraudulent activities by analysing and evaluating differing transaction patterns. However, the findings of the research have also revealed that big data analytics can be costlier to implement and might not offer substantial results if accountants lack specific skills and knowledge related to accounting principles and practices. This finding introduces a new dimension that does not resemble entirely existing literature.

In relation to the second question of the ways, ERP systems or accounting software are integrated into the accounting processes of a company. The primary data collected through interviews suggested that the first step is the consolidation of data collected from various departments and operations of a company. The ERP system helps in the collection of data generated from various sources in order to streamline the processes of a company. The findings of the literature also align with it as AHMAD SUHAIMI, NAWAWI and PUTEH SALIN (2016) stated that integration of data with the help of an ERP system is the main step that helps accountants to work properly with big data analytics and ERP system. However, the findings of the interview also suggest that there is a need for redefining to make the current processes of accounts work in alignment with advanced technology. In contrast to this, the findings of the literature suggested that the processes of accounting should not be changed instead the working staff should be trained in order to enable them to work with new systems (Blount *et al.*, 2016).

In the process of using ERP and big data analytics in accounting historical data should be aligned with the system and incompatibility and difference in the format of different data sets is one of the major challenges in the use of big data analytics in accounting. Moreover, the findings of the interview also suggest that the use of real-time data should also be performed in order to conduct various analyses such as profitability analysis and raise red flags in the case of finding differences in the figures. The findings of the literature also support this as Vasarhelyi, Kogan and Tuttle (2015) suggested that the use of big data analytics can help in the evaluation of the current processes and raising red flags or showing error messages in the case of finding some differences of chances of error. In this manner, the accounting processes can be improved with the advanced technology of ERP and big data analytics. The performance of the accounting department can be improved by the use of big data as it can also provide necessary suggestions on the basis of past data that can help in increasing the performance of a company.

The collection of data from the customers can help in developing insights into their purchasing behaviour and can assist in the decision-making process of a company. The integration of ERP and big data analytics can be performed by using the existing software or tools of accounting based on big data analytics or making customised software as per the needs of an organisation. In contrast to this, the findings of the literature suggest that the use of ERP and big data analytics contributes to causing issues in customisation as the processes have to change as per the specifications of the software or the tool that is utilized for the purpose of performing accounting operations. In alignment with the technology acceptance theory the system should be changed and

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implementation of advanced technology in the form of ERP and big data analytics should be promoted (Chou and Chang, 2008).

Further, regarding the third research question which explores the skills and knowledge required by accountants for effective and efficient use of big data analytics and ERP in accounting practices, the research highlights that accountants need various skills and knowledge to successfully run ERP and big data analytics systems. The basic requirement is that accountants should have updated knowledge about emerging technologies and software. The constant advancement in technology leads to the discovery and introduction of superior ERP and big data systems and hence accountants are required to keep themselves updated with current knowledge and ensure their ERP and big data analytics software remain aligned with the technological changes. Also, the research highlights advanced reporting, analytical, visualisation, interpretation and collaborative skills as important skills needed in accountants. In the same context, AHMAD SUHAIMI, NAWAWI and PUTEH SALIN (2016) and Akhtar et al. (2019) have also stated that accounting practices have changed significantly from the emergence of technologies like ERP and big data analytics. The successful running of these technologies requires accountants to be effective and efficient in data collection, compilation, analysis, presentation and communication skills. In order to generate accurate and error-free financial statements utilizing these cutting-edge technologies, accountants need to possess these skills. Nonetheless, other academic sources have identified a few different critical competencies that accountants must possess in order to effectively manage ERP and big data analytics systems; they are not emphasized in this study. This includes statistical, computing and mathematics skills and knowledge related to business. In addition, strong IT and technical skills are needed, especially in domains such as computer application systems, data communication, programming language and software like financial spreadsheets, business graphics, tax preparation, word processing, and audit software (Wongsim, 2016; Daff, 2021; Peers, 2015).

The current research also discusses that the mere presence of technological knowledge cannot provide excellence to accountants in practising accounting practices over ERP and big data analytics systems. This is because technologies do not perform on their own rather require accountants to predict trends and make forecasts based on the data provided. This requires accountants to have effective problem-solving and critical thinking skills to interpret the financial data provided by ERP and big data analytics. The massive raw data provided by technological solutions cannot be meaningful to the organisation until and unless accountants have the abilities to analyse, evaluate and interpret it, solve problems and make valuable decisions hence it is important for accountants to have strong problem-solving, analytical and critical thinking skills. Also, for the purpose of operating ERP and big data analytics systems in a successful manner, accountants need to have comprehensive and in-depth knowledge regarding accounting principles such as IFRS, GAAP and other accounting practices. Blount et al. (2016) have also discussed that accountants should have knowledge regarding business functions, processes and accounting principles to use ERP in the most effective and efficient manner. Therefore, both the findings of the current research and existing literature confirm that effective IT skills, analytical skills, visualisation skills, reporting skills, and interpretation skills are some of the essential skills that have become crucial for accountants to operate ERP and big data analytics in a successful manner. In addition, effective problem-solving skills, critical thinking skills and knowledge related to relevant software and accounting principles are needed in accountants to produce in-depth financial analysis, enhance accuracy and streamline operations.

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The findings of the interview also suggested that accountants should acquire certain skills that can help them in the proper use of ERP and big data analytics in accounting and prevent issues. The most important skills are technical skills that can help accountants manage their work and perform accounting tasks with full efficiency. The technical skills include knowledge of using tools and platforms of big data analytics and ERP such as SAP, Microsoft Azure, Oracle, Microsoft Dynamics and SQL. These findings are also supported by Wongsim (2016) as the use of big data analytics in accounting processes required technical skills in order to prevent issues while using the platform. In addition to the technical skills, accountants should also be required to have some knowledge of programming language. The findings of programming language are also supported by the literature findings as Wongsim (2016) suggested the use of programming language in order to make necessary changes in the accounting system and make its own module for conducting various types of accounting operations.

Accountants should also acquire other types of skills such as problem-solving skills and analytical skills in order to perform several tasks in the profession. The accountants face several issues in the form of non-compatibility of the data and issues in performing the tasks. Thus, an accountant should have problem-solving skills and high knowledge of accounting concepts to apply them in alignment with the regulatory standards. Moreover, there is also a requirement for analytical skills as the accountant needs to analyse the data and provide necessary solutions to the issues faced by the company. The findings of the literature also support the requirement of analytical skills as AHMAD SUHAIMI, NAWAWI and PUTEH SALIN (2016) suggested that analytical skills can help in analysing huge volumes of data and develop patterns in order to provide insights regarding the condition of business and future trends. In order to perform well and properly use big data analytics and ERP systems it is required to

provide necessary training to the accountants and enable them to use advanced technology effectively.

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Based on the overall discussion, a model is developed that describes the skills required for accountants to effectively use big data analytics and ERP in the accounting process. Technical skills are most of the important elements that are required by accountants in order to perform tasks with the use of advanced technology. The requirement for problem-solving skills is also observed to perform accounting operations. The customisation of the system as per the accounting operations is also needed which can be performed with the help of programming language. Moreover, the problem-solving skills and analytical skills are also required in order to perform the accounting operations. In order to acquire these skills the management of organisations should arrange training for the accountants in order to make them proficient in performing accounting operations by using advanced technology.



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Source: Self-made

### **Chapter 7: Conclusion**

# 7.1 Conclusion

In this research, the roles, responsibilities and skills required in accountants for adapting ERP and big data analytics systems in accounting have been evaluated. A total of four objectives were formulated to guide this research. The first research objective emphasised determining the impact of big data on the accounting practices carried out by accountants in companies. The research has identified both the positive as well as negative impact to be faced by companies from incorporating ERP and big data analytics systems in accounting practices. On the positive side, the integration of big data analytics systems was found to improve the decision-making capabilities of accountants by allowing them to gain useful insight from high-volume data. This technology is also essential for improving the quality of accounting and audit practices conducted by accountants. The constant and real-time data offered by these systems help accountants collect, analyse and interpret large data sets from internal and external sources in an accurate and quick manner while also aiding in fraud detection and risk management. However, on the negative side, the implementation of this technology needs huge costs and requires accountants to have adequate skills and expertise to perform it effectively.

Regarding the second objective of the research which focused on analysing the ways ERP system is integrated into the accounting processes of companies, it is concluded that the implementation of ERP systems has become a necessity for modern organisations to build an integrated system that manages operational information such as production, sales, finance, human resource effectively and efficiently. The major benefit of integrating ERP systems into accounting is that it offers real-time access to operational and financial data to accountants and helps them develop more informed decisions to make optimum utilisation of resources and consequently drive organisational efficiency and revenue. In particular, ERP has become an innovative and modern solution for accountants to replace inadequate and outdated accounting systems, consistently manage information about internal resources, and improve organisational productivity and financial cycle. This system enhances the organisational response capacity needed to satisfy the demands of customers and competitive markets. Nevertheless, similar to the implementation of big data analytics systems, the adoption of ERP demands high cost, long time and expertise to perform. The research reveals that emerging technologies such as ERP and big data analytics bring multiple benefits to accounting by simplifying and automating transactions; however, their high cost and the need for adequate technological skills and expertise make them challenging to implement on a larger scale, more specifically by small businesses.

The third objective of the research has focused on examining the skills and knowledge needed among modern accountants to use ERP and big data analytics systems in an effective and efficient manner. In this context, the findings of the research highlight different skills, expertise and knowledge to be required in accountants. The most important skills identified in the research are effective data collection, interpretation and compilation skills required to prepare accurate financial reports. Moreover, improved communication, analytical, problem-solving, strategic planning, and critical thinking skills have also been identified as essential for accountants. Likewise, accountants are required to have in-depth knowledge regarding business, machine learning, mathematics, statistics, programming language, operating systems, data communication and other advanced and updated applications related to ERP and big data analytics systems. However, the most crucial aspect identified in the

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research for the successful operations of ERP and big data analytics by accountants is to have comprehensive and in-depth knowledge regarding accounting principles. This is because technologies can only offer huge data and facilitate analysis and interpretation but they cannot replace the application of accounting rules hence accountants must possess updated knowledge regarding accounting principles such as GAAP and IFRS, along with essential technological skills and capabilities to use ERP and big data analytics successfully.

To avoid problems and make the best use of ERP and big data analytics in accounting, accountants need have a few skills. The most crucial abilities are technical and enable accountants to effectively manage their workload and complete accounting responsibilities. The technical abilities include the ability to use big data analytics and ERP technologies and platforms including SAP, Microsoft Dynamics, Oracle, Microsoft Azure, and SQL. The application of big data analytics in accounting procedures need technological know-how to avoid problems with the platform, concurs with these conclusions. Accountants should have some programming language expertise in addition to their technical abilities. Use of programming languages should be promoted to create custom modules and implement the necessary modifications to the accounting system. Accountants need also develop other kinds of abilities, such as the ability to solve problems and reason. Issues with work performance and data incompatibility are among the many problems that accountants deal with. several kinds of accounting procedures.

It is also evaluated from the above discussion that accountants need to acquire certain skills in order to properly use ERP systems and big data analytics in accounting processes. Accountants are required to acquire technical skills in order to properly use technical software and platforms for accounting purposes. The technical skills include

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the ability to use cloud platforms and the module developed for accounting processes. Moreover, the accountants are also required to get knowledge of programming language so that they can customise the module in alignment with the needs of accounting. The development of the module provides the advantage of managing and making necessary modifications in the module as per requirements. There is also a requirement of problem-solving skills as the accountants are required to manage their tasks with the use of technology due to which they need these types of skills. It is also vital for the accountant to gain analytical skills for using big data analytics and make decisions on the basis of past experience. In this relation, there is a need for providing training to the accountants in order to enable them to use the advanced technology to perform accounting operations.

### **7.2 Recommendations**

In relation to the identified challenges, suitable recommendations are provided that can help accountants gain the necessary skills to perform accounting operations using ERP systems and big data analytics.

- It is evaluated that accountants lack the necessary technical skills to use ERP and big data analytics to conduct accounting processes. In this relation, it is recommended that the organisation should provide training to the accounting professionals to enable them to use advanced technology and conduct accounting operations using big data analytics and ERP systems. This strategy can help eliminate the issue of a lack of skills in using technical systems and performing tasks (Deniswara, Handoko and Mulyawan, 2020).
- It is also evaluated that in the lack of standard processes, the accountants face issues in using advanced technology of big data analytics. In this concern, it can be recommended that organisations should develop Standard Operation

Procedures (SOPs) that can help them avoid confusion and conduct the tasks with a higher level of efficiency. The strategy of creating standard processes can help in improving efficiency and reducing the chances of error as the step-bystep processes should be followed in the accounting system (Dubey *et al.*, 2019).

- It is also evaluated that the pre-defined system or module is unable to work in performing the tasks as the conditions and requirements are different. In this relation, it is recommended that the accountants should have knowledge of programming skills so that they can develop their own module that is capable of working with the accounting needs of an organisation and customised to cater to all the needs of an accountant.
- It is also evaluated that while using big data analytics the problem of data security and privacy is one of the major issues that can cause severe consequences in the form of penalties. In this concern, it is recommended that the accountants should also be aware of the data protection laws and the steps that should be followed in order to ensure the safety and security of the data. This strategy can help in preventing issues of data theft and security in the process of using big data analytics and ERP systems in accounting (Rezaee and Wang, 2019).

### 7.3 Limitation and Future Work

In the research study, the data is collected with the use of an interview method that is highly prone to subjectivity and it is one of the major limitations of the study In order to overcome this limitation the strategy of using quantitative data with the help of conducting a survey is used that can help in providing an objective response to validate the theory. Moreover, the sample size of the research study is also small and due to this reason, the researcher is able to include inferences from some people that may not reflect the opinion of a large population. The limitation can be overcome by taking a large sample size that is capable of providing responses from a large number of populations. In order to perform this, a survey method can be opted for in future studies that is capable of providing insights from a large population. Furthermore, insights from the top management can also be considered in future studies in order to incorporate the viewpoint of higher management on the issue.

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## Appendixes

### **Appendix A: Interviewee Consent Form:**

# The Evolution of Accountants: Adapting to Big Data Analytic and Enterprise Resource Planning Systems in Accounting

Dear Interviewee,

The researcher is asking for your permission to take part in the study as a respondent through the following interview. It is an academic study on the aforementioned subject. This study will help with the research that needs to be done for a dissertation that will be submitted in order to partially fulfill the criteria for the Master of Science in Accounting degree.

Your involvement in this research is completely voluntary. At this point on, you are free to decline participation at any moment without incurring any penalty.

The researcher promise to maintain the strictest discretion regarding any material gleaned from this interview, including any recordings. Your identity will remain private, and the information will be safely saved in a password-protected program.

The researcher will obtain the interview recordings. You provide permission for recording devices to be used during the interview by signing this consent form. These recordings will only be utilized in conjunction with this study.

If you would like, you will have the chance to listen to and provide feedback on the recordings pertaining to your involvement. Kindly get in touch with me at x22247335@student.ncirl.ie if you wish to utilize this privilege.

By signing below, you confirm that you have read and reviewed all the above information and give full consent to participate in the research and for the researcher to use the recording from this interview in the final research work. Do not hesitate to contact the researcher if you have questions about your rights as a participant.

Participant's Name: \_\_\_\_\_

Participant's Signature: \_\_\_\_\_

Date: \_\_\_\_\_

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### **Appendix B: Interview Guide**

## The Evolution of Accountants: Adapting to Big Data Analytic and Enterprise Resource Planning Systems in Accounting

### Part A: Demographic information.

Question 1: Are you a full-time or part-time employee or a student?

Question 2: What is your country of resident?

Question 3: What is your country of origin?

Question 4: What is your gender?

Question 5: What age range do you fall under? 20-25, 25-30, 30-35, 40+

### Part B: Questions specific to use of Big data analytics and ERP in accounting

Question 1: How would you define Big Data and ERP in the context of accounting?

- Question 2: How has the role of accountants changed with the advent of Big Data and ERP systems?
- Question 3: How your company is using ERP and Big Data Analytics in their accounting processes?
- Question 4: How accountants are involved in the decision-making system by using big data analytics and ERP?
- Question 5: What benefits do you observe and what challenges do you face while using ERP and Big Data Analytics in accounting processes?
- Question 6: What are the skills required for using Big Data Analytics and ERP systems in the accounting system?
- Question 7: What proper set of skills and qualities are suitable for accountants to grasp the opportunities and overcome the associated challenges from accounting companies?
- Questions 8: What do you recommend to develop skills for using big data analytics and ERP in accounting of your organisation as an employee and organisation?

### **Appendix B: Interview Transcript Snippet**

#### **Interviewer:**

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When we talk about using the ERP in your organisation and Big Data analytics in accounting processes, what challenges do you face and what benefits do you observe?

#### **Respondent C:**

Technological tools such as ERP and big data analytics do not eliminate the requirement to the primary role to be played by accountants that involves forecasting the trends as well as making financial budgets. Hence critical thinking and problem solving are important skills to be needed in accountants.

#### **Interviewer:**

"You said important skills" In your opinion, what are the skills required for using Big Data Analytics and ERP systems in the accounting system?

#### **Respondent C:**

Rather the successful use of ERP and big data analytics requires accountants to have effective critical thinking and problem solving to address reporting errors, ethical dilemmas and unbalanced spreadsheets, reconciliations and to identify innovative ways to reach best solutions.

#### **Interviewer:**

So what are your recommendations to develop skills for using big data analytics and ERP in accounting of your organisation as an employee and organisation?

#### **Respondent C:**

Expertise to use ERP systems such as Oracle, SAP and Microsoft Dynamics is vital so that the accountants can properly use them in the accounting operations. One more thing, the knowledge of ERP systems only is not sufficient and an accountant should also have to understand the ways the modules of these platforms work with the financial and accounting tasks. Further, Knowledge of the cloud platforms such as Azure, and Google cloud is required as most of the ERP systems are Cloud based. And Knowledge of data integration tools are also required by an accountant, some big names are Apache Nifi and Informatica to perform tasks of data integration between big data systems and ERP.

# Appendix D: Respondent Code

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Respondents	Respondents Code
Respondent 1	Respondent A
Respondent 2	Respondent B
Respondent 3	Respondent C
Respondent 4	Respondent D
Respondent 5	Respondent E