Financial management practices, sources of finance and business performance of 3D printing SMES in South Africa

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DECLARATION

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ABSTRACT

As the 3D printing industry continues to gain momentum in South Africa's SME sector, issues about their financing and financial management need to be investigated. This is due to the capital-intensive nature of the business as well as the financing challenges encountered by 3D printing SMEs. This study aims to contribute to research on financial management practices and sources of finance as predictors of performance for 3D printing small and medium enterprises (SMEs) in terms of profitability and increase in client base. The study adopted the interpretivist research paradigm, exploratory research design, inductive research approach and qualitative research method to achieve the objectives of the study. A total of 20 3D printing firms participated in the study. Employees and managers were purposefully selected to participate in the study. The participants comprised finance managers, senior managers and managers of the 20 3D printing firms that participated in the study. Structured interviews served as the instrument for data collection based on the objectives of the study. Data gathered from interviews were transcribed and analysed using thematic analysis. The study reveals that effective working capital management practices boost the profitability of 3D printing SMEs, particularly through adopting no-credit policies and hiring competent finance officers. These practices also help expand the client base by ensuring timely delivery of products and services, with customer relationship management being a strategic approach. Regarding sources of finance, it was revealed that equity financing significantly impacts the profitability of 3D printing SMEs by avoiding debt and interest payments. Debt financing offers growth opportunities but has limited impact due to repayment challenges. Family and friends offer flexible repayment terms, but lack sufficient funds for high-cost operations. Furthermore, equity financing helps 3D printing SMEs capitalize on growth opportunities and attract customers. It offers investors' expertise and industry connections. Debt financing is limited, while family and friends' funds improve customer service. Own savings provide financial stability for growth opportunities. The

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study reveals that liquidity management practices significantly boost the profitability of 3D printing firms by ensuring sufficient cash flow to meet financial obligations, managing financial risks, and ensuring timely product delivery, thereby enhancing customer satisfaction and contributing to growth in the customer base. The study also found that 3D printing SMEs face the following challenges in managing working capital, liquidity and sourcing finance: limited access to financing, volatile input costs, limited skills and expertise, marketing and sales challenges and also equipment and maintenance upgrade challenges. Based on the study results, it is recommended that due to the challenge of limited financing for 3D printing firms in South Africa, governments and financial institutions should develop specialised financing programmes tailored to the needs of 3D printing SMEs. Secondly, due to the challenge of limited skills and expertise in 3D printing SMEs in South Africa, policy initiatives should foster collaboration between 3D printing SMEs, educational institutions, and industry associations. Finally, 3D printing SMEs should prioritise cash flow management and develop robust systems to monitor and control working capital components, including inventory, receivables, and payables.

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ABBREVIATIONS AND ACRONYMS

ACP	Average Collection Period
BSC	Balance Score Card
CAD	Computer-Aided Design
CCC	Cash Conversion Cycle
CEES	Centre for Enterprise and Entrepreneurship Studies
EFQM	European Foundation for Quality Management
EPS	Earnings Per Share
FDI	Foreign Direct Investment
FX	Foreign Exchange
ICP	Inventory Conversion Period
PCP	Payables Conversion Period
PM	Performance Management
PMS	Performance Management System
R & D	Research and Development
RAPDASA	Rapid Product Development Association of South Africa
ROA	Return on Assets
ROE	Return on Equity
ROI	Return on Investment
ROS	Return on Sales
SMEs	Small and Medium Enterprises
WCM	Working Capital Management

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CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

3D printing is a relatively new business that involves joining materials layer-by-layer based on information from a computer-aided design (CAD) model (Li, Mellor, Griffin, Waelde, Hao & Everson, 2014). When it first started in the mid-1980s, 3D printing was referred to as rapid prototyping (Li et al., 2014). These prototypes enable businesses to assess their products before manufacturing them for end-users.

The 3D printing industry in South Africa has witnessed growth, leading to increased participation of small and medium-sized enterprises (SMEs) (Aghimien, Aigbavboa, Aghimien, Thwala & Ndlovu, 2020). As it is well known, SMEs are often confronted with several challenges in financial management (Adda, 2020) and sources of financing (Njagi & Kariuki, 2017). SMEs often obtain funding from savings or informal sources such as family and friends (Adebisi & Olayinka, 2013). The source of finance for SMEs could also be debt, usually from bank loans (Abdulsaleh & Worthington, 2013) or equity (Fatoki, 2014). Sources of financing are important because they could affect profitability depending on the cost of funding (Njagi & Kariuki, 2017). Studies have found that due to their smaller sizes, most SMEs have poor financial management practices that negatively affect their performance (Adda, 2020).

Considering that 3D printing, like any high-tech business, is capital intensive due to state-of-the-art equipment, it is fair to postulate that obtaining and managing finances could pose significant challenges for 3D printing SMEs in South Africa. The study investigates the role of financial management practices and sources of finance on the performance of 3D printing SMEs in South Africa.

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In this study South African 3D printing Small and Medium-sized Enterprises (SMEs) are operationally defined as entities specializing in the creation of intricate 3D models, specialized tools, and prototypes through advanced design software and printing technology. Their operational scope extends to playing a pivotal role in 3D software development, emphasizing workflow optimization and the integration of emerging technologies. Additionally, these SMEs are crucial in the supply of diverse, high-quality materials essential for 3D printing processes. In operational terms, South African 3D printing SMEs function as key contributors to the industry's growth, serving as hubs that combine design innovation, technological advancement, and material supply to meet the diverse needs of sectors such as manufacturing, healthcare, and product development.

This study contributes to achieving Sustainable Development Goal 8, which is about decent work and economic growth. This is because issues about financial management, sources of finance, and firm performance among SMEs are relevant for economic growth in the 3D printing industry in South Africa.

1.2 PROBLEM BACKGROUND

Financial management is about planning, organising, directing, and controlling financial activities in a firm (Ali & Isak, 2019). Such activities involve the procurement and use of funds by the enterprise (Kwaning, Director & Assah, 2015). Financial management also refers to applying general management principles to the financial resources of the enterprise (Ali & Isak, 2019). Besides applying management principles to financial resources, financial management deals with financing and investment decisions (Ali & Isak, 2019). Financing decisions relate to whether a firm needs funding and how this would be accomplished. Financial management is also about identifying various sources of finance and how much needs to be raised from each (Njagi & Kariuki, 2017).

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The impact of financial management practices on firm performance has gained considerable attention in research due to their relevance to organisational effectiveness and competitive advantage in a highly competitive high-technology industry (Addo, 2017). Erambo, Mulva, Aketch, Sangoro and Muchibi (2016) investigated the effect of financial management practices on performance among SMEs in Kenya and found a strong correlation between the two variables. Within the context of SMEs in South Africa, different studies have been conducted on financial management practices and their impact on the performance of SMEs. Wolmarans and Meintjes (2015) assessed financial management practices and their relevance to successful SMEs in South Africa. The findings revealed that working capital management and profitability are positively related. The study further revealed that cash flow management positively affects performance. Mathew (2013) found that financial decisions made by SMEs significantly impact their performance. Aren and Sibindi (2014) assessed the influence of cash flow management practices on the survival or growth of SMEs. They found that cash flow management is crucial to the survival of SMEs.

While the above-mentioned studies undoubtedly enrich the literature, they also contain some apparent limitations. Firstly, they are generic, meaning that the studies are not industry-specific. Moreover, the 3D printing business, which is relatively new, brings a different dynamic due to its high-technology and capital-intensive nature. Therefore, the previous findings may not necessarily apply to it. Also, the previous studies listed above did not investigate the role of the sources of financing (Addo, 2017; Erambo et al., 2016; Wolmarans & Meintjes, 2015; Mathew, 2013; Aren & Sibindi, 2014). A gap, therefore, exists worth investigating.

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1.3 PROBLEM STATEMENT

As the 3D printing industry continues to gain momentum in South Africa's SME sector, issues about their financing and financial management need to be investigated due to the capital-intensive nature of the business. The problem that necessitates the current study is the observed paucity of research on these issues, as stated in the problem background. Doing so would reveal what should be done to enable these SMEs to remain financially sound, survive, and be competitive in a globalised economy characterised by intense competition and technological advancement (Addo 2017).

The broader problem that necessitates the need for this study is the evolving landscape of the 3D printing industry within South Africa's Small and Medium-sized Enterprises (SME) sector (Birtchnell, Bohme & Gorkin, 2017). This is because, as the 3D printing business acquires momentum and visibility among South African SMEs, it serves as a compelling example of technical innovation and industrial change (Birtchnell et al., 2017). However, the capital-intensive structure of this business has created significant finance and financial management problems which have far-reaching ramifications for the larger economic backdrop (Guliwe, 2019). Small and Medium Enterprises (SMEs) in South Africa engaged in 3D printing face formidable financial challenges. High initial investments in technology and equipment, coupled with ongoing operational costs, strain limited capital resources (Cronje,2021). Skilled labor expenses, often scarce, add to the financial burden (Serumaga-Zake & Van der Poll, 2021). Limited access to finance exacerbates the struggle, as larger competitors enjoy economies of scale (Tarr, 2021).

Within the narrow context, the problem that necessitates the need for this current study is the absence of current studies that examine the financial management practices such as cash management and liquidity management practices of 3D printing firms in South Africa and their impact on financial performance. Secondly, there is the absence

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of current studies that examine the sources of finance of 3D printing SMEs and their impact on financial performance of 3D printing SMEs.

Both the broad and narrow problems underscoring the study creates knowledge gaps that this current study seeks to address by examining the role of financial management practices and sources of financing on financial performance among 3D printing SMEs in South Africa.

1.4 AIM

This study aims to contribute to research on financial management practices and sources of finance as predictors of firm performance for 3D printing SMEs in terms of profitability and increase in client base. Practically, the study seeks to make recommendations for improvements in the performance of 3D printing firms through the adoption and implementation of financial management practices and appropriate sources of finance.

1.5 RESEARCH OBJECTIVES

This section presents the main objective and subsidiary objectives of the study.

1.5.1 Main objective

To assess the role of financial management practices and sources of finance in the performance of 3D printing SMEs in South Africa.

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1.5.2 Subsidiary objectives

The study specifically seeks to:

1. Examine how and to what extent working capital management practices affect the business performance of 3D printing SMEs in South Africa.
2. Ascertain how and the extent to which equity as a source of finance affects the business performance of 3D printing SMEs in South Africa.
3. Ascertain how and the extent to which debt as a source of finance affects the business performance of 3D printing SMEs in South Africa.
4. Ascertain how and the extent to which family and friends as a source of finance affect the business performance of 3D printing SMEs in South Africa.
5. Ascertain how and the extent to which personal savings as a source of finance affect the business performance of 3D printing SMEs in South Africa.
6. Examine how and to what extent liquidity management practices affect the business performance of 3D printing SMEs in South Africa.
7. Explore the challenges that 3D printing SMEs in South Africa face in managing working capital, liquidity, and sourcing finance.

1.6 RESEARCH QUESTIONS

In this section, the main research question and subsidiary research questions are presented.

1.6.1 Main research question

How do financial management practices and sources of finance affect the performance of 3D printing SMEs in South Africa?

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1.6.2 Subsidiary research questions

1. How and to what extent do working capital management practices affect the business performance of 3D printing SMEs in South Africa?
2. How and to what extent does equity as a source of finance affect the business performance of 3D printing SMEs in South Africa?
3. How and to what extent does debt as a source of finance affect the business performance of 3D printing SMEs in South Africa?
4. How and to what extent do family and friends as a source of finance affect the business performance of 3D printing SMEs in South Africa?
5. How and to what extent does own savings as a source of finance affect the business performance of 3D printing SMEs in South Africa?
6. How and to what extent do liquidity management practices affect the business performance of 3D printing SMEs in South Africa?
7. What challenges do 3D printing SMEs in South Africa face in managing working capital, liquidity and sourcing finance?

1.7 SUMMARY OF RESEARCH METHODOLOGY

The research paradigm refers to the set of beliefs and assumptions guiding the researcher's research approach (Kaushik & Walsh, 2019). Positivism and interpretivism are prominent research paradigms within research philosophy (Kaushik & Walsh, 2019). Positivism is a research paradigm emphasising objectivity, quantification and empirical evidence (Kamal, 2019). Interpretivism is a research paradigm that focuses on understanding the subjective meanings and interpretations individuals attach to their experiences and the social world (Romani et al., 2018).

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In this study, the interpretivist research paradigm was chosen. The justification was based on its ontology of subjectivity and epistemology of using structured interviews to acquire knowledge on financial management practices and sources of finance and their role in enhancing profitability and growth in client base among 3D printing SMEs in South Africa.

The study employed the exploratory research design due to the relatively unexplored nature of the phenomenon being investigated, justifying the need to gain an in-depth understanding of how and the extent to which financial management practices and sources of finance affect profitability and growth in client base among 3D printing SMEs in South Africa.

In terms of the research approach, the inductive reasoning was adopted, while the researcher also chose the qualitative research method. The choice of the inductive research approach was justified because the researcher dwelled on collecting and analysing data based on structured interviews to develop patterns, new insights and conceptual frameworks (Romani et al., 2018) on the role of financial management practices and sources of finance in enhancing profitability and client base expansion among 3D printing SMEs in South Africa. Also, the qualitative research approach was deemed necessary because the researcher relied on non-numerical data (Romani et al., 2018).

The population of the study comprised 275 employees of 3D printing firms that participated in the 23rd Annual RAPDASA Conference in South Africa. The respondents comprised twelve (12) finance officers, two (2) senior managers and six (6) managers from 3D printing SMEs in South Africa. Structured interviews served as the data collection instrument, which sought the opinions of participants on financial management practices such as working capital and liquidity management practices

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and how and the extent to which they affected profitability and growth in the client base of 3D printing SMEs in South Africa. The interview guides also sought the opinions of participants on how and the extent to which sources of finance such as equity, debt, family and friends and own savings affect profitability and growth in the client base. The interviews also sought the opinions of participants on the working capital, liquidity management and financing challenges they encountered as 3D printing SMEs in South Africa. Interview data were transcribed and then analysed using Nvivo software and thematic analysis.

1.8 SIGNIFICANCE OF THE STUDY

This section presents the significance or contributions of the study in terms of policy, practice and theory.

1.8.1 Contributions to theory

This study advances the pecking order theory by examining the financing dynamics of 3D printing Small and Medium-sized Enterprises (SMEs). The research identifies industry-specific determinants shaping financing preferences, including technological innovation and intellectual property considerations. It extends beyond generic challenges, offering a refined pecking order model tailored to the 3D printing context. The study contributes significantly to finance and management theory, elevating the pecking order framework from a generic understanding to a nuanced, industry-specific perspective. The insights provide a foundation for future research and potential policy implications for supporting 3D printing SMEs in navigating financing constraints.

This study extends the liquidity preference theory by intricately examining impediments faced by 3D printing Small and Medium-sized Enterprises (SMEs) in securing

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financing. It delves into investor liquidity preferences, revealing multifaceted challenges for SMEs in long-term financing. The research proposes targeted policy initiatives aligning with liquidity preference theory, aiming to enhance access to alternative financing. Beyond surface-level identification, it intricately explores the interplay of factors within the liquidity preference framework, offering a granular perspective. Additionally, the study provides pragmatic policy recommendations, bridging theory with practical implications, enriching the theoretical discourse, and enhancing the applicability of liquidity preference theory in the context of 3D printing SMME financing.

Furthermore, the study both extends and challenges the free cash flow theory in the context of 3D printing SMEs. It underscores the vital role of cash reserves for managerial control, reinforcing the theory, yet goes further by advocating for diversifying financing sources and optimizing cash flow management. Recommending improvements in working capital management, the study extends and challenges the free cash flow theory, proposing a more dynamic financial management approach for 3D printing SMEs. This dual perspective offers nuanced insights into the interplay between established financial theories and practical implications, enriching the understanding of financial management in this specific industry.

This study enhances the trade-off theory's foundations by meticulously examining financing decisions in the 3D printing industry. This is because, the study provides a profound understanding of how 3D printing SMEs strategically navigate trade-offs between debt and equity, offering nuanced insights beyond superficial examinations. The research reveals industry-specific nuances, recognizing that trade-offs are intricately linked to the unique characteristics of the 3D printing sector. This contextualization adds depth to the trade-off theory, making it more adaptable in understanding financing behaviors in technology-driven sectors. In conclusion, the study not only strengthens the theory's underpinnings but also enhances its

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applicability, offering valuable insights for academia, policymakers, and practitioners in the dynamic 3D printing industry.

1.8.2 Contributions to policy

Firstly, the study highlights the limited access to financing faced by 3D printing SMEs and recommends policy initiatives to facilitate access to alternative financing sources. This can inform policymakers about the specific challenges faced by SMEs in the 3D printing sector in South Africa and guide the development of targeted financing programmes and incentives to support their performance and growth.

Secondly, the study emphasises the importance of collaboration and knowledge sharing in the 3D printing industry. Policymakers can use this information to promote industry-academia partnerships, establish knowledge-sharing platforms, and support research and development activities. These initiatives can foster innovation, enhance skills development, and improve the overall competitiveness of 3D printing SMEs in South Africa.

The study accentuates the need for policy support in marketing and awareness campaigns for 3D printing technology. Policymakers can allocate resources for industry-wide promotional activities, educational programmes, and events to increase awareness and understanding of the technology among potential customers, investors and the general public. This can contribute to the growth of the industry and the client base of SMEs.

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1.8.3 Contribution to practice

The study provides practical recommendations for 3D printing SMEs to diversify their financing sources beyond traditional banks. This guidance can help 3D printing SMEs identify alternative funding options and explore avenues such as venture capital and crowdfunding. Implementing these recommendations can improve the financial stability and growth potential of 3D printing SMEs in South Africa.

Secondly, the study highlights the importance of effective working capital management strategies. By implementing the recommended practices, 3D printing SMEs can optimise their cash flow, improve profitability and enhance customer satisfaction through the timely delivery of products and services. These practical recommendations can guide SMEs in developing robust working capital management systems to enhance their firm performance.

Lastly, the study emphasises the significance of investing in skills development and training for personnel involved in 3D printing operations. The practical recommendation to prioritise skills development can help SMEs address the challenge of limited human resource expertise. By investing in training programmes, 3D printing SMEs can enhance their workforce's capabilities, improve working capital management, and drive innovation in the sector.

1.9 LIMITATIONS OF THE STUDY

The study had the following limitations. The first limitation had to do with the scope of the 3D printing industry in South Africa, which is relatively small. In this regard, the researcher faced challenges in the data collection process since it was difficult to have face-to-face interviews with employees and managers of 3D printing firms. Successful

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collaboration with colleagues in South Africa who attended the RAPDASA conference in November 2022 proved crucial in obtaining email contacts from conference attendees. These contacts played a significant role in facilitating the data collection process.

Furthermore, the problem of delays in the data collection process was also a limitation of this study. This is because most participants had very tight work schedules making it difficult for them to respond to interview questions in real-time. However, constant email follow-ups helped the researcher access responses for data transcription and thematic analysis for the results of the study to be achieved.

1.10 STRUCTURE OF THE STUDY

This thesis comprises nine chapters. The first chapter constitutes the introduction, problem background, problem statement, research aim, objectives, questions, hypotheses, an overview of research methodology, significance of the study, limitations and organisation of the study. The second chapter discusses the literature on firm performance, while the third chapter presents literature on working capital management from an SME perspective. The fourth chapter evaluates the literature on liquidity management in the SME context, and the fifth chapter presents literature on sources of financing for SMEs. The sixth chapter examines empirical literature based on the research questions and also the conceptual framework of the study. Chapter Seven presents the methodology of the study, and Chapter eight the results and discussions with relevant literature. The ninth chapter presents the conclusions and recommendations for policy, practice and future studies.

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1.11 CHAPTER SUMMARY

This study contributed to research on financial management practices and sources of finance as predictors of firm performance for 3D printing SMEs in terms of profitability and increase in client base. The study was guided by 13 research questions which were answered through the use of thematic analysis. This chapter comprised the introduction, problem background and statement, research aim, objectives and research questions, overview of the methodology, the significance of the study, limitations and organisation.

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CHAPTER 2: FIRM PERFORMANCE

2.1 INTRODUCTION

This chapter presents a literature review on firm performance. The chapter commences with definitions of firm performance and then discusses the evolution of performance measurement. Other components of the chapter comprise the following: categories of firm performance, characteristics of performance measurement (financial performance indicators, non-financial performance indicators), and common performance measurement models (balanced scorecard, European Foundation for Quality Management). The chapter also presents literature on determinants of firm performance (organisational/internal factors affecting firm performance and economic/external factors affecting firm performance) and SME performance measurement.

2.2 DEFINING FIRM PERFORMANCE

In very generic terms, firm performance is a set of financial and non-financial indicators capable of assessing the degree to which organisational goals and objectives have been accomplished (Bennouri, Chtioui, Nagati & Nekhili, 2018). Firm performance may also be defined in terms of financial ratios (e.g. return on assets (ROA) and return on equity (ROE), market outcomes (Tobin's Q, market share, stock price and growth), HR-related outcomes (job satisfaction, commitment and others) or organisational outcomes (productivity, service quality, new product development and others) (Fu, Singhal & Parkash, 2016). Financial performance indicators can be measured with the help of published company financial statements or data from stock exchanges (Fu et al., 2016). Importantly, firm performance can also be measured based on subjective information gathered from managers or other key informants, asking them to rate their company's

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overall performance, such as their market share, profitability, innovation efforts, the performance of HR practices, and other attributes (Nyarku & Ayekple, 2019). It has been argued that objective measures are more robust than subjective measures as managers may be reluctant to draw attention to shortcomings and instead may seek to overstate the performance of their organisations (Oztekin, Delen, Zaim, Turkyilmaz & Zaim, 2015). Nonetheless, despite this apprehension surrounding subjective measures, they have been a popular method for assessing firm performance in studies, particularly in management (Gan, Park & Suh, 2020; Liao, Lin & Lin, 2016).

In summary, the definitions of firm performance exhibit similarities in acknowledging the importance of assessing organisational goals and objectives. They also recognise the need to consider both financial and non-financial indicators. Differences arise regarding the specific indicators used, the sources of data, and the use of subjective or objective measures. Based on the definitions, this study defines firm performance as the comprehensive evaluation of financial and non-financial indicators that assess the extent to which an organisation achieves its goals and objectives. It encompasses objective measures, such as financial ratios, market outcomes, and subjective assessments from managers and key informants.

2.3 EVOLUTION OF PERFORMANCE MEASUREMENT

Performance measurement systems have been of significant interest to accounting studies since their inception in the industrial era during the 1960s (Bititci, Garengo, Ates & Nudurupati, 2015). Scholars have devised a traditional management accounting system that centres on financial metrics, including traditional budgeting, costing, variance analyses, and cost-volume-profit analysis (Bititci et al., 2015). The primary objective of the traditional performance measurement system was to oversee the expenses incurred by the organisation (Chand & Sharma, 2020). According to Dalal

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(2021), the traditional notion of a performance measurement (PM) system was primarily aimed at upholding organisational control and financial objectives for manufacturing entities. The conventional performance measurement system has proven inadequate in the current business landscape due to changes in the nature of business and its environment. The current business approach has shifted its emphasis from solely focusing on competitors to prioritising the customer and ensuring the quality of products and services offered to consumers (Cuzdriorean, 2017).

Globalisation has led to heightened competition among companies, both domestically and globally. This has resulted in an increased level of complexity within the business environment. This necessitates the implementation of a performance measurement system that places emphasis not only on cost monitoring and control (Jahan, Alrajawy, Ali & Martin, 2021). According to Siddharthan and Narayanana's (2018) research, traditional management accounting systems are insufficient in providing useful information for organisational objectives, decision-making, planning, and control in light of the rapid changes in technology, expanding information processing capabilities, and intense global competition (Tang, Wang & Yu, 2020). The conventional approach to performance measurement systems centred on optimising shareholder wealth, with metrics such as earnings per share (EPS), return on investment (ROI), and ROA being prioritised (Kurmi & Rakshit, 2017). According to Tang et al. (2020), periodic financial measures have been criticised in recent coverage of performance measures. The criticism suggests that these measures are overly aggregated, untimely, and retrospective, which limits their usefulness in helping managers comprehend the underlying causes of performance issues, take prompt corrective actions, promote cross-functional decision-making, and concentrate on strategic matters.

It is recommended that the organisation's performance measurement system incorporates financial and non-financial metrics to effectively address the complex and

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ever-changing business environment (Omram, Khallaf, Gleason & Tahat, 2021). It is imperative to obtain a comprehensive overview of organisational performance. Companies must align their performance measurement system with their organisational strategy to thrive in today's ever-changing business landscape. Additionally, this system must effectively monitor customer satisfaction levels while maintaining cost efficiency within the organisation. The study conducted by Cacciolatti, Rosli, Ruiz-Alba, and Chang in 2020 is noteworthy. The limitations of conventional measurement systems have instigated a revolution in performance measurement, as stated by Taouab and Issor (2019).

Since the early 1990s, performance measurement has gained significant attention from scholars and professionals, as Parida, Kumar, Galar, and Stenstrom (2015) noted. Scholars have identified limitations in the conventional system and have suggested diverse performance measurement systems that would allow organisations to evaluate all aspects of their business (Parida et al., 2015). The exclusive use of financial metrics was deemed inadequate in evaluating performance due to the absence of other critical factors in the contemporary economy, including expertise and knowledge, customer orientation, and operational efficiency and ingenuity, which were not encompassed in conventional financial reporting (Schleicher, Baumann, Sullivan, Levy, Hangrove & Barros-Rivera, 2018). There has been a shift in focus among practitioners, consultants and academic circles towards replacing conventional cost-based measurement systems in organisations. The emphasis is now that adopting systems aligns with their present objectives and environments, as noted by Schleicher et al. (2018). According to the professional literature, it has been recommended that managers devise a novel performance measurement system (PMS) that encompasses financial and non-financial metrics (Schleicher et al., 2018).

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Scholars have recommended the adoption of the balanced scorecard methodology and other integrated systems for measuring performance (Gibbons & Kaplan, 2015). The discourse surrounding the utilisation of integrated or multidimensional performance measurement systems has been prominent in academic and professional circles (Cuccurullo, Aria & Sarto, 2016). Incorporating financial and non-financial measures into performance management systems (PMS) has garnered significant attention from business professionals and scholars (Cuccurulo et al., 2016). An integrated or multidimensional performance measurement system is a prevalent practice in contemporary organisations, as noted by Asiaei and Bontis (2019). The integrated system to access the organisation's non-financial dimension still includes the conventional elements that gauge the organisation's activities concerning financial aspects, as stated by Ogunsiji and Ladanu (2017).

Based on the literature, the study posits that performance management systems have undergone several developmental stages. Throughout this evolution, a focus has been on incorporating financial and non-financial performance indicators as critical benchmarks for assessing firm performance. 3D printing companies must avoid relying solely on conventional performance measurement systems like ROA, ROI, and ROE to evaluate firm performance. Instead, they should prioritise multidimensional performance measurement systems such as the balanced scorecard. It is imperative to consider that the selection of performance management systems for 3D printing companies must be executed carefully to ensure alignment with their organisational vision, mission and objectives.

2.4 CATEGORISING FIRM PERFORMANCE

Firm performance encompasses various categories that reflect different aspects of organisational success and stakeholder satisfaction. These categories include financial

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performance, customer satisfaction, employee satisfaction and social and environmental performance (Taouab & Issor, 2019).

Financial performance is a crucial aspect that satisfies investors and is represented by profitability, growth, and market value (Gartenberg, Prat & Serafeim, 2019). Profitability measures the firm's ability to generate returns, while growth indicates its ability to increase size and achieve economies of scale (Musah et al., 2018; Ozcan et al., 2017). The market value represents external assessment and expectations of the firm's future performance (Coad et al., 2016; Bajic & Yurtoglu, 2018). Financial performance, encompassing profitability, growth and market value, holds significant importance for 3D printing SMEs in South Africa. These businesses must demonstrate their ability to generate returns, increase their size, and attract investor interest. Profitability reflects their capacity to deliver positive financial outcomes, while growth signifies their expansion and access to economies of scale. The market value represents external evaluations and future expectations, influenced by factors like technological advancements and product differentiation. Maintaining strong financial performance in the rapidly evolving 3D printing industry is crucial for attracting investment, ensuring sustainability and fostering growth.

Customer satisfaction is another vital aspect of firm performance. Meeting customer expectations, avoiding defects, and enhancing perceived quality and value contribute to customer satisfaction and willingness to pay (Cheema et al., 2015; Kurdi et al., 2020). In the context of 3D printing SMEs in South Africa, customer satisfaction plays a crucial role in firm performance (Steenhuis & Pretorius, 2016). By meeting customer expectations and delivering products that meet their needs, these SMEs can establish a loyal customer base and foster positive relationships (Singh & Agrawal, 2021). Ensuring product quality, avoiding defects, and providing value-added services enhance the perceived value of their offerings (Singh & Agrawal, 2021). Satisfied

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customers are more likely to continue doing business with 3D printing SMEs, recommend them to others, and be willing to pay a premium for their products or services (Maric, 2020). Therefore, by prioritising customer satisfaction, 3D printing SMEs in South Africa can differentiate themselves in the market, build a strong reputation, and drive sustainable growth (Maric, 2020).

Employee satisfaction is related to investments in human resource practices, such as clear job descriptions, training, career plans, and fair compensation policies (Ariani, 2015). Satisfied employees enhance the firm's ability to attract and retain talent and lower turnover rates (Kothman & Faber, 2016). In the context of 3D printing SMEs in South Africa, investing in human resource practices to ensure employee satisfaction is crucial. These SMEs can attract and retain talented employees by providing clear job descriptions, offering training opportunities, and implementing career development plans (Grande et al., 2021). Fair compensation policies also contribute to employee satisfaction, fostering a positive work environment. Satisfied employees are more likely to be engaged, productive, and committed to the success of the organisation (Chen & Lin, 2017).

Social and environmental performance is crucial for satisfying communities and governments. It involves engaging in safe environmental practices, ensuring product quality and safety, ethical advertising, promoting diversity in employment, and contributing to social projects (Ezzi & Jarboui, 2016; Nazari et al., 2017; Fotana et al., 2015). For 3D printing SMEs in South Africa, social and environmental performance is essential for satisfying both communities and government regulations. These SMEs can demonstrate their commitment to sustainable practices by implementing safe environmental measures, ensuring product quality and safety, and engaging in ethical advertising (De Schutter et al., 2018). Additionally, actively participating in social projects and initiatives showcases their dedication to community development

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(Youssef et al., 2022). By prioritising social and environmental performance, 3D printing SMEs in South Africa can build positive relationships with stakeholders, comply with regulations and contribute to a more sustainable and inclusive society (Shahpasand et al., 2023).

2.5 CHARACTERISTICS OF PERFORMANCE MEASUREMENT

This section presents literature on the characteristics of performance measurement comprising financial performance indicators and non-financial performance indicators.

2.5.1 Financial performance indicators

Financial indicators are essential tools for assessing the performance of firms across various industries, including 3D printing SMEs. These indicators help stakeholders understand a company's financial health, profitability, efficiency and growth potential. The following financial performance indicators are discussed in this section with emphasis on their relevance to 3D printing SMEs in South Africa: revenue growth, profitability ratios, cash flow management, ROA, ROI, liquidity ratio, debt-to-equity ratio and operation expenses ratio.

2.5.1.1 Revenue growth

Revenue growth is a fundamental financial indicator that measures the rate at which a company's sales increase over a specific period. It is a key metric for assessing a firm's performance and market position (Jiao et al., 2022). For 3D printing firms in South Africa, revenue growth is particularly crucial as it indicates their ability to attract customers, expand market share, and capitalise on the growing demand for 3D printing

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technology. High revenue growth suggests that the company successfully executes its business strategies, effectively targets customers, and meets their needs (Haltiwanger et al., 2015). It can be driven by strong marketing campaigns, product innovation, expanding into new markets or industries, strategic partnerships, or acquiring new customers (Haltiwanger et al., 2015). Additionally, increased brand recognition and customer loyalty often accompany revenue growth, further supporting future sales growth (Lehmann, 2015). Sustained revenue growth provides several benefits to 3D printing firms. It allows them to invest in research and development, upgrade their technologies, and expand their production capacity. It also enables the firms to attract investors and secure additional funding for further growth initiatives. Moreover, revenue growth enhances the firm's ability to negotiate favourable supplier contracts and achieve economies of scale, positively impacting profitability (Lehmann, 2015).

2.5.1.2 Profitability ratios

Profitability ratios are vital in assessing a firm's financial performance and ability to generate profits from its operations (Oner Kaya, 2015). In the context of 3D printing SMEs in South Africa, these ratios provide valuable insights into the efficiency of cost management, pricing strategies, and overall financial health. The gross profit margin measures the percentage of revenue after deducting direct production costs (Nariswari & Nugraha, 2020). A higher gross profit margin indicates that the company effectively manages its production costs and can command favourable pricing for its products or services (Nariswari & Nugraha, 2020). It reflects the firm's ability to generate sufficient revenue to cover variable costs and contribute to covering fixed expenses. The net profit margin, on the other hand, calculates the percentage of revenue remaining after deducting all costs, including operating expenses, taxes, and interest (Durrah et al., 2016). A higher net profit margin indicates efficient cost management, effective pricing strategies, and firm control over overhead expenses (Durrah et al., 2016).

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ROA and ROE are other profitability ratios that assess a company's ability to generate profits relative to its assets or equity (Batchimeg, 2017). ROA measures the return generated from all assets, while ROE focuses on the return generated for shareholders' equity (Ali et al., 2022). Higher ROA and ROE values indicate efficient utilisation of assets or equity to generate profits, reflecting the firm's ability to deploy resources effectively and maximise returns for investors (Nguyen et al., 2021).

These profitability ratios are essential for 3D printing SMEs in South Africa as they demonstrate the effectiveness of their cost control measures, pricing strategies, and overall financial performance. By analysing and improving these ratios, SMEs can enhance profitability, attract investors, secure funding for growth initiatives, and establish themselves as financially stable and viable businesses in the competitive 3D printing market.

2.5.1.3 Cash flow management

Cash flow is indeed a critical factor for the sustainability and success of any business, including 3D printing SMEs in South Africa. Positive cash flow ensures a company has sufficient funds to meet its financial obligations, invest in growth opportunities, and navigate unexpected expenses or market fluctuations (Bhandari & Adams, 2017). Analysing different components of cash flow is essential for 3D printing SMEs. Operating cash flow represents the cash generated from core business operations. It provides insights into the company's ability to generate cash from its day-to-day activities, such as sales, collections, and managing expenses (Noury et al., 2020). Positive operating cash flow indicates that the firm's operations generate enough cash to sustain its business activities (Noury et al., 2020).

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Investing cash flow reflects the cash inflows and outflows related to asset investments, such as equipment, technology, or research and development. Monitoring this cash flow helps assess the firm's investment decisions and the impact on its cash position (Lewellen & Lewellen, 2016). Positive investing cash flow suggests that the company is making strategic investments to enhance its capabilities, expand market reach, and drive future growth (Mulier et al., 2016). Financing cash flow represents the cash flows related to financing activities, such as raising capital, issuing debt or equity, or making dividend payments (Mulier et al., 2016). Analysing financing cash flow is crucial to understand how the company funds its operations and growth initiatives (Moshirian et al., 2017). Positive financing cash flow indicates that the firm is successfully securing external funding or generating capital internally to support its business activities (Moshirian et al., 2017).

Monitoring these cash flow indicators enables 3D printing SMEs to identify potential liquidity issues, manage working capital effectively, and make informed financial decisions. It helps them ensure a healthy cash flow position, improve financial stability, and seize growth opportunities when they arise. By maintaining positive cash flow, these SMEs can enhance their resilience, build investor confidence, and sustain long-term success in the dynamic 3D printing industry.

2.5.1.4 Return on investment (ROI)

ROI is a crucial financial indicator that measures the return generated from an investment relative to its cost (Masters et al., 2017). For 3D printing SMEs in South Africa, ROI is particularly relevant when evaluating the efficiency of capital investments in machinery, equipment, and technology necessary for their 3D printing operations.

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Positive ROI indicates that investments in 3D printing infrastructure generate satisfactory returns. It demonstrates that the capital deployed to acquire machinery, equipment, and technology is effectively utilised and contributes to the firm's profitability (Psacharopoulos & Patrinos, 2018). A higher ROI signifies that the investment has generated more returns than the initial cost, positively impacting the company's financial performance (Chalutz Ben-Gal., 2019). ROI analysis helps 3D printing SMEs assess the profitability and viability of their investment decisions. By comparing the returns generated from these investments to the initial costs incurred, the firm can evaluate the success and efficiency of its capital allocation (Chalutz Ben-Gal., 2019).

Additionally, ROI analysis provides valuable insights into the overall financial health of the business. Positive ROI indicates efficient capital utilisation and helps attract investors and secure additional funding for growth initiatives (Psacharopoulos & Patrinos, 2018). It demonstrates the company's ability to generate profitable returns from its investments, enhancing its credibility and attracting potential stakeholders (Masters et al., 2017). By regularly evaluating ROI, 3D printing SMEs can assess the profitability of their capital investments and make informed decisions regarding future investment opportunities. It enables them to optimise their resource allocation, improve financial performance, and drive sustainable growth in the dynamic and competitive 3D printing industry.

2.5.1.5 Debt-to-equity ratio

The debt-to-equity ratio is a key financial indicator that measures the proportion of a firm's financing from debt relative to equity (Batchimeg, 2017). It provides insights into a company's capital structure and financial leverage (Batchimeg, 2017). In the context of 3D printing SMEs in South Africa, managing debt levels and maintaining a healthy

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debt-to-equity ratio is crucial to ensure financial stability and mitigate risk. A high debt-to-equity ratio indicates that the firm relies heavily on debt financing, which can increase financial risk (Joseph & Kibera, 2019). It implies a more significant burden of interest payments and potential difficulties in meeting debt obligations. High debt levels can also limit the company's flexibility in pursuing growth opportunities or handling unexpected challenges (Joseph & Kibera, 2019).

Conversely, a low debt-to-equity ratio suggests a more conservative capital structure with a higher proportion of equity financing (Kamar, 2017). This indicates a lower level of financial risk and may enhance the firm's ability to weather economic downturns or industry fluctuations (Kamar, 2017). By managing their debt-to-equity ratio, 3D printing SMEs can strike a balance between utilising debt as a tool for growth and maintaining a healthy financial position. Thus, managing the debt-to-equity ratio is critical for 3D printing SMEs to maintain financial stability and mitigate risk.

2.5.2 Non-financial performance indicators

Non-financial indicators are qualitative or quantitative measures that provide insights into various aspects of a business's operations, performance, and sustainability. While financial indicators focus on monetary aspects, non-financial indicators offer a more holistic view of a company's overall health.

2.5.2.1 Market share and competitive positioning

Non-financial indicators such as market share, customer acquisition rates, partnerships with key industry players, and industry recognition play a vital role in assessing a 3D printing SME's competitive positioning. A high market share suggests a strong presence in the industry and a more extensive customer base, indicating the

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company's ability to attract and retain customers (Jindal et al., 2016). Customer acquisition rates reflect the effectiveness of the firm's marketing and sales efforts in expanding its customer reach (Meire et al., 2017). Partnerships with key industry players signify strategic collaborations that can enhance the company's market access, technology capabilities, and competitive advantage (Bustinza et al., 2019). Industry recognition in the form of awards or rankings validates the company's achievements and can positively impact its reputation and market standing (Bustinza et al., 2019).

2.5.2.2 Customer engagement and relationships

Strong customer relationships are essential for 3D printing SMEs to foster loyalty and drive repeat business. Non-financial indicators such as customer feedback, repeat business rates, customer loyalty programmes, and customer testimonials provide insights into the company's success in engaging customers and meeting their specific needs (Kumar et al., 2019). Positive customer feedback and high repeat business rates indicate customer satisfaction and loyalty (Pansari & Kumar, 2017). Customer loyalty programmes can incentivise repeat purchases and cultivate long-term relationships (Becker & Jaakola, 2020). Customer testimonials endorse the company's products or services, influencing potential customers and enhancing its reputation (Becker & Jaakola, 2020).

2.5.2.3 Sustainability and environmental impact

With growing environmental concerns, non-financial indicators related to sustainability and environmental impact have gained significance (Khosravani & Reinicke, 2020). For 3D printing SMEs, indicators such as the use of eco-friendly materials, energy-efficient manufacturing processes, waste reduction efforts, and certifications for sustainable practices demonstrate the company's commitment to environmental responsibility.

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Utilising eco-friendly materials and implementing energy-efficient processes showcase the company's efforts to reduce its ecological footprint (Hagar et al., 2016). Waste reduction initiatives contribute to sustainable practices and resource efficiency (Shahrubudin et al., 2019). Certifications for sustainable practices validate the company's commitment to environmental stewardship, potentially attracting environmentally conscious customers and investors (Shahrubudin et al., 2019).

2.5.2.4 Innovation and technological advancement

To remain competitive, 3D printing SMEs must stay at the forefront of innovation and technological advancement. Non-financial indicators such as the number of patents filed, R&D investments, partnerships with technology providers, and introduction of new products or materials demonstrate the company's commitment to innovation (Rindfleisch et al., 2017). Filing patents indicate the company's pursuit of intellectual property protection and its investment in research and development (Wimpenny et al., 2017). Partnerships with technology providers enhance access to cutting-edge technologies and expertise (Wimpenny et al., 2017). Introducing new products or materials showcases the company's ability to meet evolving market demands and maintain a competitive edge (Rayna & Striukova, 2016).

2.5.2.5 Quality and precision

The quality and precision of 3D-printed products are crucial for customer satisfaction and market reputation. Non-financial indicators, such as customer satisfaction surveys, product defect rates, and adherence to industry quality standards, reflect the company's commitment to delivering high-quality 3D-printed items (Li et al., 2017). Positive customer satisfaction surveys indicate that the company meets or exceeds customer expectations (Li et al., 2017). Low product defect rates signify a commitment

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to quality control and efficient manufacturing processes (Yan et al., 2018). Adherence to industry quality standards demonstrates compliance with established benchmarks, reinforcing the company's reputation for delivering reliable and precise 3D-printed products (Yan et al., 2018).

2.5.2.6 Talent and skills development

The expertise and skills of the workforce are vital for the success of 3D printing SMEs. Non-financial indicators such as employee training and development programmes, certifications obtained by employees, and employee retention rates provide insights into the company's ability to attract and retain skilled professionals (Ford & Minshall, 2019). Robust training and development programmes indicate the company's investment in enhancing employee skills and knowledge (Hossain et al., 2020). High employee retention rates suggest a positive work environment, competitive compensation, and opportunities for career growth, attracting and retaining top talent in the industry (Chong et al., 2018).

2.6 COMMON PERFORMANCE MEASUREMENT MODELS

This section presents literature on common performance measurement models, namely the balanced scorecard and European Foundation for Quality Management (EFQM).

2.6.1 The balanced scorecard (BSC)

Developed by Kaplan and Norton (1992), the BSC aims to link the business unit strategy to the performance measures selected. The BSC is a performance

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measurement framework containing a set of four financial and non-financial measures chosen to aid an organisation in implementing its key success factors that are defined in the company's strategic vision (Fooladvand, Yarmohammadian & Shahtalebi, 2015; Tan, Zhang & Khodaverdi, 2017). The four measures are financial results, customer satisfaction, internal business process, learning and growth (Senarath & Patabendige, 2015).

The financial perspective is the traditional approach for assessing organisational performance on top of the profit margins and returns; cost-benefit data and risk assessment have been added to this category (Hamdy, 2018). The customer perspective recognises the importance of customer focus and satisfaction. It emphasises the need for analysing the kinds of customers and processes for which the organisation provides a product or service to those customer groups (Broccardo, 2015). The business process perspective refers to internal business and strategic management processes. The matrix lets business managers know how well the organisations run and whether their products/services conform to customer requirements (Cheowsuwan, 2016). Learning and growth include employee training and corporate cultural attitudes related to individual and corporate self-improvement. It involves things like mentors and tutors within the organisation and the ease of communication among workers to enable them to get help on a problem when needed (Debnath, Roy, Chatterjee & Kar, 2018).

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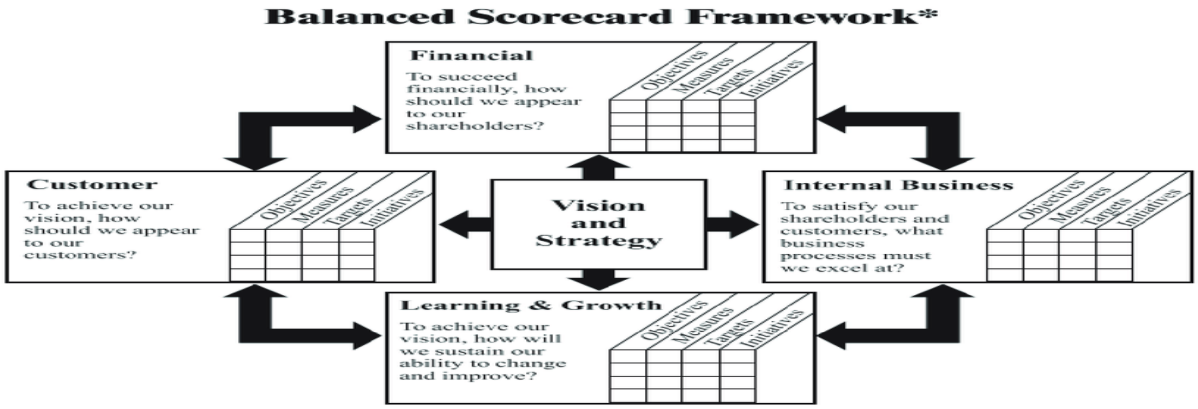

Figure 2.1: The balanced scorecard framework

Source: Kaplan and Norton, 1992.

The authors contend that the scorecard should translate the firm unit's mission and strategy into tangible objectives and measures. There are many normative and empirical studies on implementing the BSC model (Debnath et al., 2018). The BSC model gives four general performance measures that each organisation should customise to its requirements. Saputera, Amri, Affandi and Alam (2021) criticise the performance measures given by the BSC model that there are vague details given concerning how to select the performance metrics to be placed in the scorecard boxes.

In the context of 3D printing Small and Medium-sized Enterprises (SMEs) in South Africa, the Balanced Scorecard (BSC) can serve as a valuable strategic management tool. The financial perspective would involve assessing the profitability and returns of 3D printing SMEs, incorporating cost-benefit data and risk assessment to ensure financial sustainability. The customer perspective becomes crucial, emphasizing customer focus and satisfaction. For 3D printing SMEs, this involves analyzing the specific customer groups they serve and ensuring that their products and services align with customer requirements. Understanding and meeting client needs are essential for success in the competitive 3D printing industry. The business process perspective is pertinent to internal processes and strategic management within 3D printing SMEs. It

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evaluates how well these organizations operate and whether their products and services meet the quality standards and expectations of their customers. Learning and growth, in the context of 3D printing SMEs, encompass employee training and the development of a corporate culture that promotes continuous improvement. This involves providing resources for skill enhancement, mentorship programs, and effective communication channels among workers, fostering an environment conducive to innovation and problem-solving in the dynamic field of 3D printing.

In summary, the Balanced Scorecard can be applied to 3D printing SMEs in South Africa by aligning financial, customer, internal process, and learning and growth perspectives. This approach ensures a comprehensive evaluation of their performance and facilitates the effective implementation of strategic goals in a rapidly evolving industry.

2.6.2 European foundation for quality management (EFQM)

The EFQM excellence model allows the understanding of the cause-effect relationship between what the organisation is doing and its results (Murthy, Sangwan & Narahari, 2021). To achieve long-term success, an organisation needs a good management team with a clear strategic direction (Van-Schoten, de Blok, Spreeuwenberg, Groenewegen & Wagner, 2016). They must invest in employee training and professional development to improve their relationship with partners and the processes to raise the value of their products and services (Asgher, Leba, Ionica, Moraru & Ahmad (2015). The five criteria of determinant factors are the following.

Leadership – organisations with a high level of excellence have leaders who build a great future, achieve their objectives, act like ethical models, and inspire trust (Digenhsara, Rezazadeh & Soleimani, 2018).

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Strategy – organisations with a high level of excellence apply their mission and vision by developing and implementing a strategy based on stakeholders (Digenhsara et al., 2018).

People – organisations with a high level of excellence have a higher interest in their people, continuously looking to improve their capabilities and promoting fairness and equity. They try to motivate employees to obtain better results to help the organisation grow (Favaretti, De Pieri, Torri, Guarrera, Fontana, Debiasi & Flor, 2015).

Partnerships and resources – organisations with a high level of excellence plan and manage their relationship with suppliers and the internal resources to support the strategy and make the processes more efficient (Favaretti et al., 2015).

Processes, products and services – organisations with a high level of excellence try to improve their processes to add more value for their customers and other stakeholders (Calvo-Mora, Dominguez & Criado, 2018).

EFQM is one of the most complete models that can be used to measure the performance of the innovation process because it can be done through all of its criteria: leadership, people, strategy, partnership and resources and processes, products and services.

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2.7 DETERMINANTS OF FIRM PERFORMANCE

This section presents literature on the determinants of firm performance.

2.7.1 Organisational/ internal factors model of firm performance

Zeitun and Tian (2007) researched factors affecting firm performance and market value of enterprises with research data collected from 167 firms listed on the Amman-Jordan Stock Exchange covering 16 different business areas in the non-financial sector from 1989 to 2003. The research results showed that debt ratio has the most substantial impact, while total assets growth, firm size and tax rate positively impact firm performance. Enterprises with a high proportion of fixed assets experience low firm performance because the enterprises invest too much in fixed assets without an adequate improvement in the firm performance. These findings have implications for 3D printing SMEs in South Africa. As such, these companies must manage debt levels effectively, focus on strategic growth, and carefully evaluate investments in fixed assets. By doing so, they can enhance their overall performance and succeed in the competitive 3D printing industry.

Onaolapo and Kajola (2015) surveyed 30 non-financial firms listed on the Nigerian Stock Exchange from 2001 to 2007 to measure the impact of determinants on the performance of these firms. The research results show the following internal factors: debt ratio, size (assets), proportion of fixed assets, growth rate (assets), asset turnover, the firm's age, and business lines have different degrees of influence on the performance of firms. Pouraghajan and Malekian (2012) studied the impact of capital structure on the performance of enterprises with a sample of 400 firms in 12 industries listed on the Tehran Stock Exchange from 2006 to 2010. The study found the following internal factors influencing firm performance: size, age, growth rate and debt ratio.

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A study by Pervan and Višić (2012) assessed the impact of firm size on firm performance among manufacturing enterprises in Croatia from 2002 to 2010. The results of the study indicated that the larger the firm size, the higher the firm performance. For 3D printing SMEs in South Africa, these findings emphasise the importance of managing debt, optimising asset allocation, and considering growth strategies to enhance performance. Furthermore, focusing on firm size and its potential impact can provide insights into improving performance outcomes. Vo (2017) assessed factors affecting firm performance of foreign direct investment (FDI) enterprises in the fishery sector in Vietnam from 2011 to 2015. The results of the data analysis show that firm performance of enterprises, which the ROA and ROS represent, is affected by the following factors: growth rates of assets; revenue scale; scale of total assets; and structure of fixed assets.

Pham et al. (2020) used correlation regression to evaluate the performance based on the influence of factors in the BSC model, including strategic planning, internal process, finance, mission, customer, and employee learning and growth. The results show that the performance of public hospitals in the research sample is influenced by the factors in the BSC model in descending order based on the regression coefficient as follows: internal process, finance, mission, strategic planning, customer, employee learning, and growth. Relating these findings to 3D printing SMEs in South Africa suggests that optimising asset growth, revenue scale, financial management, internal processes, and customer-centric strategies could enhance their performance.

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2.7.2 Economic or external factors of firm performance

This section presents literature on the economic or external factors of firm performance.

2.7.2.1 Exchange rate

The exchange rate volatility affects the cash flow, significantly impacting the company's profit (Mbithi, 2013). Furthermore, some studies (Sarchoghaei, Nagahi & Madhumathi, 2016) suggested that firm performance can be affected by the movements in exchange rate through the following ways: the cost of imported inputs relative to other factors of production, price of exports to foreign competitors, or the cost of external borrowing. The link between foreign exchange (FX) exposure and firm value is well predicted by theory; however, the relationship is relatively weak based on empirical evidence gathered from the studies in most of the developed countries, such as the U.S., Australia, Canada and Japan (Chan, Seow & Tam, 2002).

On the other hand, the scenario is different in developing countries. For example, the research conducted by Runo (2009), Diffu (2011) and Mbithi (2013) among Kenyan firms revealed that firm performance is positively and significantly affected by exchange rate fluctuations. For 3D printing SMEs in South Africa, exchange rate dynamics play a crucial role in shaping their financial performance and overall competitiveness. Fluctuations in exchange rates can impact the cost of imported materials, the pricing of exported products, and the affordability of external borrowing, thereby influencing their profitability and ability to compete in the global market. Managing exchange rate risks becomes vital for these SMEs to maintain financial stability and enhance their competitive position.

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2.7.2.2 Interest rate

In most economies, interest rates fluctuate less frequently than commodity prices and foreign exchange rates (Kwong, 2016). Nevertheless, the economy and businesses are exposed to interest rate risk since interest rates are volatile. Generally, interest rate volatility highly impacts a firm's incentive to raise capital or invest (Saunders & Cornett, 2008; Berk, DeMarzo & Harford, 2009). Kokemuller (2017) stated that volatile interest rates affect business as they directly affect borrowing and investment account earnings.

Most studies investigating the relationship between interest rates and firm performance have been conducted in developing countries. In Pakistan, the profitability of both the banking sector and textile firms are positively and significantly affected by interest rates, as evidenced by Khan and Sattar (2014) and Zulfiqar and Uddin (2015). However, a weak and statistically insignificant relationship exists between interest rate volatility and ROE for construction companies in Kenya (Eunice, 2013). The scenario is different for agricultural firms in Kenya, as interest rates positively and significantly influence profitability ratios (Odalo, Achoki & Njugna, 2016). For 3D printing SMEs in South Africa, interest rate dynamics can notably impact their financial performance and decision-making processes. Fluctuations in interest rates can affect borrowing costs, investment returns, and overall profitability. Interest rate volatility may influence the availability and affordability of capital for these SMEs. Studies conducted in developing countries have shown mixed results regarding the relationship between interest rates and firm performance. Therefore, it is essential for 3D printing SMEs in South Africa to carefully monitor and manage interest rate risks to optimise their financial performance and make informed investment decisions.

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2.7.2.3 Inflation rate

Inflation refers to the change, whether up or down, in the overall price levels of goods and services in an economy for a given period. The changes in prices of goods and services directly and significantly affect the purchasing power of money and the cost of production in the manufacture of the same goods and services. The effects of inflation can be seen from two angles; the effect on the aggregate demand and the cost of production. When the inflation rate is high, consumers with fixed incomes have a lower purchasing power as the value of money is reduced. This will ultimately lead to reduced demand for goods and services.

On the other hand, inflation pushes up the cost of production, affecting the firms' bottom line. The nominal interest rate is made up of the real interest rate and the inflation rate and therefore changes in line with changes in the inflation rate. This is referred to as the Fisher effect. Pandey (2009), on the other hand, suggests that if capital markets operating within countries were perfect, then even in different markets, investments with equal risk should ideally offer equal returns. Per the arbitrage principle, this proposes the development of assets starting with one market and then onto the next consistently until harmony is accomplished. According to the Fisher effect, if the actual return rates are similar in the two nations, the ostensible rates of intrigue will alter precisely for the adjustment in the expansion rates. Vong & Chan (2009) contend that exact confirmation of what lies amongst expansion and productivity is uncertain; therefore, it is necessary to investigate it.

For 3D printing SMEs in South Africa, inflation can significantly affect their operations and financial performance. High inflation rates can reduce the purchasing power of consumers, leading to lower demand for their goods and services. This can impact the SMEs' revenue and profitability. Additionally, inflation can increase the cost of production as the prices of raw materials and other inputs rise. This can put pressure

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on their profit margins. Moreover, inflation rates can influence interest rates, affecting the cost of borrowing and investment decisions. 3D printing SMEs in South Africa must monitor inflation trends and consider their impact on pricing strategies, cost management, and overall business planning.

2.8 MEASURING SME PERFORMANCE

Mustapha and Sorooshian (2019) emphasised the significance of performance measurement for small firms in assessing their success and guiding sustainable improvement. However, operationalising performance in entrepreneurship and small business research is challenging (Kirsten, Vermaak & Wolmarans, 2015). Studies have approached performance measurement from various perspectives, including financial and non-financial measures (Rodriguez-Gutierrez, Moreno & Tejada, 2015; Peter, Adegbuyi, Olokundun, Peter, Amaihian & Ibidunni, 2018).

Financial measures, such as profitability and growth, are commonly used indicators of small firms' performance (Donkor, Donkor, Kankam-Kwarteng & Aidoo, 2018; Bahta, Yun, Islam & Bikanyi, 2018). They align with the overall objectives of many firms, including small ones (Jain, Vyas & Chalasani, 2016). Non-financial measures, also known as operational measures, complement financial measures in assessing small firms' performance (Budiarto, Prabowo, Djajanto, Widodo & Herawan, 2018; Mjongwana & Kamala, 2018).

While financial measures are widely used and easy to employ, non-financial measures provide a broader perspective on performance (Popa, Soto-Acosta & Perez-Gonzalez, 2018). Combining financial and non-financial measures offers a more comprehensive understanding of SME performance, clarifying the relationship between different aspects of entrepreneurial performance (Primadonna & Emrizal, 2018). Studies should

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consider multiple dimensions of performance measurement, including financial and non-financial indicators, to obtain a more robust assessment of small firm performance (Bahta et al., 2021; Budiarto et al., 2018). This approach recognises the unique characteristics of small firms and the diverse objectives of individual entrepreneurs (Mjongwana & Kamala, 2018).

Therefore, for this study, firm performance among 3D printing firms comprises financial performance indicators (profitability growth) and non-financial performance indicators (growth in employee numbers and client base).

2.9 CHAPTER SUMMARY

This chapter presented a literature review on firm performance, the study's dependent variable. Based on the literature, the study concludes that within the confines of the 3D printing business environment, measuring firm performance will comprise financial performance indicators such as profitability growth and non-financial performance measures such as growth in the number of employees and the client base.

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CHAPTER 3: FINANCE SOURCES AND ITS MANAGEMENT

3.1 INTRODUCTION

This chapter presents literature on working capital management from the SME perspective. The chapter begins with definitions and contextualisation of working capital and working capital management in the 3D printing SME sector. Literature on the importance of working capital management, and types of working capital management practices, such as cash conversion cycle, accounts receivable period and accounts payable period, are presented. The chapter also elaborates and contextualises determinants of working capital management practices in the SME sector, such as firm size, sales growth, profitability, leverage, level of economic activities and nature of business/industry. Literature on the implications of working capital management for SMEs and challenges in applying working capital management practices are discussed.

Furthermore, this chapter presents literature on liquidity management in the SME context. The chapter constitute definitions of liquidity and liquidity management. The chapter discusses the importance of liquidity and liquidity management and practices, namely cash, debtors and current liability management. Root causes of liquidity problems in SMEs are discussed, namely nature and size of business, manufacturing cycle, business fluctuations, credit policy, operating efficiency and price level changes. The chapter also discusses the uniqueness of liquidity management in SMEs and the 3D printing industry. The chapter also discusses three liquidity ratio types: current, quick and cash ratios.

Finally, the chapter presents literature on sources of financing SMEs. The components of the literature comprise the following: defining financing, methods of financing, types

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of financing available, sources of financing, approaches to assessing sources of finance, factors influencing sources of financing decisions and obstacles facing SMEs when trying to secure financial support.

3.2 DEFINING WORKING CAPITAL

Working capital is the difference between current assets and current liabilities, representing the funds available to finance day-to-day operations and meet short-term obligations (El-Ansary & Al-Gazzar, 2021). Working capital also refers to the amount of current assets in excess of current liabilities, indicating the liquidity and operational efficiency of a firm (Filbech et al., 2017). Malm and Sah define working capital as the net investment in current assets, comprising cash, accounts receivable, and inventory, after deducting current liabilities. Parker (2016) also defines working capital as the measure of a company's short-term financial health, computed as the difference between current assets and current liabilities, providing insight into a firm's ability to cover short-term obligations. Working capital is defined as the capital required to fund a firm's day-to-day operations, encompassing current assets and current liabilities and highlighting the firm's liquidity position (Akindele & Odunsina, 2015).

Comparing these definitions, it is evident that they share common elements. All the definitions of working capital emphasise the importance of current assets and current liabilities in determining working capital. The definitions also highlight the role of working capital in financing day-to-day operations, meeting short-term obligations, and assessing the liquidity position of a firm.

Based on these definitions, the researcher defines working capital as the financial resources available to a company to sustain its daily operations and fulfil short-term financial obligations. Thus, working capital is calculated by subtracting current liabilities

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from current assets and indicates a firm's liquidity, operational efficiency, and ability to manage short-term financial needs.

3.3 DEFINING WORKING CAPITAL MANAGEMENT

Working capital management involves managing the firm's current assets and current liabilities to ensure the company maintains sufficient liquidity while maximising profitability (Aktas et al., 2015). Pais and Gama (2015) define working capital management as the administration of current assets, current liabilities, and their interrelationships with the goal of maintaining a balance between liquidity and profitability. Furthermore, Alvarez et al. (2021) define working capital management as the planning, coordination, and control of a firm's current assets and liabilities to optimise its liquidity position and enhance overall financial performance. In addition, Dhole et al. (2019) define working capital management as the firm's investment in current assets and financing of current liabilities to achieve a balance between profitability and liquidity. Working capital management also refers to the strategic management of a firm's current assets and liabilities to maintain an appropriate level of liquidity and support operational efficiency, profitability, and shareholder value (Ujah et al., 2021).

All the definitions emphasise the importance of effectively managing the interplay between current assets and current liabilities to balance liquidity and profitability. The definitions also highlight the need to optimise working capital to enhance overall financial performance and support operational efficiency.

The researcher defines working capital management as the strategic planning, coordination, and control of a company's current assets and liabilities to maintain an optimal balance between liquidity and profitability. Working capital management also

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focuses on efficiently managing the firm's investment in current assets and financing current liabilities to ensure sufficient working capital for day-to-day operations while maximising the value for shareholders.

3.4 IMPORTANCE OF WORKING CAPITAL MANAGEMENT

The effective management of working capital among firms in the SME sector is essential to firm profitability, risk management and value enhancement by setting the capital ratio to its optimal level (Chalmers, Sensini & Shan, 2020). Through effective working capital management, the maximisation of shareholder wealth can be accomplished by reducing investments in short-term liabilities and carefully controlling short-term obligations (Afrifa & Tingbani, 2018). This has implications for the 3D printing industry in South Africa in the sense that proper control of short-term liabilities and debt could intensify shareholder's wealth and hence open doors for more investments in the 3D printing SME sector.

Managing working capital effectively not only helps firms withstand the effects of economic turbulence but also plays a crucial role in firms during periods of economic boom (Gorondutese, Ali, Abubakar & Naalah, 2017). A vital part of any company's survival and long-term success is its ability to communicate effectively with its stakeholders (Gorondutse et al., 2017). According to Singh and Kumar (2017), working capital management is critical for the following reasons: First, working capital is a larger percentage of a company's total assets than other assets. Additionally, working capital management directly affects the long-term growth and survival of the firm and directly impacts liquidity and profitability (Singh & Kumar, 2017).

When working capital management practices are adequate, companies can maintain steady growth (Tran, Abbott & Yap, 2017). Working capital management is critical to a

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company's long-term viability and avoidance of financial distress (Abimbola & Kolawole, 2017). As a result, a company's working capital can be mismanaged, resulting in the loss of many profitable investment opportunities (Abimbola & Kolawole, 2017). On the other hand, the availability of more current assets can lead to management making irresponsible decisions. Managers, for example, may purchase luxury assets for themselves or the company if they have the funds (Singh, Kumar & Colombage, 2017). On top of all that, management may be complacent about their own performance and, as a result, fail to make critical investment decisions (Singh et al., 2017).

From the literature, the study argues that working capital management is relevant to the South African 3D printing SME sector because it can potentially enhance the long-term financial sustainability of 3D printing firms. In this regard, the financial sustainability of 3D printing firms in South Africa could pave the way for future investments, which could intensify the growth and expansion rate of the 3D printing industry in South Africa as a whole.

3.5 TYPES OF WORKING CAPITAL MANAGEMENT PRACTICES

This section discusses the types of working capital management practices such as cash conversion cycle, accounts receivable period and accounts payable period.

3.5.1 Cash conversion cycle

The Cash Convention Cycle (CCC) is one of the key practices of working capital management (Zeidan & Shapir, 2017). CCC is the time that elapses between when money leaves a business and when money is received. In this way, it measures how quickly current assets are converted into cash (Zeidan & Shapir, 2017). Chang (2017)

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states that the length of time funds are held in working capital is referred to as the "cash conversion cycle". This also measures how long it takes to collect and remit money (Wang, 2019). It is calculated by subtracting the payables conversion period (PCP) from the estimated inventory conversion period (ICP) (Boisjolyu, Conine Jr & McDonald, 2020). To improve a company's profitability and market value, efficient cash management practices reduce the time cash is held in the cash conversion cycle (Kasozi, 2017; Khalid, Saif, Gondal & Sarfraz, 2018).

However, within the 3D printing industry context, the cash conversion cycle must be short to ensure firm profitability. In this regard, 3D printing SMEs must put in place the right policies that ensure that the conversion of liabilities into assets is achieved in real-time, which is relevant for firm profitability. In this regard, SMEs that can achieve shorter cash conversion cycle periods will achieve the benefits of firm productivity and profitability. On the other hand, 3D printing firms that do not have the right policies that enhance shorter cash conversion cycles are most likely to suffer from increased liabilities and debt stock, which has detrimental effects on firm profitability, growth and financial sustainability.

3.5.2 Accounts receivable period

SMEs prefer to sell their products on a cash basis if they have the option. Trade policies, prevailing market conditions, and other factors necessitate businesses to sell their products on credit (Jikia & Kharabadze, 2018). Businesses may intentionally extend credit to boost sales in certain situations. Therefore, the accounts receivable period is the time frame between the outstanding debt owed and when the company can recover the debt from its debtors (Meilani & Pandoyo. 2019). Management of the costs associated with the accounts receivable period, such as interest payments and bad debt losses, must be done effectively and adequately (Meilani & Pandoyo, 2019).

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A management policy for accounts receivables should ensure that the benefits accruing from receivables outweigh the costs incurred by receivables, increasing profit (Ndeburi & Tweneboah, 2017). The proper management of the accounts receivable period greatly benefits from effective control. Numerous variables affect the amount of working capital a small business requires, and these should all be considered when preparing a sales and investment forecast (Yang, 2020).

To ensure that the average credit offered to customers does not exceed the budgeted period, a business should attempt to track credit days regularly; otherwise, the need to invest in working capital would rise, putting pressure on business operations and negatively impacting growth (Nwude & Agbo, 2018). Businesses generate extended accounts receivable periods by offering their customers a longer period to make payments on credit sales (Daryanto & Rachmanto, 2017). Extended accounts receivable periods increase the risk of bad debts and the cost of managing accounts receivable (Nguyen, 2021). Consequently, management must create mechanisms to monitor and control the sale of credit policies. It is the goal of the control process to detect policy deviations and provide signals of expectations that are out of line (Nguyen, 2021).

For 3D printing firms in the SME sector to achieve effective working capital management, accounts payable periods must be short to ensure that short-term debts are correctly managed. In this regard, 3D printing firms in the SME sector that lack the proper management policies to ensure shorter accounts payable periods could suffer from improper short-term debt management that could affect their sales growth and eventually have negative implications on firm profitability.

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3.5.3 Accounts payable period

The accounts payable period is concerned with the time frame it takes for firms to pay debts owed to suppliers for goods and services (Chowdhury, Alam, Sultana & Hamid, 2018). An individual business should take responsibility for their accounts payable periods to build trust and healthy relationships with suppliers (Chowdhury et al., 2018). It is argued that when the time frame for settling accounts payable is too short, firms tend to lose money because their working capital is reduced, which could affect their profitability (Akomeah & Frimpong, 2019). Thus, firms should be able to settle their accounts payable in a time frame that is not too short or too long. This is because when accounts payable periods are too long, it could lead to poor debt management, and interests could accrue on the debt, negatively affecting the firm's working capital (Nwude, Allison & Nwude, 2021).

In dealing with accounts payable periods, firms can evaluate the quality of the product before paying the supplier. Firms could use accounts payable to suppliers to fund their operations more cost-effectively and flexibly, sometimes prolonging the accounts payable period (Nwude et al., 2021). However, paying late could be costly when the supplier offers discounts for early payment. It has long been assumed that companies with a higher profit margin fulfil their accounts payable obligations faster than those with a lower profit margin. The assumption is that if firms pay their suppliers on time, they are most likely to see a boost in profits because of the substantial discounts that suppliers offer for prompt payment (Pakdel & Ashrafi, 2019).

Accounts payable management deals with how businesses can stretch accounts payable without jeopardising their credit status with suppliers. Extending accounts payable is done to lower the working capital required to finance the purchase of current assets (Ng, Chen, San-Ong & Teh, 2017). For creditors to accept this practice, businesses must follow the rules set by the suppliers. The decision to extend accounts

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payable is based on ethical, legal, and economic considerations (Sharif & Islam, 2018). Management must first quantify the costs involved to determine how much time accounts payable can be stretched. Cash outflows must be carefully managed if delaying payments is not an option due to the risk of damaging the firm's future, reputation, and credit standing (Sharif & Islam, 2018).

There are a variety of approaches that can be used to manage accounts payable. Notable among such approaches comprise using purchasing cards, setting up disbursement systems, scheduling accounts payable, ageing accounts payable, forecasting accounts payable, budgeting, monitoring accounts payable-to-purchases ratio, evaluating the number of days' purchases outstanding in payables, monitoring the ageing schedule, analysing payment patterns and variances, and sequential approach and integer-programming approaches (Ng et al., 2017).

The accounts receivable period has implications for the 3D printing SME sector in South Africa. A key implication is that they can take advantage of discount promotions and make early payments to suppliers to help reduce purchasing costs, which could help them save money. However, without discount promotions, payment arrangements could be with their suppliers, ensuring a prolonged period for accounts payable without jeopardising the relationships between firms and their suppliers. In this regard, it is crucial for 3D printing SMEs to strategically decide on their accounts payable periods to ensure that their working capital is well managed to reduce costs to the bare minimum.

3.6 DETERMINANTS OF WORKING CAPITAL MANAGEMENT IN SMEs

This section presents literature on the determinants of working capital management practices in the SME sector. The following determinants were identified in the literature:

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firm size, growth in sales, profitability, leverage, level of economic activities and nature of business.

3.6.1 Firm size

The literature suggests that there is no clear correlation between a company's size and its working capital needs. However, studies indicate that large companies are more likely to invest in working capital than smaller companies due to their enormous operational requirements daily (Fatimatuzzahra & Kusumastuti, 2016; Lyngstadaas & Berg, 2016; Onaolapo & Kajola, 2015). The operational needs of large companies, including production volumes, supply chain complexity, and customer demands, often require a significant investment in working capital. These companies may have a larger pool of suppliers and enjoy more favourable terms, allowing them to hold their creditors longer. This extended payment period reduces their immediate cash outflows and, consequently, their working capital needs (Mongrut et al., 2014).

On the other hand, smaller companies, with their relatively smaller operational needs, may require less working capital (Afrifa, 2016). They may have lower production volumes, a simpler supply chain structure, and a smaller customer base. As a result, their working capital requirements tend to be lower than larger companies (Afrifa & Padachi, 2016). It is important to note that while larger companies may have the advantage of holding creditors for longer periods, they also face challenges in managing their working capital effectively (Jana, 2018). They need to strike a balance between maintaining a sufficient level of liquidity and maximising their profitability. Inefficient working capital management can lead to increased costs, reduced profitability, and potential cash flow issues (Jana, 2018).

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In the context of 3D printing SMEs in South Africa, the relationship between company size and working capital needs is not straightforward. While larger 3D printing firms are more likely to invest in working capital due to their significant operational requirements, smaller SMEs may have relatively lower working capital needs. Factors such as production volumes, supply chain complexity, customer base, and supplier payment terms influence the working capital requirements. However, regardless of company size, the 3D printing industry's evolving nature and the need for research, development, and technology investments can impact working capital needs. Other factors, such as supply chain efficiency, inventory turnover, and financial processes, also play a role in determining working capital requirements.

3.6.2 Sales growth

Sales growth is crucial in determining a company's working capital requirements. The literature suggests that there is a positive correlation between sales growth and working capital needs (Kwenda & Holden, 2014). As companies experience sales growth, they often need to invest in working capital to support increased production and meet the growing demand. Businesses that anticipate sales growth and have the financial capacity to make working capital available are perceived as being able to invest in long-term opportunities (Kwenda & Holden, 2014). This implies that companies willing to allocate sufficient working capital are better positioned to seize growth opportunities and drive long-term success.

Furthermore, the relationship between sales growth and working capital is bidirectional. Higher customer inventory commitments and favourable long-term credit policies can increase sales (Afrifa, Tpiromgana & Tingbani, 2016). In other words, companies that consciously focus on sales growth are likely to increase their inventory and other current assets to meet customer demands and support their expansion efforts (Afrifa

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et al., 2016). It is worth noting that the relationship between sales growth and working capital is influenced by various factors, such as industry dynamics, market conditions, and the efficiency of a company's supply chain. Different industries may have different working capital requirements based on their specific characteristics and customer demands (Singh & Kumar, 2017).

For 3D printing SMEs in South Africa, sales growth directly impacts their working capital requirements. As sales volume increases, these SMEs must allocate more working capital to meet rising demand and support production expansion. The ability to invest in working capital is crucial for long-term growth and seizing market opportunities. However, effective working capital management is necessary to avoid excess tied-up capital. The unique dynamics of the 3D printing industry in South Africa, including competition, technology advancements, and customer preferences, should be considered when determining the appropriate level of working capital to support sales growth and ensure financial sustainability.

3.6.3 Profitability

High-profit firms often have the financial resources and flexibility to invest in long-term projects, which can positively impact their working capital management. Research by Abbadi and Abbadi (2012) suggests that companies with higher profitability tend to pay more attention to their working capital management, leading to higher current assets. The positive correlation between profit and working capital is supported by empirical evidence. Studies by Lyngstadaas and Berg (2016) and Onoalapo and Kajola (2015) also highlight the relationship between profit and working capital, indicating that companies that generate higher profits are more likely to focus more on managing their working capital effectively.

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When firms generate higher profits, they can allocate funds toward working capital requirements such as inventory, accounts receivable, and cash management (Tran et al., 2017). This allows them to maintain sufficient current assets to support operations, meet customer demands, and take advantage of growth opportunities (Chalmers et al., 2020). Furthermore, high-profit firms may adopt proactive working capital management strategies to optimise cash flow, reduce financing costs, and improve overall financial performance (Alvarez et al., 2021). They may negotiate favourable payment terms with suppliers, implement efficient inventory management systems, and closely monitor accounts receivable to ensure timely collection (Sensini, 2020).

In the context of 3D printing SMEs in South Africa, profitable firms have the potential to prioritise and enhance their working capital management. High-profit 3D printing SMEs are more likely to allocate resources towards working capital requirements, such as inventory and accounts receivable. This enables them to meet operational needs, satisfy customer demands, and seize growth opportunities. Efficient working capital management strategies, which include negotiating favourable payment terms and implementing effective cash flow practices, contribute to improved financial performance. However, it is vital to consider the industry-specific dynamics and market conditions that impact the working capital requirements and profitability of 3D printing SMEs in South Africa.

3.6.4 Leverage

The level of leverage a company carries impacts its working capital requirements (Tsuruta, 2015). Leveraged firms with higher debt levels tend to exercise caution in managing their working capital to mitigate financial risks. As a result, they strive to minimise their investment in current assets (Tsuruta, 2017). Leveraged firms adopt a conservative approach to working capital management to meet debt obligations and

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maintain financial stability (Tsuruta, 2017). They aim to balance the trade-off between maximising profitability and minimising the risk associated with high debt levels (Arnaldi et al., 2021). By keeping their investment in current assets low, leveraged firms can allocate funds towards debt repayment and reduce their reliance on external financing (Arnaldi et al., 2021).

The negative correlation between working capital and leverage has been supported by various studies (Abbadi & Abbadi, 2012; Akinlo, 2012; Onaolapo & Kajola, 2015) have found empirical evidence highlighting this relationship. These studies suggest that firms with higher leverage tend to have lower levels of working capital investment.

Leveraged firms employ strategies such as tight inventory control, efficient cash flow management, and stringent credit policies to optimise their working capital (Alvarez et al., 2021). They may implement just-in-time inventory systems, negotiate favourable payment terms with suppliers, and closely monitor receivables to improve cash flow and reduce the need for excessive working capital (Alvarez et al., 2021). However, it is essential to strike a balance in working capital management, as very low investment in current assets may lead to operational inefficiencies, inadequate inventory levels, and potential missed sales opportunities (Mahmood et al., 2019). It is crucial for leveraged firms to carefully assess their specific business requirements, market conditions, and industry norms to determine the optimal level of working capital that balances risk and profitability (Mahmood et al., 2019).

In the context of 3D printing SMEs in South Africa, the relationship between leverage and working capital management is significant. Leveraged 3D printing SMEs with higher debt levels tend to be cautious in their approach to working capital management. They strive to minimise their investment in current assets to meet debt obligations and reduce reliance on external financing. By implementing efficient inventory control, cash

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flow management, and credit policies, leveraged 3D printing SMEs aim to optimise working capital. However, these SMEs must strike a balance, ensuring they maintain adequate working capital to support operational needs, meet customer demands, and seize growth opportunities while managing their leverage effectively.

3.6.5 Level of economic activities

The activities of the economy in which a company operates play a significant role in shaping its working capital needs. Businesses are inherently interconnected with the broader economic environment, and the state of the economy directly influences their operations (Aktas et al., 2015). The state of the economy impacts working capital requirements in several ways. During economic booms, when overall business activity and consumer spending are high, firms may experience increased sales and demand for their products or services (Aktas et al., 2015). To meet this heightened demand, companies may need to invest more in inventory and accounts receivable to ensure sufficient stock and meet customer orders promptly. This increases the need for working capital during boom times (Brigham & Houston, 2021).

Conversely, during economic downturns or recessions, when consumer spending and business activity decline, firms may face reduced sales and cash flow challenges. As a result, they may tighten their working capital management and reduce investment in current assets to conserve liquidity (Goncalves et al., 2018). Companies may adopt measures such as inventory rationalisation, more stringent credit policies, and cost control to navigate the challenging economic environment and maintain financial stability (Oseifuah, 2018). The availability of credit and financing options also fluctuates with the economic conditions. In times of economic expansion, access to credit may be easier, allowing firms to secure working capital financing for their operations (Singhania & Mehta, 2017).

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Moreover, credit availability may tighten during economic downturns, making it more challenging for companies to access external funding for their working capital needs (Singhania & Mehta, 2017). It is crucial for businesses to closely monitor the economic conditions and adjust their working capital strategies accordingly (Wang et al., 2020). This involves understanding the business cycle, market trends, and consumer behaviour to anticipate changes in working capital requirements (Wang et al., 2020). By aligning their working capital management with the economic environment, companies can ensure sufficient liquidity, optimise operational efficiency, and adapt to the dynamic nature of the economy (Botoc & Anton, 2017).

The state of the economy significantly impacts the working capital requirements of 3D printing SMEs in South Africa. During economic booms, SMEs may increase working capital to meet growing demand, while in downturns, they adopt cautious strategies to preserve liquidity. Access to financing also fluctuates, posing challenges or opportunities for SMEs. Aligning working capital management with the economic environment allows them to optimise liquidity, adapt to market dynamics, and position for growth and stability.

3.6.6 Nature of business (industry)

The nature of a company's business activities plays a significant role in determining its working capital requirements (Ahmedova, 2015). Different types of businesses have varying working capital needs based on their operational characteristics and industry dynamics (Ahmedova, 2015). In manufacturing, firms typically require substantial investments in fixed and current assets. Manufacturing companies have production cycles where raw materials are transformed into finished goods (Panda & Nanda, 2018). These cycles involve multiple stages and may take a significant amount of time. As a result, manufacturing firms have a greater need for working capital to finance raw

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materials, labour costs, and other expenses during the production process. The longer the production cycle, the larger the working capital requirements (Adam et al., 2017).

On the other hand, trading companies, such as retailers, focus on buying and selling goods. These companies must maintain adequate cash, inventory, and accounts receivable levels to effectively conduct their business (Jama et al., 2018). Cash is essential for day-to-day operations; inventory ensures product availability and accounts receivable represents sales made on credit (Jama et al., 2018). Trading companies aim to balance their cash flow, inventory turnover, and credit policies to optimise their working capital and support their sales activities. In contrast, utility companies, such as electricity or water providers, have different working capital requirements (Mun & Jang, 2015). Their business models often involve cash sales or services where customers pay immediately. Utility companies typically do not have significant investments in stocks or accounts receivable, as their revenue is primarily generated through the provision of services. Consequently, their working capital needs are relatively lower compared to manufacturing or trading firms (Boisjoly et al., 2020).

Understanding a company's specific industry's unique characteristics and operational processes is crucial in assessing its working capital requirements (Boisjoly et al., 2020). Manufacturing firms with longer production cycles require more working capital, while trading companies emphasise effective management of cash, inventory, and accounts receivable (Adam et al., 2017). Utility companies have comparatively lower working capital needs due to their specific business model. By aligning their working capital management strategies with their business activities, companies can optimise their financial resources and ensure smooth operations within their respective industries (Adam et al., 2017).

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For 3D printing SMEs in South Africa, the manufacturing nature of their business influences their working capital requirements. Longer production cycles necessitate significant working capital for raw materials, labour costs, and equipment maintenance. Efficient inventory management is crucial to balance customer demands and optimise working capital. Cash flow management is also essential, considering challenges related to payment terms and cash conversion cycles. Effective working capital management strategies help support growth, meet customer demands, and ensure financial stability. Analysing production cycles, inventory levels, and cash flow patterns allows SMEs to balance liquidity and operational needs, fostering success in the dynamic 3D printing industry.

3.7 IMPLICATIONS OF WORKING CAPITAL MANAGEMENT FOR SMEs

According to Aregbeyen (2013), the importance of working capital management can be attributed to the fact that it is a significant component of the firm's assets and significantly impacts the profitability of their businesses (Sharma & Kumar, 2011). Working capital management in SMEs affects corporate risk and the ultimate goal of increasing shareholder wealth (Bhatia & Srivastava, 2016; Enqvist et al., 2014). Business organisations are constantly striving to improve their bottom line. As a result, the firm's day-to-day commitments must be financed with adequate liquidity. When it comes to finance managers, they must balance the competing objectives of ensuring sufficient liquidity and increasing profitability (Akinlo, 2012). For example, a company's goal of maximising profits may lead to a lack of liquidity, leading to bankruptcy. Thus, a well-executed working capital management (WCM) strategy is critical to balance the profitability-liquidity trade-off and avoid the risk of corporate bankruptcy (Baños-Caballero et al., 2014).

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Other studies have suggested that the firm's long-term financial decisions, such as capital expansion projects, are also influenced by the firm's WCM decisions. Using the day-to-day mix of short-term assets and liabilities, working capital management in SMEs helps evaluate the firm's short-term financial health (Adam et al., 2017). Short-term assets, such as inventory, receivables, and cash, or short-term obligations, such as accounts payable, must be held by SMEs at any given time to maximise returns.

Strategically, the management of SMEs may prefer to hold fewer short-term assets or large amounts of short-term liabilities. A more liberal approach to working capital management might be taken instead, with a large amount of investment held on hand (Altaf & Shah, 2018; Ukaegbu, 2014). Accordingly, managers adept at selecting an appropriate working capital level tend to create value for the company regardless of policy choice (Gorondutse et al., 2017; Ukaegbu, 2014).

SME firms across various setups have provided mixed results on the relationship between working capital management and profitability, with a similar proportion of positive and negative results between studies. According to Konak and Güner (2016), working capital management negatively impacted the profitability of Istanbul-based SMEs. Working capital management was found to be negatively associated with SME performance in Pakistan (Gul et al., 2013).

On the contrary, SMEs in Norway have a positive relationship with working capital management, according to Lyngstadaas and Berg (2016). Pais and Gama (2015) and Tran et al. (2017), who conducted a similar study in Portugal and Vietnam, found similar findings. Working capital management has positively impacted small business profitability in other studies. For example, a study by Mohamad and Saad (2010) examined the relationship between working capital management and stock

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performance in Malaysia. Based on Tobin Q, ROI, and ROA, they found that the current assets to total asset ratio had a positive effect on the firm's performance.

Conversion cycle, accounts receivables, inventory period, and listed firm performance in Nigeria from 1999 to 2007 were found to be linked positively by Akinlo (2012). In contrast, profitability and accounts payable have a negative relationship. In Pakistan, Afeef (2011) found a negative correlation between working capital management and the performance of SMEs. There was a negative correlation between operating profit and the time it takes to convert inventory and collect accounts receivable. The number of accounts payable days (APP) positively correlates with profitability. In contrast, the average collection period (ACP), cash conversion cycle (CCC), inventory turnover and debt ratio (DR) have a negative relationship with profitability in Pakistani SMEs (Afeef, 2011). There is a correlation between the number of days' accounts payable and the ROA of Ethiopian SMEs in a study conducted by Dinku (2013). ROA is negatively impacted by the length of the cash conversion cycle, the number of days' inventory, and the days' accounts receivable. There is a direct correlation between an increase in the number of days' accounts payable, an increase in the number of days' receivable, and a decrease in the ROA level (Afeef, 2011).

Working capital management is crucial for the financial health and profitability of 3D printing SMEs in South Africa. Balancing liquidity and profitability is essential for their long-term success. Managing short-term assets and liabilities is critical to evaluating their financial health, impacting day-to-day operations and returns. Striking the right balance in working capital levels is crucial, ensuring sufficient liquidity without excessive risk. Optimising working capital practices, such as managing conversion cycles, accounts receivable, and inventory periods, can impact profitability. Understanding the dynamics of the 3D printing industry in South Africa, including market conditions and customer payment patterns, helps SMEs make informed

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decisions regarding working capital. Strategic working capital management is vital for the profitability and sustainability of 3D printing SMEs in South Africa.

3.8 CHALLENGES OF SMEs IN WORKING CAPITAL MANAGEMENT

SMEs have a higher failure rate than larger corporations. This has partly been attributed to SMEs' poor working capital management (Agyei-Mensah, 2010). SMEs often lack the resources to manage their trade debtors effectively. According to Agyei-Mensah (2010), the absence of a credit control department is not uncommon in small businesses. A common consequence is a lack of expertise and information to make sound decisions about sales terms.

Debt collection procedures, such as timely invoicing and sending out regular statements, are also lacking in small businesses. Late payment and defaulting debtors are more likely as a result of this. Risks are likely to rise in an environment focused solely on growth. SMEs may be willing to extend credit to customers with poor credit ratings to boost sales. Businesses of all sizes are susceptible to this issue, but SMEs appear particularly vulnerable (Akoto, Awunyo-vitor & Angmor, 2013). Akoto et al. (2013) further claim that SMEs face another problem regarding working capital management: a lack of market power. As a result, SMEs are often in a disadvantageous position when negotiating credit terms with larger companies. The smaller supplier may fear losing future business if it presses a significant customer for payment when the latter exceeds the credit limit. SMEs owe more money than large corporations. According to Akoto et al. (2013), inefficient and ineffective inventory management is frequently caused by SMEs' lack of financial management expertise. It is not always clear to small business owners and managers that stocking too much or too little can have a financial impact. There must be accurate sales forecasts, or

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budgets, available for stock ordering purposes for a stock management system to be effective.

Regarding establishing sound working capital management systems in SMEs, Agyei-Mensah (2010) found several obstacles to overcome, including a lack of qualified internal accounting staff, inadequate training, and a lack of value from actively engaged accounting staff. Other challenges SMEs encounter include long supply-chain lead times, inaccurate sales, inventory, and operations planning; delinquent receivables; inability to transfer transaction data to business analytics; ageing or obsolete inventory; rapid payables; and a lack of visibility. They often cannot manage their receivables due to lack of resources. As a result of this lack of credit control expertise and information, most SMEs worldwide cannot accurately assess the terms of sales and other aspects of their business (Agyei-Mensah, 2010).

According to Bart (2016), one of the difficulties SMEs face is poor credit management or diligence. Since they lack proper debt procedures, they encounter challenges in working capital management. When it comes to prompt invoicing and sending out regular statements to their credit customers, they often fall short, increasing their chances of receiving late payments and eventually defaulting on their debts (Bart, 2016). SMEs are more than willing to extend credit to customers with poor credit risk in an effort to boost sales and help the company grow. Growth-hungry SMEs are particularly vulnerable to this risk, which can occur in any business. One of the most challenging aspects of running a small business's working capital is dealing with bad contracts (McGuinness & Hogan, 2016).

Deloof and La Rocca (2015) clarified that this problem has a dual nature in terms of contracts with suppliers and customers that are unfavourable to SMEs. When negotiating credit terms with their customers, SMEs often find themselves

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disadvantaged. A small-scale business may be reluctant to pursue payment from a large customer who has defaulted on a credit agreement to avoid losing future business from that customer. SMEs have more overdue debts than large corporations (Deloof & La Rocca, 2015).

According to Prasanna et al. (2019), SMEs face intense competition from large corporations. The lack of a solid financial foundation in many small businesses shifts the power struggle between competitors to the larger businesses, just like those unfavourable contractual agreements do for SMEs. As a result, these companies gain an unfair advantage in various areas, including production, marketing, and general operations (Prasanna et al., 2019).

Effective working capital management is crucial for the success of 3D printing SMEs in South Africa. Limited resources and expertise in managing trade debtors can result in late payments and defaulting debtors, impacting cash flow. SMEs may struggle with implementing credit control procedures and collecting outstanding debts, emphasising the need for efficient credit management. The lack of market power when negotiating credit terms with larger companies disadvantages SMEs. Inefficient inventory management due to a lack of financial expertise can tie up funds or lead to stockouts. Investing in qualified internal accounting staff, training, and value from accounting functions is vital for establishing robust working capital management systems. Intense competition from larger corporations' further challenges SMEs. Addressing these challenges through proactive financial management, including credit control, inventory optimisation, and investment in financial expertise, can enhance cash flow and competitiveness for 3D printing SMEs in South Africa.

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3.9 LIQUIDITY MANAGEMENT IN THE SME CONTEXT

This section presents literature on liquidity management in the SME context. The chapter begins with definitions of liquidity and liquidity management. The section also discusses the importance of liquidity and liquidity management and practices, namely cash, debtors and current liability management. Root causes of liquidity problems in SMEs are discussed, namely nature and size of business, manufacturing cycle, business fluctuations, credit policy, operating efficiency and price level changes. The section also discusses the uniqueness of liquidity management in SMEs and the 3D printing industry. The final section discusses three liquidity ratio types: current, quick and cash ratios.

3.9.1 Defining liquidity

Bonner et al. (2015) define liquidity as the ease with which an asset or security can be bought or sold in the market without causing a significant change in its price. De Young and Jang (2016) also define liquidity as the ability of a financial market to absorb large trades without causing excessive price movements or affecting market efficiency. Moreover, Chen et al. (2018) define liquidity as the ease with which assets or financial instruments can be converted into cash quickly, with minimal transaction costs, and without significant price impact. Le and Gregoriou (2020) also define liquidity as the degree to which an asset or security can be quickly bought or sold at a price reflecting its intrinsic value.

It could be deduced from the definitions that all of them emphasise the ease of buying or selling assets or securities. The authors also highlight the importance of minimal transaction costs and the ability to convert assets into cash quickly. Additionally, there

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is a shared recognition that liquidity relates to the impact on prices, whether avoiding significant price changes or ensuring prices reflect intrinsic value.

Based on these definitions, the researcher defines liquidity as the ease with which an asset or security can be bought or sold in the market, allowing for quick conversion into cash with minimal transaction costs while avoiding significant price impact and ensuring prices reflect the asset's intrinsic value.

3.9.2 Defining liquidity management

Bassey et al. (2016) define liquidity management as the process of ensuring that a firm has sufficient cash and liquid assets to meet its short-term obligations while maintaining an appropriate level of liquidity risk. As Akinwumi et al. (2017) defined, liquidity management involves monitoring and controlling a firm's cash flows, working capital, and the availability of liquid assets to ensure the company can effectively meet its financial obligations. According to Jiang et al. (2021), liquidity management is the process by which an organisation plans, monitors, and controls its cash flows, funding sources, and liquid assets to ensure the availability of funds when needed. Liquidity management also refers to the strategies and practices employed by financial institutions to ensure the availability of sufficient liquid assets to meet funding needs, manage risks, and maintain stability (Bianchi & Bigio, 2022).

There are similarities in the definitions of liquidity management provided by the researchers. First, all definitions emphasise the importance of monitoring and controlling cash flows and liquid assets. Secondly, all the definitions highlight the need to ensure sufficient liquidity to meet financial obligations. Additionally, the definitions recognise liquidity management as an ongoing process rather than a one-time activity. All the definitions also acknowledge the role of liquidity management in managing risks

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and maintaining stability. Based on these definitions, the researcher defines liquidity management as the ongoing process by which organisations monitor, control, and plan their cash flows, working capital, and liquid assets to ensure the availability of funds when needed while effectively managing liquidity risk, meeting financial obligations, and maintaining stability.

3.9.3 Importance of liquidity and liquidity management

The ability of a company to meet its current liabilities is commonly referred to as liquidity, and it is typically measured using various financial ratios such as current, quick, and cash ratios (Bianchi & Bigio, 2022). For a business to be successful and profitable, liquidity management is one of the key decision areas in financial management that must be carefully handled and planned (Edem, Cukwu & Ekpe, 2022). It is impossible to overstate how crucial liquidity management is to a company's financial performance (Obim, Takon & Mgbado, 2020). The most important aspect of capital management is to ensure that it runs smoothly and fulfils its obligations by maintaining its liquidity on a day-to-day basis (Obim et al., 2020). The short-term demands of a company necessitate that it does not suffer from a lack of or excess liquidity. As a vital component of a company's day-to-day operations, liquidity is an area that both internal and external analysts should focus on (Jiang, Li & Wang, 2021).

The survival of a company is dependent on its ability to access capital. No business can survive if it cannot raise funds (Jiang et al., 2021). Over a period of time, companies that do not make a profit may be considered under par, but if they lack liquidity, they may not be able to continue operating (Feng, Lu & Wang, 2020). According to Ejike and Agha (2018), liquidity management in an organisation is essential for mitigating risks that could be associated with the improper management of current assets and liabilities. Liquidity management in firms is essential for making an organisation solvent

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enough to stay in operation and also make profits (Jiang et al., 2021). Effective liquidity management in organisations ensures that businesses have enough cash to carry out their day-to-day operations and take advantage of opportunities in the business environment. Effective liquidity management can potentially enhance a firm's profitability and competitive advantage (Batten & Vo, 2019).

Within the context of the 3D printing SMEs in South Africa, liquidity and liquidity management are essential in ensuring efficient financial management. 3D printing SMEs must always have optimum liquidity levels to have the funds to run their daily operational activities to enhance firm efficiency and profitability. Ensuring efficient current assets and liabilities management is crucial to optimise liquidity management.

3.10 LIQUIDITY MANAGEMENT PRACTICES

In this section, the study presents literature on liquidity management practices, including cash, debtors and current liabilities management.

3.10.1 Cash management

Luo and Tian (2022) defined cash management as the process of minimising the amount of cash that a company must hold for use in conducting its normal business activities while at the same time maintaining sufficient cash to take advantage of trade discounts, maintain a credit rating, and meet unexpected cash needs. Cash and other cash equivalents appear in the asset section of a company's balance sheet as the most readily available financial resources (Schroeder & Kacem, 2019). Those assets that can be easily converted into cash are known as cash equivalents. Money market holdings, short-term government bonds or treasury bills, marketable securities, and commercial papers are examples of cash equivalents (Nso, 2018). It's easy to see the

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difference between short-term investments, like short-term bonds, and more long-term investments, such as stocks and mutual funds, because cash and cash equivalents mature mostly in three months (Faque, 2021).

Another essential requirement for a cash equivalent is that the investment has a low risk of value fluctuation. However, preferred stock purchased shortly before its redemption date can be considered a cash equivalent (Faque, 2021). The company can pay its day-to-day expenses and reduce the costs associated with cash holding because the cash balance is monitored (Hamid, Naveed, Hamid & Rao, 2020). One part of an effective cash management strategy is investing unused funds in marketable short-term securities that guarantee capital preservation and a positive rate of return (Hamid et al., 2020). Cash management is an essential part of effective liquidity management. Risk and return must be balanced when it comes to cash management (Hamid et al., 2021). Controlling cash inflows and outflows is also vital in effective cash management. It is necessary to coordinate cash flows, speed up collections, get available funds to the locations where they are required, and regulate disbursements (Bajalan & MotaghianPour, 2021).

The study argues that cash management is one of the vital liquidity management practices that 3D printing SMEs must use as a strategic element for effective financial management. It remains pertinent for 3D printing SMEs to strategically ensure that as they make profits, they emphasise making short-term investments and securities to guarantee capital preservation. This can be re-converted to cash with more profits and enhance their profitability levels. Thus, by cash management, 3D printing firms can take advantage of short-term securities and investments in the South African financial markets and intensify their profits while at the same time keeping enough liquidity for daily operational management.

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3.10.2 Debtors management

The term "debtor" refers to an entity that owes money to another entity. An individual, a business, a government, or some other type of legal entity could be the subject of the inquiry (Richard & Kabala, 2020). Companies and other entities with outstanding debts to the company are referred to as debtors. In most cases, this happens when a business sells products on credit (Wekesa, 2018). For a set period (typically one month), the buyer can purchase the product or service from the company (Wanyoike, Onyuma and Kungu, 2021). During this time, the buyer owes the business money and is therefore regarded as a debtor by the company. What is owed is considered an asset because it can be converted into cash held in the bank when the debtors pay what they owe (Ahmed & Mwangi, 2022). Because most debts are owed for a few years or less, they are considered current assets. Debtors are dealt with by determining the most appropriate payment terms to attract customers. It is done in such a way that any negative impact on revenue and return on capital is offset by increased cash flows and the cash conversion cycle (Alle, 2021).

Firms must manage their debts, which are also current assets, to maximise profitability. According to Wanyoike et al. (2021), they need to have efficient debt management policies to ensure that debts are retrieved on time to intensify liquidity in the company. Poor debt management could lead to losses in business, and firms need to avoid long-term debts that can jeopardise their profitability. As a way of ensuring strong liquidity in the South African 3D printing sector, 3D printing SMEs need to have rigorous debt policies that enable them to over-turn their debts into cash equivalents in real-time and enhance their profitability. SMEs can develop stringent payment plans with their debtors and ensure that debts are retrieved according to the payment plans to ensure efficient debt management.

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3.10.3 Current liabilities management

According to Uma and Santohosh (2019), a company's unpaid debt from borrowing or other financial obligations, like employee pension plans, is a liability. Debt repayment can occur over a short or extended period (Lessambo, 2018). The amount of time allotted to repay a liability is determined by the amount of money borrowed as part of a long-term strategy (Alvarez, Sensini & Vazquez, 2021). One year or the current operating cycle is the maximum amount of time a short-term obligation must be paid within (Kusuma & Bachtiar, 2018).

Current liabilities include debts owed to creditors, accounts payable, and accrued expenses. Keeping the company's short-term debt, accrued liabilities, and accounts payable to a minimum is the goal of managing current liabilities (Goodswill, Ailemen, Osabohien, Chisom & Pascal, 2018). Managing current liabilities includes the management of accounts payable and accrued debts (Goodswill et al., 2018).

In relating the literature to the context of the study, the study argues that as a mechanism to enhance effective liquidity management, 3D printing SMEs must put in place suitable structures that will ensure that debts that they owe to their creditors, such as suppliers and taxes due the government, are paid within the shortest possible time. This will ensure that 3D printing SMEs are not indebted but rather manage their current debts/liabilities efficiently to maintain good liquidity levels.

3.11 ROOT CAUSES OF LIQUIDITY PROBLEMS IN SMEs

In this section, the study discusses the literature on the root causes of liquidity problems in SMEs. The root causes identified comprise the nature and size of the business, inefficient manufacturing cycles, business fluctuations, poor credit policies,

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discrepancies in operating efficiencies and price level changes. These root causes are discussed in line with the context of 3D printing SMEs.

3.11.1 Nature and size of business

The nature of a company's business significantly impacts its liquidity requirements. Most trading and financial firms require a significant investment in working capital, despite their low fixed-asset investments (Chodorow-Reich, Darmouni, Luck & Plosser, 2022). In most circumstances, large firms seem to have the upper hand when it comes to having access to working capital which makes their liquidity levels solvent enough to carry out their operations and make more profits continually (Anton & Afloarei-Nucu, 2020). However, the situations seem to differ regarding SMEs that usually find it difficult to have adequate funds to carry out their daily operations efficiently. The size of a firm, be it large or small, has a considerable effect on how effective liquidity management can be handled to achieve firm solvency (Banos-Caballero et al., 2016).

Studies have also argued that the nature of business has instrumental effects on how liquidity can be managed efficiently (Afiezan, Wijaya & Claudia, 2020). According to Afiezan et al. (2020), most manufacturing firms, per the nature of their business, tend to have more liquidity problems than retail firms. This is because the manufacturing firms require more capital to get raw materials, produce the products, and then distribute the products to the retail firms that sell them to the final customer (Afiezan et al., 2020). The tedious processes that manufacturing firms go through to supply the finished products to the retail stores tend to expose them to liquidity problems since their operational costs always remain high, and they need to invest more to produce and transport to the retailers (Obilikwu, 2018). Retail firms are instead exposed to low levels of risks and liquidity problems because they only accrue low operational costs, and they mostly tend to have shorter periods to sell the finished products, make good

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profits and always have enough working capital to reinvest in their business (Gu, Zhang & Liu, 2022; Chabachip, Yudha & Udin, 2020).

In this regard, the size of the firm and the nature of the business have instrumental effects on how liquidity problems could emerge in an organisation. Without efficient systems for managing inventory, production and distribution procedures, manufacturing firms will have severe liquidity problems. Moreover, SMEs that mismanage their working capital could face serious liquidity challenges, negatively affecting their profitability. Linking the literature to the 3D printing industry, the study argues that lack of working capital for 3D printing SMEs could be one of the vital liquidity problems that could be encountered in their financial management. Also, the mismanagement of working capital could negatively affect their business outcomes, such as profitability. That notwithstanding, since the 3D printing industry hinges on innovation for gaining a competitive advantage, 3D printing firms can use innovation as a strategic asset for gaining a competitive advantage to attract investors so they can have enough working capital to carry out their business operations and make good profits.

3.11.2 Inefficient manufacturing cycle

Since a longer manufacturing period results in more funds being committed to inventories, there will be greater demand for liquid capital if the manufacturing cycle is stretched over a longer period (Vu et al., 2020). Any delay in the manufacturing process will increase the work-in-process, increasing the need for liquidity capital (Dadepo & Afolabi, 2020). Manufacturing firms that produce heavy machinery or other products with a lengthy production cycle try to reduce the amount of money they have to invest in their inventories and, consequently, their working capital and one way they do this is by asking their customers for advance or recurring payments (Pheny, 2019).

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However, this strategy of advance payment requests from customers does not always work, making manufacturing cycles problematic when it comes to liquidity management for most manufacturing firms (Pheny, 2019). Poor processes from the inventory stage to the production stage and, finally, the distribution stage makes it difficult for most manufacturing firms to manage their liquidity efficiently due to poor financial planning (Abimbola & Kolawole, 2017). For instance, poor inventory management as part of the manufacturing cycle could lead to either overstocking or understocking, which leads to increased operational costs and thereby ends up affecting the working capital used by manufacturing firms to complete the manufacturing cycle and attain profitability (Abimbola & Kolawole, 2017).

Within the context of 3D printing SMEs, manufacturing cycles are not as long as the traditional manufacturing processes since 3D printing firms rely on digitised manufacturing models to create designs and print them layer by layer according to client specifications. That notwithstanding, it remains essential for 3D printing SMEs always to ensure that their manufacturing cycles are efficient to avoid any fund wastages that could negatively affect liquidity management.

3.11.3 Business fluctuations

Product demand seasonal and cyclical fluctuations significantly impact the company's working capital needs, particularly its short-term working capital needs (Grilli, Tedeschi & Gallegati, 2020). When the economy improves, there is an increase in the amount of money invested by a company in its inventory, accounts receivables, or book debts (Kiyotaki & Moore, 2019). The other side of the coin is that a slowdown in economic activity may lead to decreased sales, inventory, and book debts. Seasonal shifts can also cause problems in the production process. Increasing production during peak periods may incur additional costs (Dang, 2020). During the busiest times of the year,

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a company's strategy may include maintaining constant production and quickly selling off its inventory (Hashmi & Bhatti, 2019). Therefore, financial planning for seasonal working capital needs should begin well before the peak demand period. As the year progresses, the budget should be able to accommodate any changes in demand (Konovalova, 2018). It is further argued that fluctuations in the cost of doing business impact liquidity negatively as the firms have to increase their working capital to meet the demands of their customers.

The study, therefore, argues that as the 3D printing sector continues to emerge and expand in South Africa, it remains pertinent for 3D printing SMEs to constantly study the demand trends for 3D printing products and prepare accordingly regarding their liquidity levels. This is because a lack of proper financial planning and liquidity management could make it difficult for them to take advantage of demand spikes that may emerge in the 3D printing sector in South Africa as 3D technology continues to make a considerable impact on the South African economy.

3.11.4 Poor credit policy

The company's credit policy affects the amount of book debt and working capital (Brunnermeier & Krishnamurthy, 2020). A company may still try to shape its credit policy according to industry or trade norms and practices, even though these norms and practices significantly impact the terms of credit granted to customers (Peng, Yan, Elahi & Wan, 2022). The more time it takes to get paid, the more money a firm may owe. Customer defaults may even increase due to lax debt collection practices (Sabki, Wong & Regupathi, 2019). To some extent, the amount of working capital a business needs is influenced by the terms of credit that its creditors are willing to extend. Liquid capital requirements will be lower for companies with favourable credit terms (Hsieh & Lee, 2020). Poor credit policies will affect the extent to which they can overturn their

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current liabilities into assets, and if the proper mechanism for strengthening the credit policies is not implemented, it has negative implications on the firm's solvency (Orobia et al., 2016). Relating to the 3D printing context, the study argues that the inability of 3D printing SMEs to implement efficient credit policies, such as having well-structured credit agreements between them and their debtors, could negatively affect their liquidity as debts will eventually continue to accrue.

3.11.5 Discrepancies in operating efficiency

Operating efficiency is a firm's ability and capacity to use available resources (Rashid, 2018). By exercising effective management over operating expenses, the company can reduce the amount of liquid capital required (Rashid, 2018). The use of available liquidity is enhanced, and the pace of the cash cycle is sped up when operational efficiency is increased (Akhter, 2018). The more effectively resources are used, the higher the company's profitability and the more pressure is relieved on its liquidity and capital (Akhter, 2018).

However, most firms find it challenging to use their available resources as that creates deficiencies in their operational efficiency, thereby increasing operational costs and requiring more liquidity to meet the operational costs eventually (Seth, Chadha & Sharma, 2019). Inefficiencies in operational efficiency also negatively impact customer service delivery, making it difficult for firms to meet and exceed their customers' expectations and unable to achieve a competitive advantage (Seth et al., 2019). Operational inefficiencies could also be attributed to human errors, system failures, and process-related failures, negatively affecting firm liquidity due to increased operational costs.

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Within the context of the 3D printing SMEs, discrepancies in operational efficiencies have negative implications for firm profitability and competitive advantage. Apart from operational efficiency discrepancies affecting firm profitability, it also has negative implications on the ability of 3D printing SMEs to have the capacity to maintain a good level of liquidity to enhance their operational effectiveness.

3.11.6 Price level changes

A general increase in the price levels necessitates a greater outlay of funds designated for working capital. As prices continue to rise, maintaining the same levels of current assets will require increased investment (Berentsen & Waller, 2018). However, businesses that can immediately revise the prices of their products upwards are less likely to experience severe working capital problems when price levels rise (Asriyan, Fuchs & Green, 2019). However, the effects of an increase in the overall price level might be felt differently by various businesses since individual prices tend to vary (Allen & Gale, 2018). There is a chance that certain businesses will not be impacted by a recent spike in prices, whereas other companies might be severely impacted by it (Chung, Lee & Rosch, 2020). Therefore, management should ensure that adequate and effective use of working capital is made to maintain the required level of liquidity necessary to meet the firm's obligations when due (Chung et al., 2020).

Linking the literature to the context of the study, the study contends that within the 3D printing industry, an increase in price levels of 3D printers and their accessories as a result of macro-economic indicators such as high inflation rate and high exchange rate, among others, could put pressure on 3D printing firms to increase their working capital if they want to survive in the business environment. In this regard, price level changes can negatively affect the efficiency of 3D printing SMEs, which may not be able to maintain optimum liquidity levels to meet the increased price obligations.

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3.12 UNIQUENESS OF LIQUIDITY MANAGEMENT IN SMEs

Small businesses' long-term viability and growth depend on effectively managing their liquid assets (Mayanja & Mayanja, 2020). Many small business owners and managers are not given the credit they deserve when improving their company's liquidity management practices. Instead, they are judged solely based on what large corporations do or what professionals such as accountants and consultants do (Mohanty & Mehrotra, 2018). Financial management techniques were not used effectively by owners and managers of small businesses, according to a survey by Wasiuzzaman (2018). As a result, the financial management and decision-making process in small businesses remains a "black box" despite the use of these techniques (Wasiuzzaman, 2018). Liquidity management is the most challenging aspect of small business financial management and is even more crucial than the literature indicates (Sabki, Wong & Regupathi, 2019).

Zimon (2020) asserts that the success and survival of small businesses depend on their ability to effectively manage their working capital (inventory, debtors, and creditors), and he identifies the soundness of their liquidity management as the single most important factor in ensuring their success and financial well-being. Cash and credit management are examples of liquidity management. In contrast to cash flow management, which focuses on preventing long-term cash shortages, credit management includes not only the granting and receiving of credit but also the evaluation of individual customers, the credit periods allowed, and the steps taken to ensure timely payments (Kontus & Mihanovic, 2019).

Small-business owner-managers spend a large portion of their time managing working capital (Kontus & Mihanovic, 2019). This includes time spent on managing excess liquid funds. Working capital shortages are viewed as a common problem by Chodorow-Reich, Darmouni, Luck, and Plosser (2022) because of the liquidity gap

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between large and small firms, which they attribute to small firms' limited access to capital markets or to the very nature of the business itself. It is concluded that because cash is so scarce due to supply constraints, small businesses should be concerned about liquidity. However, this is not the case for large corporations (Chodorow-Reich et al., 2022). The fact that small-business owners and managers are more likely to take risks in a risky and uncertain environment exacerbates this concern (Posylnaya, Cline & Aaron, 2019). A company's long-term viability depends heavily on organisational learning, as innovation and new ways of combining existing knowledge are necessary to stay afloat in a risky and competitive environment (Posylnaya et al., 2019).

Based on the literature, the study contends that effective liquidity management among 3D printing SMEs is essential for managing their current assets, liabilities/debts to achieve solvency and become more profitable. As the 3D printing SME industry in South Africa continues to emerge and expand, liquidity management should be a critical financial management practice for achieving firm performance.

3.13 LIQUIDITY MANAGEMENT IN THE 3D PRINTING INDUSTRY

Within the 3D printing industry context, liquidity management deals with the ability and capacity of 3D printing firms to manage their current assets and liabilities effectively. In terms of current assets, 3D printing firms need to concentrate on managing their working capital since the absence of working capital will make it impossible for them to carry out their day-to-day operations. Working capital can be well managed when stringent measures are put in place to ensure that debts owned by creditors are paid in real-time to avoid situations of having cash stacked in debt. It is also argued that 3D printing firms need to have workable credit policies that ensure reasonable agreements regarding timeframes for payments to be made to them by their debtors. Again, it also remains vital for firms to ensure that liquidity levels are kept at optimum levels since

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low or excess liquidity levels can negatively impact liquidity management, considering the expansive nature of the 3D printing industry in South Africa.

Liquidity management in the 3D printing industry also hinges on the ability and capacity of 3D printing firms to effectively deal with current liabilities, such as accounts payable to suppliers and taxes they owe the government. This is because delays in debts owed to suppliers and the government in terms of taxes could attract higher interests/penalties, making 3D printing firms illiquid. In this regard, efficient management of liquidity in the 3D printing industry is essential for enhancing their firm performance in terms of profitability, gaining competitive advantage and having the ability and capacity to make good use of emerging opportunities in the 3D printing sector.

3.14 LIQUIDITY RATIOS

This section presents literature on liquidity ratios: current, quick and cash ratios.

3.14.1 Current ratio

The current ratio assesses how well current assets cover obligations due within a year (Breuer, Frumusanu, Breuer & Manciu, 2012). Companies' market liquidity and capacity for meeting creditors' demands are referred to as liquidity and determine whether a company can pay off its debts in the coming year using the current ratio (Breuer et al., 2012). The current assets and liabilities of a company are compared. If a company's current ratio is less than one, it suggests that it may be having trouble meeting its short-term financial obligations (Yameen, Farhan & Tabash, 2019). Liquidity problems are not always evident from a lack of value. It may be possible for an organisation to borrow against its long-term future prospects to meet its current

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obligations (Yameen et al., 2019). Some industries have a common current ratio of less than one. This is because the inventory turnover is higher than the rate at which accounts payable must be paid. As a result, the company's current ratio can be reduced (Breuer et al., 2012). Current ratio is mathematically expressed as Current Assets/Current Liabilities (Yameen et al., 2019).

3.14.2 Quick ratio

According to Noor and Lodhi (2015), the quick ratio indicates the company's ability to meet its current liabilities as they become due. Using this ratio, one can ascertain whether or not a business has sufficient short-term assets to cover its immediate liabilities without having to liquidate any inventory (Noor & Lodhi, 2015).

The quick ratio is a more accurate indicator of a company's liquidity for businesses with large inventories or prepaid expenses (Lalithchandra, 2021). This is because current assets, such as inventory and prepaid expenses, are not as liquid as other types of assets, such as cash, short-term investments, and accounts receivable. The quick ratio can be calculated mathematically as Current Assets – Inventory Current Liabilities (Lalithchandra, 2021).

3.14.3 Cash ratio

The cash ratio measures the amount of cash and cash equivalents a company has available to meet the demand of paying off its short-term debt (Stevanovic, Minovic & Ljumovic, 2019). The higher the cash ratio, the more cash and cash equivalents a company has to pay off its short-term debt. What this means is determining whether or not a company can ensure the ability to cover its debts immediately with the cash and

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cash equivalents it currently holds, given the amount of cash and cash equivalents that the company currently possesses (Stevanovic et al., 2019).

This ratio is one type of measurement that is utilised in the process of determining whether or not the company is solvent. Other resources, like receivables and inventories, are not considered in the calculation, which is one of the reasons why this ratio is considered the most conservative form of the liquidity ratios (Madushanka & Jathurika, 2018). Another reason is that this ratio is the most straightforward. It considers only a company's most liquid assets, such as cash and assets nearly equivalent to cash in terms of market value. The cash ratio is mathematically expressed as cash and cash equivalents/current liabilities (Madushanka & Jathurika, 2018).

3.15 SOURCES OF FINANCING SMEs

This section presents literature on sources of financing SMEs. The components of the literature comprise the following: defining financing, methods of financing, types of financing available, sources of financing, approaches to assessing sources of finance, factors influencing sources of financing decisions and obstacles facing SMEs when trying to secure financial support.

3.15.1 Defining financing

According to Iacoviello (2015), financing refers to the activities, strategies, and processes involved in obtaining funds for a business enterprise. It encompasses the acquisition of capital from various sources, such as equity investors, debt financing, and retained earnings, to support the company's operations, investments, and growth (Sodeyfi, 2016). Similarly, Gitman et al. (2015) define financing as the process of obtaining funds and capitalising a business. They highlight the decision-making aspect

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of the financing, including the choice between debt and equity financing and determining appropriate sources and structure of funding to meet the company's financial needs and objectives. Moreover, Nguyen and Canh (2021) define financing as the act of raising funds to support a company's activities and investments. Their definition emphasises the consideration of factors such as the cost of capital, financial risk, and the optimal capital structure in making financing decisions.

From the definitions, it could be deduced that all the authors recognise financing as a process of acquiring funds to support business operations and investments. Additionally, they acknowledge the importance of decision-making in selecting financing options and determining the appropriate capital structure. From the definitions the researcher defines financing as the process of acquiring funds to support business activities and investments. Financing involves decision-making regarding the mix of debt and equity financing and identifying appropriate funding sources.

3.15.2 Methods of financing SMEs

This section provides literature on financing methods comprising debt and equity capital.

3.15.2.1 Debt

Debt is one of the methods of financing for SMEs. According to Cole and Sokolyk (2018), debt financing occurs when capital expenditures are raised through the use of instruments of debt to individuals or institutional investors. In return for the lending of money, individuals or institutional investors become the creditors and therefore receive a promise that both the principal and the interest on the debt will be repaid in a specified time frame (Githajgo & Kabiru, 2015). Debt financing can either be long- or short-term

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based on the cash flow of SMEs and the interest rate charged to them by individual or institutional investors (Yazdanfar & Ohman, 2015). Managers of SMEs are more likely to rely on commercial lenders, especially institutional lenders, as a source of short-term debt financing that can be renewed for long-term debt. In contrast, managers of large firms typically have a broader selection of debt financing resources from which to choose (Yazdanfar & Ohman, 2015).

Dioha and Kamaluga (2017) argue that SMEs' debt finance links must be long-term for them to be able to deal with the ensuing agency issues between them and their lenders. When considering whether or not to employ short-term debt, it is vital to consider the advantages and disadvantages of doing so. Short-term debt is adaptable enough to suit the company's fluctuating financial needs, and the flotation expenses are lower than long-term loans (Yazdanfar & Ohman, 2015). Some forms of short-term debt, such as trade credit, have interest rates of zero, while other forms have interest rates significantly lower than the nominal interest rate on long-term loans (Franquesa & Vera, 2021).

Moreover, from the lender's perspective, short-term debt is an effective way to address concerns around information asymmetry because businesses are obligated to repay the debt and related fees over a shorter, more regular period. This makes the lender's repayment plan more manageable (Omollo, Muturi & Wanjare, 2018). In contrast, the most significant disadvantage of short-term debt is the elevated amount of risk associated with it. Financially vulnerable businesses tend to favour long-term debt because the benefits of this sort of borrowing do not outweigh its dangers (Kljucnikov & Belas, 2016). That notwithstanding, long-term debt interest rates can fluctuate radically and may not enhance business growth and expansion in the long term (Githajgo & Kabiru, 2015).

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From the literature on debt financing, the study argues that debt can be instrumental in financing 3D printing firms in South Africa. However, depending on their financial needs and cash flow, 3D printing firms must decide whether to go into short- or long-term debt. Short-term debts could benefit 3D printing firms as the interest rates could be lower than long-term debt, whose interest rates could fluctuate over time.

3.15.2.2 Equity capital

Equity capital is the type of fund paid into a business by investors in exchange for a preferred stock percentage of the company. Equity capital can be generated internally or externally (Tykyova, 2018). Internal equity capital is the type of fund paid into the business by owners or managers of the firm in exchange for a percentage of the company's shares or assets. On the other hand, external equity capital is funds paid into business by external investors in exchange for a preferred percentage in the share or assets of the firm (Coleman, Cotei & Farhat, 2016).

In the case of SMEs, equity financing is preferred over debt financing due to the difficulty in obtaining collateralised loans during the start-up stage of most SMEs. Equity financing has two key benefits (Coleman et al., 2016). Firstly, equity financing requires minimal interest payments and is usually a form of long-term financing compared to debt. Secondly, the availability of equity financing implies that a company has the backing of experienced financiers who can give the firm much credibility in the business environment (Feng, Wang & Huang, 2015).

Nguyen and Rugman (2015) identified two circumstances in which SMEs seek financing from equity capital sources. The first scenario is when SMEs are in dire need of financing but have no access to conventional banking services. In the second scenario, it is required to deduct from cash outflows the recurring sources of income

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received. According to Blomkvist, Korkeamaki and Takalo (2022), the hesitation of traditional lenders to lend to the company due to uncertainties regarding the company's future growth potential motivated the SMEs in these two examples to adopt equity financing.

In the context of 3D printing firms, equity financing can be a good financing strategy to raise funds to expand product lines and serve customers better. This is because equity financing usually has minimal interest rates compared to debts and is usually for the long-term compared to debt which demands collaterals and other requirements which SMEs might not be able to have. In this regard, equity financing can support 3D printing firms in their growth and expansion agenda.

3.15.3 Types of financing available to SMEs

In this section, the researcher discusses two types of financing available to SMEs, which are internal and external sources of financing.

3.15.3.1 Internal financing

Internal sources of financing refer to the funds raised from within a firm or organisation (Shrotriya, 2019). The internal sources of financing comprise owner’s capital invested in the company from their own personal savings, ploughing back of profits to be invested into the company and selling of fixed assets to raise funds for the company (Khan, 2015). Other examples of internal sources of financing comprise the sale of a company’s stocks to raise funds and engaging in the collection of debts owned by either individuals or organisations to raise funds for the firm (Shukla, 2022).

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Internal sources of financing are crucial for 3D printing SMEs in South Africa. These include the owner's capital, ploughing back profits, selling fixed assets, issuing company stocks, and collecting debt. Owner's capital, personal savings, and reinvestment of profits provide control and flexibility. Selling fixed assets and issuing stocks attract investors. Effective debt collection helps maintain financial stability. Leveraging these internal sources allows 3D printing SMEs to meet financial needs while balancing profitability and growth objectives.

3.15.3.2 External financing

The external sources of financing comprise capital raised outside of the organisation to fund the operations or projects undertaken by the firms (Amornkitvikai and Harvie, 2018). Examples of external sources of financing comprise loans taken from banks, monies borrowed from friends and family, investments from new partners, seeking funding from venture capitalists and angel investors, and engaging in leasing and hire purchases. Other forms of external sources of financing include grants from international organisations and governments to support projects undertaken by SMEs (Fowowe, 2017).

External sources of financing are essential for 3D printing SMEs in South Africa to support their operations and projects. These sources include bank loans, borrowing from friends and family, investments from new partners, venture capitalists and angel investors, and leasing arrangements. Grants from international organisations or government initiatives may also be accessible. 3D printing SMEs can secure funds for expansion, technology investments, and growth opportunities by utilising these external sources. SMEs can access additional capital beyond their internal resources and foster their development in the competitive 3D printing industry.

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3.15.4 Sources of financing for SMEs

This section presents literature on financing sources for SMEs, including personal savings, ploughing back profits, selling fixed assets, sale of stocks, loans from banks or financial institutions, venture capitalist and angel investors, and grants.

3.15.4.1 Personal savings

Personal savings represent a convenient and easily accessible source of finance for SMEs (Naegels, Mori & D'Espallier, 2018). SME owners can lend money from their personal savings to their businesses without the need for collateral or interest payments (Naegels et al., 2018). This simplicity and flexibility make personal savings an attractive option for SMEs needing funds. Using personal savings eliminates the time-consuming process of applying for loans or seeking external investments. Owners can quickly inject funds into their businesses to meet immediate financial needs or exploit growth opportunities. This immediacy can be crucial for SMEs operating in dynamic and competitive markets, allowing them to respond swiftly to market demands (Taiwo & Falohun, 2016). However, relying solely on personal savings carries inherent risks. If the SME fails to generate sufficient profits or faces financial difficulties, owners who have lent money from their personal savings may suffer financial losses (Buric et al., 2022). In such cases, owners' personal wealth can be at stake, potentially affecting their financial stability and well-being. Despite these risks, personal savings demonstrate the commitment and belief of owners in the success of their businesses. The willingness to invest personal funds conveys confidence to other stakeholders, including potential investors or lenders, and can enhance the credibility of the SME (Naegels et al., 2018).

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For 3D printing SMEs in South Africa, personal savings can serve as a vital source of financing. Owners of these SMEs can lend money from their personal savings to support the financial needs of their businesses. Personal savings offer a convenient and accessible option, allowing SMEs in 3D printing to access funds without the complexities associated with external financing quickly. This is particularly beneficial for 3D printing SMEs operating in a dynamic and competitive industry, enabling them to respond swiftly to market demands and capitalise on growth opportunities. However, SME owners must carefully assess the risks involved and consider diversifying their sources of financing to mitigate potential losses and ensure the long-term sustainability of their 3D printing ventures.

3.15.4.2 Ploughing back profits

Ploughing back profits into the business operations is a common practice among SMEs as a source of financing (Fairfield & Jorratt De Luis, 2016). Instead of relying on external loans involving interest payments, SMEs can allocate a portion of their net profits to reinvest in the business (Eniola & Entebang, 2015). This internal source of financing allows SMEs to fund ongoing or future business operations and projects without incurring additional debt (Eniola & Entebang, 2015). By reinvesting profits, SMEs can enhance their financial position and support various growth initiatives. These initiatives may include expanding production capacity, investing in research and development, upgrading technology and equipment, or entering new markets (Xiang & Worthington, 2015).

Ploughing back profits enables SMEs to control their finances and avoid reliance on external lenders. Moreover, utilising profits as a source of financing offers advantages such as lower financial risk and reduced interest expenses (Kisseih, 2017). SMEs can avoid the burden of debt servicing, thereby improving their cash flow and financial

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flexibility. This approach also demonstrates the business's ability to generate sustainable profits and reinvest in its own growth. However, there are considerations associated with ploughing back profits (Noor & Simiyu, 2020). SMEs must balance retaining profits for reinvestment and distributing dividends to shareholders or owners. Striking this balance ensures that the business continues to attract investors and retain their confidence (Noor & Simiyu, 2020).

For 3D printing SMEs in South Africa, reinvesting profits into their operations serves as a crucial source of financing. By allocating a portion of their net profits, these SMEs can enhance their production capabilities, invest in research and development, and stay competitive in the rapidly evolving industry. This approach allows SMEs to maintain control over their finances, reduce reliance on external borrowing, and demonstrate their ability to generate sustainable profits. Additionally, ploughing back profits minimises financial risks, strengthens cash flow, and provides greater financial stability and flexibility. Balancing the allocation of profits between reinvestment and dividend distribution is vital for satisfying stakeholders' expectations.

3.15.4.3 Selling fixed assets

SMEs can generate funds for their business operations by selling assets such as property, machinery, or equipment (Deutsch & David, 2021). This internal mechanism allows SMEs to unlock the value of their fixed assets and use the proceeds to support their ongoing operations or projects (Flickinger & Klamer, 2016). Selling fixed assets can provide SMEs with a quick infusion of capital, enabling them to address immediate financial needs or invest in new initiatives. By liquidating unproductive or surplus assets, SMEs can optimise their resource allocation and focus on more profitable ventures (Deutsch & David, 2021). This approach can be particularly beneficial for SMEs needing liquidity without incurring additional debt or interest expenses.

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Furthermore, the sale of assets offers flexibility and allows SMEs to adapt to changing market conditions. They can reallocate their resources to align with evolving business strategies or seize new opportunities. By divesting non-essential assets, SMEs can streamline operations, improve efficiency, and enhance their overall financial position (Flickinger & Klamer, 2016). However, there are considerations to keep in mind when selling assets. SMEs should carefully evaluate the impact of selling specific assets on their long-term growth prospects and operational capabilities. Selling essential assets may hinder future expansion or reduce the overall value of the business (Deutsch & David, 2021). Additionally, SMEs need to assess the potential tax implications, transaction costs, and the availability of suitable buyers before proceeding with asset sales (Deutsch & David, 2021).

For 3D printing SMEs in South Africa, selling assets can be a strategic approach to raise funds and support their business endeavours. By selling property, machinery, or equipment, these SMEs can generate immediate capital to address financial needs or invest in new technologies and infrastructure specific to the 3D printing industry. Asset sales offer flexibility, allowing SMEs to reallocate resources and adapt to evolving market dynamics. However, careful consideration should be given to the impact of asset sales on the long-term growth potential of the business and the ability to deliver quality products and services. 3D printing SMEs in South Africa can strategically leverage asset sales to optimise their operations and enhance their financial position while aligning with their growth objectives.

3.15.4.4 Sale of stocks

SMEs have the option to raise funds by selling their stocks to investors, granting them ownership stakes in the company (Ehrhardt & Brigham, 2016). The SMEs can then utilise the proceeds from the sale of stocks to finance their business operations or

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projects (Mayo, 2020). Selling stocks internally allows SMEs to generate funds without incurring interest expenses, enabling them to support business expansion and growth (Kidwell et al., 2016). When stocks are sold to investors, they become shareholders and are entitled to dividends when the firm generates profits (Leach & Melicher, 2020). This mechanism allows SMEs to share their success with investors, creating a mutually beneficial relationship. Additionally, selling stocks can attract investors who believe in the company's growth potential, providing the SME access to additional capital and resources (Ehrhardt & Brigham, 2016). The sale of stocks offers SMEs a flexible financing option, as they can determine the percentage of ownership to be sold and the corresponding amount of funds to be raised. This strategy allows SMEs to maintain control over their operations while obtaining the necessary capital for growth and expansion (Mayo, 2020). However, SMEs should carefully consider the implications of selling stocks, such as dilution of ownership and potential loss of control over decision-making processes. SMEs must strike a balance between raising funds through stock sales and maintaining sufficient ownership and control to safeguard their long-term interests (Leach & Melicher, 2020).

For 3D printing SMEs in South Africa, selling stocks to investors is an important financing source. This approach allows SMEs to generate internal funds without incurring interest expenses and provides an opportunity to attract investors who believe in the growth potential of the 3D printing industry. The proceeds from stock sales can be used to support business operations, invest in advanced technologies, and expand production capabilities. However, they must carefully manage the balance between raising capital and maintaining control over the company. Selling stocks gives them access to funds while fostering relationships with investors aligned with the long-term success of the business.

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3.15.4.5 Loans from banks/ financial institutions

SMEs often turn to bank loans as a significant source of finance to support their business activities and expansion plans (Boadi et al., 2017). SMEs typically seek these loans to fund projects that have the potential to enhance profitability and drive business growth. However, it is essential to note that bank loans come with interest rates, and the terms and conditions of the loan agreement are determined through negotiations between the SME and the bank. Banks assess the creditworthiness of SMEs by evaluating their financial statements, specifically analysing their cash flows and profitability levels (Boadi et al., 2017). Additionally, banks often require collateral to serve as security against the loan provided to the SME (Rostamkalaei & Freel, 2016). This collateral guarantees the bank if the SME cannot fulfil the repayment obligations. Loan repayment plans are established, and specific timelines are allocated to SMEs to repay the borrowed funds (Rostamkalaei & Freel, 2016). The repayment terms can vary depending on the agreement reached between the SME and the bank, considering factors such as the amount borrowed, interest rates, and the financial capabilities of the SME (Campanella & Serino, 2019). While bank loans offer SMEs access to substantial financing, it is essential for SMEs to carefully consider the associated interest rates and repayment obligations (Campanella & Serino, 2019). Proper financial planning and analysis of the loan's impact on cash flows and profitability are crucial to ensure that the borrowed funds are used effectively and that the repayment obligations can be met (Osano & Languitone, 2016).

Bank loans provide a valuable source of financing for 3D printing SMEs in South Africa. These loans enable SMEs to access funds for expanding their operations, investing in advanced technologies, and acquiring the necessary equipment. However, SMEs must carefully consider the terms and conditions associated with bank loans, including interest rates, repayment terms, and collateral requirements. Comprehensive financial statements demonstrating cash flows and profitability are crucial in securing favourable

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loan terms. By effectively managing bank loans, 3D printing SMEs can fuel their growth, innovate, and remain competitive while ensuring repayment obligations are met without compromising financial stability.

3.15.4.6 Venture capitalist and angel investors

Angel investors are a group of wealthy individuals who come together to invest their own money into start-ups or businesses that are already in operation but need funds for expansion (Drover et al., 2017). On the other hand, venture capitalists are private equity investors who provide capital to organisations with high growth potential in exchange for a stake in their equity (Mason, Botelho & Harrison, 2019). Venture capitalists and angel investors provide capital to start-ups and existing businesses to seek a stake in their equity. To avoid risks, angel investors and venture capitalists carry out many checks on the sustainability of the business they intend to invest in and also check the potential of high returns of the firm before they make their final decision to invest (Wu, 2016). Venture capitalists and angel investors may be at risk when the returns on investments in ventures that they invested in run at a loss. In such situations, they tend to lose their investment. However, venture capitalists and angel investors make high profits when the ventures in which they invest their capital have high returns in terms of profitability over time (Edelman, Manolova & Brush, 2017).

Angel investors and venture capitalists play a significant role in financing 3D printing SMEs in South Africa. These investors provide external capital to support the growth and expansion of the SMEs in the industry. They conduct thorough assessments to ensure the sustainability and high-growth potential of the businesses before making their investments. While there is a risk of losing their investment, angel investors and venture capitalists stand to gain significant profits when the SMEs succeed. Their financial support enables SMEs to invest in advanced equipment, research and

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development, and market expansion. Attracting these investors offers opportunities for accelerated growth, expertise, and industry connections for 3D printing SMEs in South Africa.

3.15.4.7 Grants

Grants offer several advantages as a source of finance for SMEs, including those operating in the 3D printing industry. Unlike loans or investments, grants are financial gifts awarded by entities such as international organisations, non-governmental organisations (NGOs), or governments (Martin, 2015). They are not expected to be repaid, making them a highly attractive funding option for SMEs (Swirska & Zukovskis, 2015). One key advantage of grants is that they do not require repayment with interest rates, alleviating the financial burden on SMEs and allowing them to allocate their resources more effectively (Swirska and Zukovskis, 2015). Additionally, grants do not typically require collateral, providing SMEs with access to funds without the need to pledge assets as security (Martin, 2015).

Moreover, grants can support SMEs in their pursuit of business expansion and profitability. These financial gifts can be utilised to invest in research and development, upgrade equipment, train employees, or implement new technologies (Srhoj, Skinjaric & Radas, 2021). By receiving grants, SMEs in the 3D printing industry can access the necessary funds to enhance their production capabilities, improve product quality, and expand their market presence. Furthermore, grants often come with additional benefits beyond financial support. They can give SMEs credibility and recognition, as receiving a grant signifies external validation of their business concept or potential (Srhoj, Skinjaric, & Radas, 2021). Additionally, grants may offer networking opportunities and access to valuable expertise or resources through the organisations providing the funding.

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However, it is important to note that grants are highly competitive, and SMEs must meet specific criteria and requirements to be eligible. The application process can be time-consuming and demanding, requiring detailed proposals, financial information, and supporting documentation (Martin, 2015). Furthermore, grants may have specific stipulations or restrictions on how the funds can be used, which can limit the flexibility of SMEs in utilising the finances.

In conclusion, grants serve as a valuable source of finance for 3D printing SMEs. They provide non-repayable funds, eliminate the need for interest rates or collaterals, and support business expansion and profitability. While the application process and restrictions may pose challenges, the benefits of grants, including credibility, networking, and access to expertise, make them a valuable avenue for SMEs seeking financial support.

3.16 APPROACHES FOR ASSESSING SOURCES OF FINANCE BY SMES

There are two approaches SMEs use when assessing finance from different sources. These are the direct and indirect approaches.

3.16.1 Direct approach

The direct approach for assessing finance is when owners/managers of SMEs contact banks or investors by themselves to seek financial support in the form of loans or equity (Jones-Evans, 2019). The key advantage of the direct approach is that owners and managers of SMEs can establish direct contact with potential financiers and get detailed information about their requirements to enhance their decision-making on the funds they seek (Chuang, 2016). Owners and managers of SMEs can use the direct

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approach to get first-hand information about the fund they seek and therefore make real-time decisions (Adams, 2019).

Direct engagement with banks and investors benefits 3D printing SMEs in South Africa. By presenting their value proposition and growth potential, SMEs can highlight advantages like innovative products, cost reduction, and market opportunities. Leveraging industry knowledge, owners and managers can build relationships, address concerns, and negotiate tailored terms. This approach increases the likelihood of securing financing for expansion, research and development, and technology investments.

3.16.2 Indirect/broker approach

The indirect approach to assessing finance is also known as the broker approach. This is when firms contact financial brokers to help them seek funding from external sources such as angel investors, venture capitalists and banks to meet their financial needs at a point in time (Egan, 2019). The financial broker takes a broker fee, which could be 5% of the fund sought. The indirect/broker approach can be used when SMEs can access investors with the financial capacity to provide them with the necessary funds (Chuang, 2016). In most situations, the indirect/broker approach is used when SMEs seek substantial funds for long-term projects. Although the indirect/broker approach can help SMEs to access these funds to be invested in their companies, the processes can be cumbersome, and investor demands can be overwhelming and challenging to meet (Adams, 2019).

The indirect approach to finance involves utilising financial brokers to secure funding from external sources like angel investors, venture capitalists, and banks. This approach benefits 3D printing SMEs in South Africa without direct access to investors.

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It provides access to substantial funds for long-term projects. However, challenges include additional costs and meeting investor demands. Despite this, the broker approach expands the network of potential investors, enhancing the likelihood of securing significant funds to foster the growth and development of 3D printing SMEs in South Africa.

3.17 FACTORS INFLUENCING SOURCES OF FINANCING DECISIONS BY SMEs

In this section, literature is presented on the factors influencing sources of financing decisions by SMEs.

3.17.1 Cost of financing

One of the critical factors that influence the source of financing decisions by SMEs is the cost of financing (Zairani and Zaimah, 2013). Before SMEs seek finance from an external source, such as banks or financial institutions, they tend to compare the interest rates of various financial institutions (Zairani and Zaimah, 2013). SMEs are primarily interested in loans from banks or financial institutions with the lowest interest rates (Turyahikayo, 2015). Choosing banks or financial institutions with the lowest interest rates helps SMEs keep their financing cost low compared to going for loans with high-interest rates (Ahinful, 2012). Based on the literature, the study argues that 3D printing firms should always consider the cost of financing in terms of interest rates before deciding to go for loans from banks or financial institutions to fund their businesses.

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3.17.2 Risk

Another factor influencing the financing decisions SMEs make when deciding on the source of financing is the risk associated with the fund they seek (Blazy and Weill, 2013). According to Blazy and Weill (2013), SMEs can risk losing key assets such as building properties, vehicles, and land used as collateral for their business if they cannot repay loans from banks or financial institutions. In this regard, it remains vital for SMEs to re-assess the purpose for which they are taking the loans and ensure that the loans taken can help to increase profitability levels (Bilal and Al Mqbali, 2015). This is because when loans taken cannot help achieve increased profits, there will be difficulties in making repayment, and that can lead to loss of collaterals which sometimes makes the source of financing through loans a risky venture for SMEs (Zarrouk, Sherif, Galloway and El Ghak, 2020).

Based on the literature, the study augments that the purpose of 3D printing firms taking loans from banks must be properly evaluated to ensure that the loans can yield more profitability and enhance repayment within the allotted timelines. This will help reduce the risks they could be exposed to in terms of losing collateral to banks or financial institutions due to their inability to repay the loans on time.

3.17.3 Cash flow position

The cash flow position of an SME remains critical when deciding to source funding for its business (Zarook, Rahman and Khanam, 2013). Be it individuals, angel investors, venture capitalists, and banks, among others, the cash flow position of a firm is crucial when seeking funding (Prempeh, 2015). This is because the cash flow position improves the confidence of the lender that the fund invested or loaned to the firm will achieve high returns or can be repaid within the stipulated timeframe. (Prempeh, 2015).

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In this regard, it is essential for SMEs to always ensure that their cash flow position is strong enough to attract individuals, angel investors, and venture capitalists to invest in their business operations (Zarook et al., 2013).

Furthermore, the study argues that owners and managers of 3D printing firms must always ensure their cash flow positions are strong to help them attract investors to invest their funds for a share of their firms or get banks to give them loan facilities to support and expand their businesses.

3.17.4 Repayment terms

The repayment term is also an important decision to take when seeking finance. This is especially so when taking loans from banks or financial institutions where the loans are supposed to be paid at a specific interest rate (Obokoh, Monday and Ojiako, 2016). In this regard, SMEs need to decide whether the loan will be paid within a short time (short-term loan) or a longer time (long-term loan). Therefore, SMES need to assess their cash flows and capacity to repay the loans before deciding whether to take a short- or long-term loan (Wehinger, 2014). Commenting on the literature, the study augments that 3D printing firms need to consider repayment terms based on their capacity to pay to decide whether to apply for a long-term or short-term loan.

3.18 OBSTACLES FACED BY SMEs IN SECURING FINANCIAL SUPPORT

This section presents literature on the obstacles SMEs face when trying to secure financial support.

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3.18.1 Tight requirements

Due to the stringent conditions frequently linked with loans, numerous SMEs cannot obtain credit from financial institutions. Financial institutions may refuse to extend loans to SMEs if the businesses do not have suitable collateral to back the loans. Previous studies have observed that the availability of bank financing is contingent upon the collateral being secured through lending (Obokoh et al., 2016). Lending institutions are shielded from financial loss by using asset collateral if SMEs fail to repay their loans. Financial institutions have some room for manoeuvre when it comes to protecting themselves against SMEs in default that do not have collateral (Wehinger, 2014)). Financial institutions require some form of collateral to mitigate the risks inherent in their customer loans. Even if an SME has a wonderful business strategy, it will likely be denied credit owing to a lack of proper security/collateral (Bilal and Mqbali, 2015). This is because banks cannot afford the risk of loans not being repaid. When a financial institution is considering making a loan, it will require the bare minimum of security to be provided to approve the transaction (Zarrouk et al., 2020). Since most SMEs do not have adequate assets to be used as collateral, they find it difficult to meet the requirements of the banks or financial institutions, and as a result, it becomes difficult for them to access funds from loans (Zarrouk et al., 2020).

Access to credit and loans from financial institutions can be challenging for SMEs, including 3D printing SMEs in South Africa, due to strict lending conditions and collateral requirements. Many SMEs struggle to meet the collateral criteria set by financial institutions, which is essential for securing loans. Without suitable collateral, banks may refuse to extend credit to SMEs (Obokoh et al., 2016). Financial institutions rely on collateral to mitigate the risk of non-repayment by SMEs, as it safeguards potential losses (Wehinger, 2014). However, this poses a difficulty for SMEs, as they often lack sufficient assets to use as collateral (Zarrouk et al., 2020). Consequently, SMEs, including 3D printing businesses, face difficulties in accessing funds through

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loans due to their inability to meet the collateral requirements imposed by financial institutions.

3.18.2 Inconsistent cash flows

When the cash flows of SMEs are not consistent, it makes it difficult for them to attract investors to invest funds in their firms. Again, inconsistent cash flows make it difficult for banks or financial institutions to accept loan applications from SMEs (Forkuoh, Affum-Osei and Quaye, 2015). This is because individual investors, angel investors or venture capitalists dwell on cash flows to determine the extent to which a venture is viable for investment (Forkuoh et al., 2015). Again, banks also dwell on cash flows to determine whether SMEs can repay loans offered to them in the allotted timelines (Quartey, Turkson, Abor and Iddrisu, 2017). However, due to the challenging business environment where SMEs operate, it becomes difficult for them to have a consistent cash flow that yields high profits/returns, and this tends to make investors lose interest in investing. In this regard, SMEs do not seem attractive to investors and banks when sourcing funding (Quartey et al., 2017).

Inconsistent cash flows pose challenges for 3D printing SMEs in South Africa in attracting investors and obtaining loans from banks or financial institutions. Investors, including individual investors, angel investors, and venture capitalists, rely on consistent cash flows as an indicator of the viability of a venture for investment (Forkuoh et al., 2015). Similarly, banks assess their cash flows to determine their ability to repay loans within specified timelines (Quartey et al., 2017). However, the challenging business environment faced by 3D printing SMEs often hinders their ability to generate consistent cash flows and achieve high profits. As a result, investors and banks may perceive these SMEs as less attractive for funding, making it difficult for them to access the necessary financial resources (Quartey et al., 2017).

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3.18.3 Poor financial documentation

Poor financial documentation is a key obstacle affecting SMEs' efforts to seek finance from banks or investors. This is because many SMEs have poor bookkeeping and accounting practices and therefore do not keep proper financial data records, which is highly relevant when seeking funding (Quaye, Abrokwah, Sarbah and Osei, 2014). As a result, most SMEs cannot access accurate financial statements that clearly show their profitability indicators, such as ROA, ROE, and ROI (Quaye et al., 2014). In this regard, it becomes difficult for most SMEs to support their applications with the requisite financial information or data to convince banks or investors that their businesses are worth investing in (Kwarteng and Lin, 2015).

Poor financial documentation poses a significant challenge for 3D printing SMEs in South Africa when seeking finance from banks or investors. Many of these SMEs struggle with inadequate bookkeeping and accounting practices, resulting in a lack of proper financial data records (Quaye et al., 2014). Consequently, these SMEs often lack access to comprehensive financial statements demonstrating important profitability indicators, such as ROA, ROE, and ROI (Quaye et al., 2014). This deficiency in financial information makes it difficult for 3D printing SMEs to support their funding applications with the necessary data to convince banks or investors of the viability and potential of their businesses (Kwarteng and Lin, 2015). Without robust financial documentation, these SMEs face challenges in gaining the trust and confidence of financial institutions and investors, hindering their ability to secure the necessary funds for growth and expansion.

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3.18.4 Poor organisational structures

Poor organisational structures are another factor affecting SMEs' quest for business funding. According to Abor, Agbloyor and Kuipo (2014). the ownership structures of most SMEs are not formalised, and there is no proper documentation to know who the owners of the firms are and the share percentage of each owner (Quartey et al., 2017). In other instances, SMEs may be in the form of a sole proprietorship, which raises concerns about trust when seeking funding from banks or investors (Forkuoh et al., 2015). Poor structures in terms of departments to handle different aspects of business operations also tend to negatively affect the confidence of investors in SMEs regarding their ability and capacity to repay loans or attain high returns for investors (Kwarteng and Li, 2014).

Poor organisational structures pose challenges for 3D printing SMEs in South Africa when seeking funding for their businesses. Many of these SMEs lack formalised ownership structures, resulting in a lack of proper documentation regarding the owners and their respective share percentages (Abora et al., 2014; Quartey et al., 2017). This lack of transparency raises trusts and accountability concerns for banks and investors (Forkuoh et al., 2015). Additionally, inadequate departmental structures within these SMEs can negatively impact investor confidence in their ability to repay loans or generate high returns (Kwarteng and Li, 2014). The absence of clear ownership structures and well-defined organisational frameworks makes it challenging for 3D printing SMEs to instil trust and credibility in potential financiers, hindering their access to funding opportunities for business growth and development.

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3.19 CHAPTER SUMMARY

This chapter explores financial management practices and sources of financing for Small and Medium-sized Enterprises (SMEs), with a specific focus on the 3D printing sector in South Africa. Emphasizing the significance of working capital management for effective cash flow, it underscores the pivotal role it plays in influencing investment opportunities, profitability, and productivity in 3D printing SMEs. The discussion highlights the potential risks of poor working capital management, emphasizing its detrimental impact on firm growth and financial sustainability.

The chapter also delves into liquidity management in the SME context, emphasizing its essential role in optimizing current assets and liabilities to maintain optimal liquidity levels. The positive implications of effective liquidity management for 3D printing SMEs in South Africa are emphasized, noting its potential to enhance firm profitability and competitive advantage.

Furthermore, the chapter addresses the sources of financing available to 3D printing firms in South Africa. It concludes that financing is instrumental in fostering the growth and expansion of 3D printing firms. However, strategic decision-making is crucial, requiring careful consideration of key indicators such as cash flow, profitability, and organizational structures when choosing between debt and equity financing for business operations or projects.

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CHAPTER 4: THEORETICAL AND CONCEPTUAL FRAMEWORK

4.1 INTRODUCTION

This chapter presents literature on the theoretical framework and empirical literature leading to the formation of conceptual framework for the study. The theoretical literature comprised of theories on financing such as cash flow theory, financial investment theory, liquidity preference theory, trade off theory and pecking order theory. The justifications for these theories were provided in this chapter. The empirical literature was done in congruence with the research questions that touched on issues related to how and the extent to which working capital management practice and liquidity management practices affect business performance among SMEs. The empirical literature also discussed the literature on how and the extent to which sources of finance such as equity, debt, family and friends and own savings affect profitability and expansion in the client base. The challenges affecting SMEs in working capital, liquidity management and financing are examined. The chapter ended with a conceptual framework and chapter summary.

4.2 PECKING ORDER THEORY

This section presents literature on the pecking order theory regarding its application, critique and justification for the study.

4.2.1 Application of the pecking order theory

The pecking order theory was proposed by Myers and Majluf (1984). The pecking order theory suggests that firms have a preferred hierarchy for financing their investments (Martinez et al., 2019). According to this theory, firms first use their internally generated

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funds, such as retained earnings, to finance their projects. This is the most desirable source of financing as it does not involve any costs or obligations to external parties (Martinez et al., 2019). If internally generated funds are insufficient or unavailable, firms then turn to debt financing. Debt can be obtained through bank loans or issuing corporate bonds. Debt financing allows firms to leverage their existing assets and cash flows to secure the necessary capital (Adair & Adaskou, 2015). However, it comes with the obligation to repay the borrowed amount and interest, increasing the financial risk for the firm. Equity issuance, such as selling shares or seeking investments from external investors, is considered the last resort for firms under the pecking order theory (Adair & Adaskou, 2015). This is because equity financing dilutes ownership and control of existing shareholders and can be costly in issuing fees and potential dividend obligations. The preference for internal funds, followed by debt and then equity, is driven by the rationale that managers prefer to maintain control over the firm and avoid the costs and obligations associated with external financing (Qureshi et al., 2015). However, it is important to note that the application of the pecking order theory may vary depending on the specific circumstances and financial needs of each firm (Qureshi et al., 2015).

4.2.1.1 Critique of the pecking order theory

The pecking order theory is criticised for its inability to deal with the problem of information asymmetry that SMEs may encounter when making financing decisions (Bessler, Drobetz & Gruninger, 2011). Information asymmetry occurs when there is an imbalance of information between two parties, such that one enjoys a competitive advantage over the other because they have more information than the other party (Bessler et al., 2011). As a result of the information asymmetry, external sources of finance, such as financial institutions, tend to demand higher interest rates on loans given to SMEs to compensate for higher risk (Leary & Roberts, 2010). In this regard,

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in applying the pecking order theory, internal financing can limit information asymmetry only when SMEs have financial strength from their retained earnings. Thus, since most SMEs struggle with making high profits, they are more exposed to higher interest rates due to information asymmetry when accessing funds from external sources such as financial institutions.

4.2.1.2 Justification for the use of the pecking order theory in the study

The pecking order theory is relevant to this current study because it could be used to explain SMEs' financial decisions and manage their finances. Again, the pecking order theory could be used to explain reasons why the choice of a particular source of financing for SMEs (retained earnings, debt or equity) as these sources of financing have implications for their financial performance. SMEs can also adjust their investment plans based on the principles of pecking order and then use a form of borrowing ratio to achieve their funding policy (Chimucheka & Mandipaka, 2015). Thus, in taking investment decisions, SMEs can have a ranking system based on their borrowing ratio and decide to use retained earnings, debt or equity to invest in their business.

That is to say that as 3D printing firms in the SME sector in South Africa seek access to funds to expand their businesses and carry out projects that will enhance their profitability, through the application of financial management practices, they will seek cost-effective funding sourcing, before moving to the expensive funding sources. This is because 3D printing firms in the SME sector in South Africa will ensure that their funding sources do not negatively affect their firm performance, especially in terms of their profitability levels in both the short and long run since the 3D printing industry continues to expand with new opportunities. Thus, taking the right financial decision in the correct order of preference will put SMEs in the 3D printing industry in South Africa

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in a better position to make good use of the opportunities that the industry presents to them both in the short and long run.

4.2.2 Free cash flow theory

According to the free cash flow theory, as proposed by Jensen (1987), managers of firms are encouraged to maintain a cash reserve in the form of a buffer to exercise a higher degree of control over the distribution of cash in the firm. It is reasonable to assume that managers who can use 'cost-free' financial resources to finance the expansion of their firms are more likely to misappropriate those funds. This is because managers are more likely to invest in projects that would improve their personal remuneration and power (Jensen, 1987). Because of the continued expansion of the business, there is a chance that senior management will exercise their discretionary spending authority to a greater degree (Buus, 2015).

The advantages of the free cash flow theory include the notion that maintaining a cash buffer allows managers to have flexibility in pursuing investment opportunities and weathering financial downturns (Toumeh et al., 2020). It also safeguards against external shocks and allows for strategic decision-making without being overly constrained by immediate financial needs (Afiezan et al., 2020). However, there are also potential disadvantages to this theory. Accumulating excess cash reserves may lead to suboptimal utilisation of resources and missed investment opportunities (Nguyen & Nguyen, 2018). It can result in the agency problem, where managers prioritise their own interests over those of shareholders, potentially leading to inefficiency and reduced profitability. Furthermore, excessive cash holdings can reduce the firm's ROI and increase the cost of capital (Dewi et al., 2019).

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Relating the theory to 3D printing SMEs in South Africa, it can be argued that these SMEs may face challenges in managing their cash flows effectively. Due to limited financial resources, SMEs must carefully allocate funds to drive business growth. Excessive cash reserves may not be viable for most 3D printing SMEs, as they must invest in technology, research and development, and marketing efforts to stay competitive. However, having some level of cash reserves can provide stability and security in uncertain market conditions. The key lies in balancing between maintaining a cash buffer and utilising available funds to pursue growth opportunities. Effective cash flow management and monitoring mechanisms are crucial for 3D printing SMEs to avoid the pitfalls associated with the misappropriation of funds and ensure the optimal utilisation of resources for sustainable growth and profitability.

4.2.3 The trade-off theory

The trade-off theory of capital structure was proposed by economists Franco Modigliani and Merton Miller in the 1950s and 1960s. This theory suggests that firms face a trade-off when deciding on their capital structure, weighing the benefits and costs associated with debt financing (Abel, 2018). The key elements of the trade-off theory include determining the optimal capital structure, considering the trade-off between debt and equity, and incorporating factors such as taxes, bankruptcy costs, and agency costs (Serrasqueiro & Caetano, 2015).

The trade-off theory offers several advantages. First, debt financing provides tax advantages as interest payments are tax-deductible, leading to potential tax savings for firms (Florackis et al., 2015). Second, debt is often a cheaper source of financing compared to equity, especially when interest rates are low, which can result in a lower overall cost of capital (Alzoubi, 2018). Third, debt financing offers flexibility to firms in managing their capital structure by adjusting the debt level based on their specific

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needs (Alipour et al., 2015). Lastly, the trade-off theory suggests that increasing the proportion of debt in the capital structure can result in a leverage effect, where returns to equity shareholders are magnified, potentially enhancing shareholder value (Reinartz & Schmid, 2016).

However, the trade-off theory also faces criticisms. One criticism is that the theory relies on simplifying assumptions, such as perfect capital markets and rational behaviour, which may not hold in real-world scenarios (Daw et al., 2015). Additionally, the theory does not fully address agency costs associated with debt financing, such as conflicts of interest between shareholders and bondholders. It assumes that firms can time the market accurately and adjust their capital structure accordingly, which may not always be feasible in practice (Aggarwal & Padhan, 2017).

The trade-off theory is justified for this study because it suggests that 3D printing SMEs can make informed decisions regarding the mix of debt and equity financing to balance tax advantages, cost of capital, and flexibility. By considering factors such as interest expenses, tax implications, and potential financial distress costs, 3D printing SMEs can optimise their capital structure and effectively manage working capital. This, in turn, can contribute to improved firm profitability by minimising financing costs, leveraging tax benefits, and maintaining adequate liquidity levels for smooth operations.

4.2.4 Liquidity preference theory

John Maynard Keynes (1989) proposed the liquidity preference theory. This theory proposes that investors should demand a higher interest rate or premium on securities with long-term maturities that carry greater risks since, all other factors being equal, investors prefer cash or other liquid holdings (De Carvalho, 2015). According to the liquidity preference theory, investors are more interested in higher premiums on

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medium- and long-term securities than short-term ones (Lavoie & Reissl, 2019). This is because investors want their investments to have a high level of liquidity (Appelt, 2016). According to the liquidity preference theory, there are lower interest rates on short-term securities than on medium- or longer-term securities because investors are not interested in sacrificing their liquidity for more extensive time frames (Appelt, 2016).

According to Keynes (1989), three motives determine the demand for liquidity: transactions, precautionary and speculative motives. According to the transactions motive, organisations prioritise liquidity because it ensures they always have sufficient cash to cover their daily requirements (De Carvalho, 2015). In other words, stakeholders have a high demand for liquidity to meet their short-term financial obligations, such as paying their mortgage or rent (Culham, 2020). The precautionary motive refers to an organisation's preference for additional liquidity if an unexpected problem or cost arises that requires a significant outlay of cash (Appelt, 2016). These occurrences include unanticipated costs such as repairing broken machinery. It is also possible for organisations to have a speculative motive (Culham, 2020). When interest rates are low, there is a high demand for cash, and people may choose to hold onto their assets until interest rates rise again (Koutsobinas, 2022). The speculative motive is the reluctance of an investor to tie up investment capital for fear of missing out on a better opportunity in the future (Asensio, 2020).

The liquidity preference theory, proposed by John Maynard Keynes, offers several advantages. Firstly, it explains interest rate determination by considering the supply and demand for money and investors' preference for liquidity (Rezende, 2015). By incorporating these factors, the theory offers insights into the dynamics of interest rate fluctuations. It also helps to understand how changes in liquidity preferences can impact the overall interest rate environment (Rezende, 2015). Secondly, the theory emphasises the behaviour and preferences of investors, particularly their desire for

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liquidity (Bonizzi & Kaltenbrunner, 2020). It recognizes that investors are risk-averse and generally prefer holding liquid assets over less liquid ones. This aspect adds a psychological dimension to interest rate analysis, acknowledging the role of sentiment and uncertainty in financial markets (Bonizzi & Kaltenbrunner, 2020).

However, the liquidity preference theory also has some disadvantages. Firstly, it relies on simplifying assumptions, such as a single interest rate and homogeneous expectations among investors (Brady, 2018). These assumptions may not fully capture the complexities and heterogeneity of real-world financial markets, limiting the theory's ability to provide accurate predictions and explanations. The theory may oversimplify the dynamics of interest rate determination (Brady, 2018). Secondly, critics argue that the liquidity preference theory neglects the role of market forces (Ghani & Hossain, 2023). It does not fully consider factors such as credit risk, liquidity risk, or market sentiment that impact interest rates and financial market dynamics (Ghani & Hossain, 2023). The theory focuses primarily on the short-term determination of interest rates and may not provide a comprehensive understanding of the long-term dynamics of financial markets (Ghani & Hossain, 2023).

In the context of 3D printing SMEs in South Africa, the liquidity preference theory offers insights into their financing and liquidity management decisions. These SMEs prioritise liquidity to meet their day-to-day financial obligations, including payroll, raw material purchases, and supplier payments. The liquidity preference theory highlights the transactions, precautionary and speculative motives driving the demand for liquidity. For 3D printing SMEs, maintaining sufficient liquidity is crucial for smooth operations and addressing unforeseen costs. Adhering to the transaction motive ensures they have enough cash to meet short-term requirements. Additionally, the precautionary motive encourages them to hold extra liquidity to handle unexpected expenses, such as equipment breakdowns. The speculative motive suggests that SMEs may retain

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liquidity during periods of low-interest rates, waiting for better investment opportunities. These SMEs can make informed financing and liquidity management decisions considering the liquidity preference theory. Balancing short-term obligations with long-term growth goals becomes essential. Understanding the liquidity preferences of investors and lenders also helps attract external capital. By aligning financing needs with investor preferences, SMEs can optimise their liquidity position and ensure stability.

4.3 WORKING CAPITAL MANAGEMENT AND BUSINESS PERFORMANCE

According to Kasozi (2017), empirical literature indicates that the efficient management of accounts receivable is a vital component of working capital management for companies operating in diverse industries. Research has indicated that implementing more stringent credit policies has the potential to enhance the profitability of companies (Kasozi, 2017). Firms can enhance their financial performance by minimising accounts receivable and proactively managing customer debt, which helps to mitigate the risk of bad debt and collection difficulties (Lamptey et al., 2017). In addition, the act of reducing the credit period has the potential to expedite cash inflows and enhance liquidity. This, in turn, enables companies to fulfil their financial commitments and pursue investment prospects for growth (Dudley, Andren & Jankensgard, 2022). This approach can also assist in reducing the administrative expenses related to credit management, including allocating resources for credit evaluation, monitoring, and collection processes (Dudley et al., 2022). Organisations can allocate their resources effectively by optimising credit-related processes and prioritising core business functions, enhancing productivity and profitability (Hofmann et al., 2022). Furthermore, an effectively administered accounts receivable function enhances customer relationships by facilitating prompt payments and mitigating potential disputes or delays (Singh et al., 2021).

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The empirical literature provides additional support for the importance of policy formulation in working capital management, emphasising its influence on profitability (Alshatti, 2015). According to Alshatti (2015), organisations that have clearly defined working capital policies, which encompass credit management, have been observed to exhibit greater levels of profitability. Implementing effective working capital policies has been correlated with increased profitability and stock returns (Iqbal & Zhuquan, 2015). The aforementioned findings underscore the significance of implementing well-defined policies and guidelines to maximise working capital and improve financial performance (Iqbal & Zhuquan, 2015).

Research has demonstrated that implementing efficient cash flow management practices can significantly enhance overall profitability. Research has revealed a notable correlation between cash conversion cycles and profitability, suggesting that a reduction in cash conversion cycles is associated with increased profitability (Linh & Mohanlingam, 2018). Finance officers with advanced skills are essential in optimising working capital and cash flow, as they contribute to efficient management practices that ultimately result in improved profitability (Rosenbaum & Pearl, 2021). Financial analysis and risk management practices are integral to effective working capital management. According to Zietlow et al. (2018), companies that adopt enhanced financial analysis and risk management strategies typically exhibit reduced levels of investment in working capital and increased profitability. This underscores the significance of proficient finance professionals who recognise potential risks, such as credit defaults, inventory obsolescence, and liquidity constraints, and execute suitable strategies to mitigate these risks and bolster profitability (Zietlow et al., 2018).

The timely delivery of products or services is widely acknowledged as a crucial element in ensuring customer satisfaction. It has been consistently observed to substantially influence customer loyalty and the likelihood of repeat business (Meesala & Paul,

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2018). The empirical literature provides evidence that effective working capital management, particularly inventory levels, is of utmost importance for 3D printing companies. This is necessary to guarantee the availability of materials or components for timely production and delivery. Ensuring optimal inventory levels is crucial for preventing stockouts and facilitating prompt fulfilment of customer orders. This practice directly impacts delivery speed and can effectively reduce lead times (Nguyen et al., 2018).

According to recent studies conducted by Song et al. (2020), there is evidence to suggest that efficient inventory management directly contributes to improved customer responsiveness. By implementing effective inventory management practices to optimise working capital, 3D printing companies can ensure the timely fulfilment of customer demands, thereby enhancing customer satisfaction and facilitating the growth of their portfolio. The prompt fulfilment of customer needs contributes to developing customer confidence and trust in the firm's capabilities (Utami, 2015). Customers receiving their orders within the designated timeframe enhances their perception of the company as dependable and proficient in fulfilling its commitments (Utami, 2015).

In addition, there is empirical evidence suggesting that satisfied customers are more inclined to engage in positive word-of-mouth referrals, wherein they recommend the products and services of the firm to others (Barreda et al., 2015). Word-of-mouth referrals play a crucial role in the acquisition of new customers and have the potential to drive sustainable business growth for companies operating in the 3D printing industry. When customers have a positive experience characterised by punctual delivery and exceptional service, they are inclined to become advocates for the company. They willingly share their positive experiences with their networks, which has the potential to attract a continuous flow of new customers (Barreda et al., 2015).

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Empirical studies have consistently shown that customer satisfaction is critical in cultivating customer loyalty and influencing behaviours such as repurchase and referral (Payne & Frow, 2016). The implementation of efficient working capital management and a strong emphasis on customer relationship management are crucial strategies for improving customer satisfaction across diverse industries (Payne & Frow, 2016).

A fundamental element of effective customer relationship management is personalised service and prompt response (Anshari et al., 2019). By implementing proactive strategies to manage working capital and adopting streamlined inventory management practices effectively, organisations can ensure the timely availability of products or services necessary to meet customer demands (Anshari et al., 2019). This capability allows them to provide customised and individualised solutions that cater to the specific requirements and preferences of customers (Soltani & Navimipour, 2016). Firms engage in proactive customer engagement, crucial for building strong relationships, by demonstrating a commitment to understanding customer challenges and promptly responding to them (Soltani & Navimipour, 2016).

To successfully implement customer relationship management, companies must establish efficient communication channels with their customers. By actively listening to customer feedback, effectively addressing their concerns, and providing timely support, companies can effectively showcase their dedication to ensuring customer satisfaction (Payne & Frow, 2016). Two-way communication enables organisations to obtain valuable insights into customer needs, adapt their offerings accordingly, and deliver valuable solutions. This practice not only cultivates trust and loyalty among customers but also generates positive experiences that enhance the probability of customer referrals and recommendations (Payne & Frow, 2016).

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4.4 SOURCE OF FINANCE AND BUSINESS PERFORMANCE

In this section, the empirical literature is provided on how and the extent to which sources of finance such as equity, debt, family and friends, and own savings affect the business performance of SMEs in terms of profitability and increase in client base.

4.4.1 Equity and profitability

Studies have demonstrated that equity financing is vital in providing SMEs with essential capital to support their growth initiatives (Dowling et al., 2019). Notably, research by Beck (2013) indicates that equity financing enables firms to overcome financial constraints, thereby facilitating their pursuit of investment opportunities that contribute to long-term profitability.

Equity financing offers SMEs a range of advantages, including increased financial flexibility. By opting for equity financing, businesses can reduce their reliance on debt and, consequently, their financial leverage (Islam et al., 2019). This reduced dependence on borrowed funds allows SMEs to allocate resources strategically, without the burden of fixed interest and principal payments (Islam et al., 2019). As a result, SMEs can make more informed decisions about resource allocation, focusing on initiatives that foster growth and profitability (Islam et al., 2019).

The evidence from existing literature consistently underscores the significance of equity financing in providing SMEs with vital capital for their growth. Beyond the immediate financial injection, equity financing allows SMEs to allocate resources strategically, unencumbered by fixed debt obligations (Harris, 2015). This financial flexibility empowers businesses to pursue investment opportunities and contribute to long-term profitability. By reducing their financial leverage through equity financing,

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SMEs can unlock their growth potential and enhance their overall financial performance (Harris, 2015).

Research has also consistently highlighted the significant impact of equity investors on SMEs, particularly in terms of driving operational efficiency (Maulana & Rusmita, 2019). Equity financing plays a pivotal role in facilitating innovation within SMEs. Baldock and North's (2015) study provides evidence that equity financing positively affects innovation in small firms. The demands of shareholders for long-term growth encourage SMEs to invest in research and development activities, fostering technological advancement and enabling them to maintain a competitive edge in their respective industries. Equity financing in the 3D printing sector can provide SMEs with the necessary resources to invest in cutting-edge technologies, explore new materials, and enhance their product offerings.

Furthermore, equity financing offers SMEs access to shareholders' expertise and networks, which can prove highly beneficial. As Dasilas and Papasyriopoulos (2015) highlight, shareholders often bring industry knowledge, business connections, and managerial experience. This wealth of expertise can assist SMEs in penetrating new markets, forging strategic partnerships, and expanding their customer base (Dasilas & Papasyriopoulos, 2015).

4.4.2 Debt and profitability

The study conducted by Boadi et al. (2017) highlights the importance of debt financing in supporting the growth and profitability of SMEs. This research highlights the significance of debt as a beneficial resource for SMEs in acquiring additional capital for purposes such as investment, expansion, and technological advancements.

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Debt financing offers SMEs a means to obtain the required capital for various growth endeavours. They can enhance their operations and capitalise on market opportunities by acquiring capital through borrowing. This capital infusion enables them to invest in various areas, such as new equipment, infrastructure, and research and development, facilitating their expansion (Obuya, 2017).

Debt financing presents numerous advantages for SMEs. First and foremost, this approach enables businesses to utilise their current assets and anticipated cash flows to obtain funding while preserving ownership and control without dilution. This can be especially advantageous for SMEs with valuable assets but face constraints in obtaining equity financing (Wasiuzzaman & Nurdin, 2019). In addition, debt financing can serve as a motivating factor for SMEs to enhance their operational efficiency and profitability. According to Githaigo and Kabiru (2015), debt obligations promote disciplined financial management and the implementation of strategic decision-making. SMEs are driven by the desire to generate adequate cash flows to meet their debt obligations and interest payments. This motivation often leads them to focus on streamlining operations, optimising costs, and enhancing overall performance (Githaigo & Kabiru, 2015).

It is crucial to acknowledge that debt financing presents significant opportunities; however, SMEs must exercise caution in effectively managing their debt levels and the associated risks (Abbasi et al., 2017). The accumulation of substantial debt can lead to significant financial challenges and restrict their ability to adapt to economic uncertainties. Hence, it is advisable for SMEs to carefully manage the allocation of debt and equity financing while considering their growth objectives, cash flow projections, and risk tolerance (Abbasi et al., 2017). The research conducted by Worokinasih and Potipiroon (2019) provides valuable insights into the importance of creditworthiness and debt payments in obtaining future financing for companies. The importance of

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meeting debt obligations and maintaining a positive credit score is underscored by Worokinasih and Potipiroon (2019), as they highlight the significance of these factors in enabling firms to secure favourable financing terms and access additional funding. In the ever-evolving realm of the 3D printing industry, upholding a favourable credit history is paramount. The industry is distinguished by swift technological advancements and market uncertainties, which require a constant need for capital to support growth and innovation.

According to the research conducted by Osano and Languitone in 2015, a company's credit history plays a crucial role in determining its capacity to secure funding for innovation and expansion. Lenders and investors evaluate a company's creditworthiness and financial track record to assess its ability to manage risks and generate returns effectively. Positive credit history can significantly improve a company's reputation and credibility, thereby increasing its likelihood of obtaining financing under favourable conditions (Osano & Languitone, 2015). However, it is important to note that a negative credit history arising from an inability to fulfil financial obligations can impede a company's ability to secure future funding and restrict its growth potential (Osano & Languitone, 2015).

Engaging in meticulous financial management and ensuring prompt repayment of debts is essential to uphold a favourable credit history. Companies can showcase their capacity to responsibly handle financial commitments by meeting debt obligations. Establishing trust with lenders and enhancing the firm's creditworthiness are key factors facilitating access to future financing opportunities (Calabrese et al., 2022). In addition, companies that possess a favourable credit history are more inclined to attract prospective investors and strategic partners. Investors and partners actively search for dependable and credible entities to establish collaborations. A firm's credit history is a crucial factor that indicates its financial stability and reliability (Calabrese et al., 2022).

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4.4.3 Family and friends and profitability

The research by Nguyen et al. (2022) demonstrates the importance of informal financing for small enterprises, particularly from sources such as family and friends. Informal financing arrangements, such as obtaining loans from personal connections, present numerous benefits for small businesses. First and foremost, they allow SMEs to access capital quickly, especially when traditional financing options may be restricted or time-consuming (Mpofu & Sibindi, 2022). Individuals with personal relationships with SME owners, such as family and friends, often are more willing to provide timely financial assistance. This support is typically offered without the bureaucratic procedures and stringent requirements commonly associated with formal lenders (Mpofu & Sibindi, 2022). Furthermore, informal financing arrangements provide flexibility concerning repayment terms and conditions. According to Mungiru and Njeru (2015), individuals may find that their family and friends are more receptive and flexible when it comes to negotiating loan conditions, such as interest rates and repayment schedules. The flexibility of this financing arrangement enables SMEs to customise it according to their specific requirements, offering them enhanced financial flexibility (Mungiru & Njeru, 2015).

Additionally, a study by Allen et al. (2019) emphasises that informal financing provides SMEs with non-financial advantages. Entrepreneurs can benefit significantly from financial support from their family and friends, as it often provides them with access to invaluable advice, guidance, and industry connections. The close rapport between SME owners and their informal lenders facilitates transparent communication, mentorship opportunities, and the exchange of valuable knowledge. The provision of non-financial support can be highly valuable, especially for SMEs, as they navigate the complexities of their specific industries (Allen et al., 2019). Building upon the significance of informal financing, it is noteworthy that these arrangements can also cultivate trust and accountability within interpersonal connections (Forkuoh et al.,

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2015). Seeking financial assistance from family and friends often involves a sense of mutual support and shared objectives. SME owners may have an increased sense of obligation to fulfil their financial obligations to uphold the trust and positive reputation of their informal lenders (Forkuoh et al., 2015).

When it comes to financing small businesses, relying exclusively on personal connections, such as family and friends, may pose limitations in accessing significant funding. The study conducted by Adebisi et al. (2015) emphasises that individuals within one's personal network, such as family and friends, frequently possess limited financial means. Consequently, these resources may not prove adequate to fulfil the financial needs of SMEs operating across different sectors. Although personal networks can offer financial assistance, their ability to provide significant capital may be limited (Adebisi et al., 2015). A significant contributing factor to the constrained financial capacity of family and friends is their individual financial obligations and limitations. Individuals may have personal financial obligations, such as mortgages, education expenses, or retirement savings, that can limit the amount of capital they can invest in a business endeavour (Khan, 2015). According to Khan (2015), it is important to note that family and friends frequently encounter their own financial limitations, which can pose difficulties in offering substantial financial support to SMEs.

A lack of adequate financial support from family and friends can substantially affect small businesses. Insufficient capital can pose challenges for SMEs in scaling up their operations, investing in new technologies, expanding their market reach, and pursuing growth opportunities (Amornkitvikai & Harvie, 2018). A lack of adequate funds can impede an organisation's capacity to capitalise on market opportunities, foster the creation of innovative products or services, and sustain competitiveness within their respective industries. In conclusion, these limitations can potentially affect profitability and impede long-term sustainability (Amornkitvikai & Harvie, 2018).

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4.4.4 Own savings and profitability

SMEs can derive several advantages that can enhance their profitability by utilising their own savings (Abbasi et al., 2017). One significant advantage is avoiding the financial burdens of interest payments and dividend obligations commonly associated with external financing. By utilising internal financing, SMEs can mitigate the expenses and financial obligations associated with servicing debt or disbursing dividends to external stakeholders (Abbasi et al., 2017). The pecking order theory, which emphasises the preference for internal financing over external financing, aligns with this concept. Based on the aforementioned theory, it is recommended that SMEs prioritise utilising internal resources, such as personal savings, before considering external financing alternatives (Agyei et al., 2020). This approach effectively mitigates the expenses and intricacies linked to external financing, encompassing interest rates, collateral prerequisites, and the potential for ownership dilution. According to Agyei et al. (2020), SMEs can exert more control over their operations and financial decisions by prioritising internal financing.

The research conducted by Baker et al. (2020) presents empirical findings that support the idea that SMEs that rely on internal financing, as opposed to external debt, tend to experience greater profitability. By mitigating the encumbrance of debt obligations, SMEs can effectively allocate their cash flow towards essential business functions, including operations, marketing, and capital investments. The improved cash flow can positively affect profitability by supplying the essential resources required for growth and expansion (Baker et al., 2020). Moreover, a study by Khan and Anuar in 2018 indicates that SMEs with greater internal funds tend to allocate more of their profits towards strategic initiatives such as research and development, marketing, and capital investments. These investments are instrumental in promoting competitiveness, driving innovation, and ensuring sustained profitability in the long run. SMEs can enhance their overall success by utilising their own savings to allocate funds towards value-creating

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activities (Khan & Anuar, 2018). However, it is imperative to acknowledge that depending exclusively on internal financing may not always be viable or adequate for all SMEs. The availability of internal funds may differ based on the financial capability of the business owners or the stage of business development (Omondi & Jagongo, 2018). In certain instances, the acquisition of external financing may become imperative to facilitate substantial investments or capitalise on growth prospects that exceed the capacity of internal funds (Omondi & Jagongo, 2018).

4.4.5 Equity and growth in client base

Equity financing enables SMEs to acquire the necessary capital to expand their product lines, diversify their offerings, and enter new markets (Baldock & Mason, 2015). Implementing these growth initiatives is of utmost importance for SMEs to effectively attract new customers, expand their market presence, and enhance their overall competitiveness. SMEs can establish a competitive advantage and generate value for their intended customer base by allocating resources towards product development, innovation, and marketing initiatives (Baldock & Mason, 2015). Additionally, the research conducted by Wijetunge (2016) underscores the significance of external equity investment in facilitating SMEs to invest in enhancing customer service. By strategically investing capital in initiatives to improve customer experiences and satisfaction, SMEs can effectively cultivate robust relationships with their current customer base while attracting new customers. Positive customer experiences not only have the potential to foster customer loyalty but also can generate positive word-of-mouth recommendations, which can significantly impact their growth and success. (Wijetunge, 2016).

Equity financing provides SMEs with a range of benefits beyond mere financial resources. Furthermore, it is important to note that this collaboration offers

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supplementary advantages, including specialised skills, an extensive understanding of the industry, and valuable professional connections (Boaz et al., 2018). Equity investors frequently contribute valuable insights and experiences derived from their entrepreneurial or managerial backgrounds. The participation and guidance of subject matter experts can assist SMEs in effectively addressing obstacles, making well-informed strategic choices, and recognising potential avenues for expansion (Boaz et al., 2018). In addition, equity financing offers enhanced financial flexibility in comparison to debt financing. In contrast to debt, equity financing does not entail fixed financial obligations such as regular interest payments and principal repayments (Alipour et al., 2015). The flexibility provided by this approach allows SMEs to efficiently allocate resources towards strategic initiatives without being constrained by fixed financial commitments. As a result, they can focus on pursuing long-term growth and profitability, as highlighted by Alipour et al. (2015).

The study by Eldridge et al. (2021) highlights the considerable importance of strategic investors in SMEs by virtue of their expertise and industry connections. Strategic investors bring valuable resources to the table, including extensive industry networks and knowledge. This can be advantageous for SMEs as it allows them to tap into new customer bases and broaden their market presence (Eldridge et al., 2021). By leveraging these networks, SMEs can acquire valuable insights regarding target markets, customer preferences, and emerging trends. According to Fraser et al. (2015), this data enables them to enhance their marketing strategies and successfully engage with prospective customers. Furthermore, the research conducted by Kele et al. (2017) underscores the significant importance of strategic investors in offering valuable guidance and mentorship to SMEs. Strategic investors frequently possess extensive industry experience and knowledge, and their expertise can be extremely valuable to SMEs (Kele et al., 2017). They can provide expert advice on a wide range of business aspects, such as devising effective customer acquisition strategies,

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identifying growth opportunities, and implementing industry best practices. According to Kele et al. (2017), strategic investors can provide valuable mentorship to SMEs. This mentorship can assist them in effectively navigating various challenges, recognising and taking advantage of growth opportunities, and making well-informed decisions.

4.4.6 Debt and growth in client base

The significance of debt financing in bolstering the marketing endeavours of SMEs, as highlighted by Aminu and Shariff (2015), should not be underestimated. Debt financing enables SMEs to secure the required capital for investing in a range of marketing activities, including advertising campaigns, digital marketing strategies, and promotional initiatives. By strategically investing capital into marketing initiatives, SMEs can significantly improve their brand visibility, effectively attract new customers, and ultimately expand their customer base (ElDeeb et al., 2021). The research conducted by Civelek et al. (2020) provides additional support for the correlation between debt financing and technological advancements/product innovation. Debt capital enables SMEs to allocate funds towards research and development, technological advancements, and the creation of new products (Civelek et al., 2020). By utilising debt financing, SMEs can optimise their 3D printing solutions, provide innovative products, and effectively address the changing demands of their target clientele. This strategic positioning establishes them as prominent figures within the industry and empowers them to secure a competitive edge in the market.

Furthermore, a study by Mazanai and Fatoki (2011) highlights the favourable influence of debt financing on customer service enhancement. Debt capital can be strategically allocated to improve customer support systems, optimise internal processes, and invest in technology that enables personalised and efficient customer experiences (Mazanai & Fatoki, 2011). By emphasising enhancing customer service, SMEs can

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significantly improve customer satisfaction levels, generate positive word-of-mouth recommendations, and cultivate a sense of loyalty among their customer base (Fatoki & Asah, 2011). Satisfied customers are more inclined to repeat purchases and promote the products or services the SME offers. This, in turn, contributes to the long-term growth and success of the business (Fatoki & Asah, 2011).

According to Ohman and Yazdanfar (2017), the study indicates that elevated debt levels may restrict the capacity to invest in growth-oriented endeavours, such as marketing and product expansion. When SMEs have considerable repayment obligations related to debt financing, a notable portion of their financial resources may be dedicated to fulfilling these obligations. As a result, there may be reduced availability of funds for customer acquisition endeavours (Ohman & Yazdanfar, 2017). According to the research conducted by Ding et al. (2017), it has been observed that elevated debt levels can adversely affect the capacity of SMEs to improve customer service and fulfil customer requirements. They may face constraints in making essential investments in technology, training, and customer support systems due to their limited financial resources resulting from high levels of debt (Ding et al., 2017). Consequently, SMEs may encounter difficulties in attracting and retaining customers due to their potential inability to meet the changing expectations of customers and deliver the necessary level of service to effectively compete in the market (Ding et al., 2017).

It is crucial to consider the equilibrium between debt financing and the allocation of resources towards customer acquisition and service enhancements (Block et al., 2018). Debt can serve as a means for SMEs to acquire vital funds; however, they must exercise prudent management of their debt levels to prevent excessive strain on their financial resources. SMEs must find a harmonious equilibrium between their debt responsibilities and investments in marketing, technology, and customer support. This balance is essential to effectively attract new customers, improve customer

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satisfaction, and maintain sustainable long-term growth, as highlighted by Block et al. (2018).

4.4.7 Family and friends and growth in client base

The research by Boudreaux et al. (2021) emphasises the significant role that family and friends play in offering financial resources to entrepreneurs, especially in the initial phases of business development. Informal funding sources are frequently more easily accessible and involve fewer creditworthiness procedures than formal financing alternatives, such as bank loans or venture capital (Boudreaux et al., 2021). Family and friends' importance extends beyond providing financial assistance exclusively. Additionally, their participation in various facets, such as marketing campaigns, can contribute to the expansion and achievement of SMEs (Abbasi et al., 2017). This discovery is consistent with previous research highlighting the significance of social networks and word-of-mouth marketing in entrepreneurial pursuits (Abbasi et al., 2017).

The networks and connections of family and friends can be utilised as valuable resources for SMEs to reach potential customers and enhance their client base effectively. Utilising these relationships can assist entrepreneurs in accessing untapped markets, acquiring referrals, and establishing brand recognition (Nielsen, 2020). The trust and familiarity associated with close relationships can amplify the efficacy of word-of-mouth marketing, as recommendations from acquaintances are frequently regarded as more dependable and impactful (Nielsen, 2020). Furthermore, the participation of family and friends in providing support to SMEs goes beyond mere financial contributions. Professionals can offer valuable insights, guidance, and advice from their personal experiences or expertise within pertinent industries (Udomkit & Schreier, 2017). The expertise and assistance professionals provide can be

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instrumental in helping entrepreneurs make well-informed decisions, effectively navigate challenges, and capitalise on growth opportunities (Udomkit & Schreier, 2017).

4.4.8 Own savings and growth in client base

The research conducted by Morgan and Pontines (2018) demonstrates the significance of financial stability for SMEs. This stability enables them to effectively navigate economic downturns, take advantage of growth prospects, and attract prospective clients. SMEs' ability to access their own savings grants them a heightened level of authority over their financial assets. Consequently, this autonomy yields various benefits (Omondi & Jagongo, 2018). First and foremost, it offers a financial buffer that can assist them in navigating through periods of uncertainty. Economic fluctuations or unforeseen challenges can potentially affect the cash flow of businesses. However, adequate internal savings allows SMEs to sustain stability and operations without relying exclusively on external sources of financing (Jorda et al., 2016). Additionally, using personal savings enables SMEs to strategically allocate funds towards critical areas such as marketing initiatives, product advancement, and customer acquisition. It is essential to allocate funds from personal savings towards marketing initiatives to attract new clients and expand the customer base (Nassr & Wehinger, 2016). According to a study conducted by Zeebaree and Siron (2017), a positive correlation exists between higher marketing expenditures and sales growth and the expansion of the customer base. By allocating resources towards marketing initiatives, SMEs can augment their brand's visibility, expand their target audience, and solidify their standing as reputable participants within the market (Zeebaree & Siron, 2017).

According to the study by Kijkasiwat (2021), it was determined that internal funds offer SME owners a higher level of control over investment decisions, resulting in enhanced

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business performance. This control allows owners to capitalise on growth opportunities that external financiers may not recognise, thereby allowing them to strategically align investments with their specific objectives and market conditions (Kijkasiwat, 2021). In their seminal work, Myers and Majluf (1984) put forth the pecking order theory to advocate for the merits of internal financing. This theory posits that businesses prefer to utilise internal funding sources, such as their own savings, to retain control and mitigate the challenges posed by information asymmetry commonly associated with external financing. SMEs can enhance their decision-making authority and effectively allocate funds based on their unique needs and growth strategies by utilising their own savings. This approach enables them to optimise resource utilisation and achieve better business outcomes (Kuruppu & Azeez, 2016).

In addition, the flexibility provided by personal savings is especially advantageous in industries characterised by rapid technological advancements and evolving customer demands (Sima et al., 2020). SMEs' ability to access their savings enables them to adapt to emerging trends promptly, invest in new technologies, and pursue innovative business opportunities. The flexibility demonstrated by the organisation enhances its capacity to attract new clients by proactively addressing evolving customer needs and staying ahead of industry trends (Sima et al., 2020).

4.5 Liquidity management practices and business performance

In a study conducted by Smirat and Yousef (2016), it was found that a positive correlation exists between cash flow management and the profitability of SMEs. The study revealed that implementing effective cash flow management strategies, such as closely monitoring cash inflows and outflows, reducing the collection time for receivables, and efficiently managing payables, can significantly enhance profitability (Smirat & Yousef, 2016).

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The importance of precise cash flow forecasting, as highlighted by Uwonda and Okello (2015), cannot be overstated. It significantly contributes to improved decision-making and mitigates the potential for financial difficulties. SMEs can enhance their resource allocation, make well-informed investment choices, and reduce their dependence on expensive external financing by gaining a comprehensive comprehension of future cash flows (Uwonda & Okello, 2015). In addition to cash flow forecasting, SMEs must consider inventory management. The significance of accurately forecasting cash flows to optimise inventory levels is emphasised by Katehakis et al. (2016). SMEs can enhance their profitability by effectively managing their inventory levels in accordance with projected cash flows. This strategic approach enables them to prevent stockouts and reduce carrying costs, ultimately leading to positive financial outcomes. Implementing efficient inventory management strategies enables SMEs to enhance their working capital utilisation and operational effectiveness and promptly fulfil customer demands (Katehakis et al., 2016).

In addition, SMEs can implement strategies that encourage timely customer payment, as Soboleva et al. (2018) proposed. Providing incentives for early settlement or imposing penalties for delayed payment serves as a means to motivate customers to make timely payments, thereby fostering a reliable and steady cash flow. By effectively managing their cash flow, SMEs can minimise their reliance on expensive external financing, enhance their liquidity, and optimise their profitability (Soboleva et al., 2018). Numerous studies have provided evidence regarding the significance of maintaining sufficient cash reserves to address unexpected declines in revenue and unforeseen expenses (Calabrese, 2018). As exemplified by the research conducted by Bassey et al. (2016), it is emphasised that effective liquidity management plays a critical role for SMEs. This practice enables them to fulfil their short-term financial obligations and successfully navigate various financial challenges. Empirical evidence shows that maintaining cash reserves is a risk mitigation strategy for SMEs and enables them to

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effectively navigate financial shocks and sustain stability even under challenging circumstances (Bassey et al., 2016). According to Martinez-Sola et al. (2018), companies that maintain higher levels of cash reserves demonstrate a greater ability to manage financial risks and mitigate potential distress effectively. SMEs can ensure the uninterrupted operation of their businesses, fulfil their financial responsibilities, and pursue growth opportunities, even in unforeseen circumstances or economic downturns, by maintaining adequate cash reserves (Martinez-Sola et al., 2018).

Financial planning is widely acknowledged as an essential factor in ensuring the profitability of SMEs. Numerous studies have indicated a positive correlation between financial planning and the performance of SMEs (Karadag, 2015). Sound financial planning allows SMEs to establish well-defined financial objectives, create feasible budgets, and effectively distribute resources. This, in turn, enhances the overall profitability of the organisation (Karadag, 2015). Effective cash flow management is a crucial aspect of financial risk management for SMEs (Crovini et al., 2021). Effective cash flow management is essential for mitigating the potential of financial distress, decreasing reliance on external funding, and enhancing overall financial performance (Crovini et al., 2021).

Empirical research has demonstrated the importance of efficient liquidity management for SMEs in promptly meeting customer demands and ensuring customer satisfaction (Majakusi, 2016). According to a study conducted by Edem (2017), it was determined that effective liquidity management plays a vital role in facilitating SMEs to fulfil customer demands promptly. By effectively managing cash flow and working capital, SMEs can strategically allocate funds to procure raw materials, optimise production processes, and ensure timely fulfilment of customer orders. According to Akinwumi et al. (2017), implementing this solution allows SMEs to effectively decrease lead times, enhance operational efficiency, and improve overall customer satisfaction.

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In a similar vein, the empirical research conducted by Ramachandran and Neelakrishnan (2017) has shed light on the favourable influence of cash flow management on the punctuality of delivery performance within SMEs. The study findings indicate that implementing efficient cash flow management practices is crucial in ensuring the prompt delivery of products or services to customers. The prompt delivery of goods or services contributes to increased customer satisfaction and plays a pivotal role in fostering strong customer relationships. This, in turn, can result in repeat business and the potential for customer referrals (Ramachandran & Neelakrishnan, 2017).

In addition, research conducted by scholars has demonstrated that effective liquidity management positively impacts customer-focused performance outcomes within SMEs. An investigation by Ambroise et al. (2018) revealed a favourable correlation between liquidity management and customer satisfaction. Ambroise et al. (2018) observed that SMEs with effective liquidity management practices are more capable of meeting customer demands, increasing customer satisfaction.

The empirical literature consistently emphasises the importance of marketing investments and efficient liquidity management in acquiring new customers, expanding the customer base, and enhancing profitability for SMEs. The significance of marketing investments in customer acquisition and business growth is underscored in a study by Ware (2015). By strategically allocating resources to targeted advertising, digital marketing campaigns, industry event participation, and promotional activities, SMEs can effectively reach potential customers and enhance customer acquisition efforts. The finding has been consistently supported by empirical research, demonstrating the positive impact of marketing investments on customer acquisition rates and revenue growth in various industries (Ware, 2015).

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In addition, it is important to note that efficient liquidity management plays a crucial role in bolstering marketing endeavours and enhancing overall business performance (Bassey et al., 2016). SMEs can effectively allocate resources towards marketing initiatives, such as advertising and promotional campaigns, and reach their target audience by efficiently managing their cash flow and working capital. According to empirical research, SMEs that implement effective liquidity management practices have been found to possess greater financial resources for marketing endeavours. Consequently, this leads to increased customer acquisition rates and enhanced market performance (Bassey et al., 2016).

4.6 WORKING CAPITAL, LIQUIDITY, AND FINANCE SOURCING CHALLENGES

This section presents literature on the challenges confronted by 3D printing SMEs in managing working capital, liquidity and sourcing finance.

4.6.1 Lack of access to finance

The empirical literature provides valuable insights into the financial challenges faced by 3D printing SMEs, particularly in their efforts to obtain loans or credit from traditional lenders. For instance, a study conducted by Ballard et al. (2018) revealed that traditional lenders, such as banks, exhibited risk aversion towards 3D printing SMEs in the USA. The unfamiliarity of banks with 3D printing technology was identified as a critical factor contributing to their cautious approach (Ballard et al., 2018). In another study, Rayna and Striukova (2021) investigated the specific financial challenges encountered by 3D printing SMEs in France. The research highlighted the limited collateral these SMEs face when seeking loans or credit (Rayna & Striukova, 2021). Unlike traditional manufacturing businesses that possess physical assets, such as machinery or inventory, 3D printing SMEs in the USA primarily rely on intangible

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assets, such as intellectual property and specialised skills (Ahluwalia & Mahto, 2018). This unique characteristic of the 3D printing industry poses challenges when providing tangible collateral, as traditional lenders require (Ahluwalia & Mahto, 2018).

4.6.2 High cost of raw materials

A study by Sasson and Johnson (2016) explores the challenges faced by 3D printing SMEs in managing costs and forecasting production expenses in Norway. The research reveals that the uncertainty and unpredictability of raw material prices pose significant difficulties for SMEs in planning their budgets, accurately estimating project costs, and maintaining profit margins. This is particularly relevant for SMEs operating in dynamic markets with fluctuating demand, such as the 3D printing industry (Sasson & Johnson, 2016). Weller et al. (2015) emphasise the importance of effective cost management strategies, including strategic sourcing, supplier relationships, and inventory management, to mitigate the impact of volatile raw material costs on the financial performance of SMEs in Germany. Moreover, Savastano et al. (2016) support the notion that raw material costs play a critical role in the financial viability of 3D printing SMEs in Italy. The volatility and unpredictability of these costs pose challenges in budgeting, cost estimation, and maintaining profit margins (Li et al., 2017).

4.6.3 Lack of skills and expertise

A study by Hossain et al. (2020) highlighted the scarcity of skilled workers as a significant challenge in successfully integrating these technologies. The study emphasised the limited availability of training programmes and educational resources specific to 3D printing, contributing to a shortage of skilled personnel in the field in Bangladesh (Hossain et al., 2020). Shahrubudin et al. (2020) also assert that scarcity

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of expertise hinders the adoption and effective utilisation of 3D printing technologies, limiting the productivity and competitiveness of SMEs operating in Malaysia.

Supporting this finding, another study by Conner et al. (2015) highlighted the crucial role of skilled personnel in the industry. The study highlighted that the lack of skilled workers in operating and maintaining 3D printers, troubleshooting technical issues, and implementing process improvements adversely affects the productivity and efficiency of SMEs in the USA. This shortage of expertise leads to inefficiencies, quality control issues, and a diminished ability to effectively utilise working capital (Conner et al., 2015).

4.6.4 Marketing and sales challenges

Marić (2020) conducted a study emphasising customers' limited knowledge and understanding regarding 3D printing due to its newness and innovative nature. This lack of awareness poses a marketing challenge for SMEs operating in the 3D printing industry in France (Marić, 2020). Building awareness, trust, and acceptance among potential customers is a crucial task for SMEs operating in the 3D printing industry (Prath, 2021). This process involves addressing scepticism and demonstrating the value and ROI of 3D printing (Prath, 2021). Providing evidence of the benefits, cost savings, and customised solutions that 3D printing can offer through case studies, testimonials, and pilot projects becomes essential (Ben-Ner & Siemsen, 2017).

4.6.5 Equipment maintenance and upgrades challenges

Laplume et al. (2016) focused on the financial hurdles SMEs face when adopting 3D printing technology in the USA. Their research identifies high capital costs as a significant challenge, as smaller businesses may struggle to allocate sufficient financial

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resources for purchasing and upgrading equipment (Laplume et al., 2016). Similarly, Rogers et al. (2016) examined the financial considerations of implementing 3D printing in Germany. Their study highlights the substantial initial investment required for equipment acquisition and the ongoing costs related to maintenance and upgrades (Rogers et al., 2016). Ford and Despeisse (2016) assert that financial burdens can significantly impact the profitability of SMEs, as they may need to allocate a considerable portion of their financial resources to cover expenses on machinery upgrades and repairs.

4.10 Conceptual framework

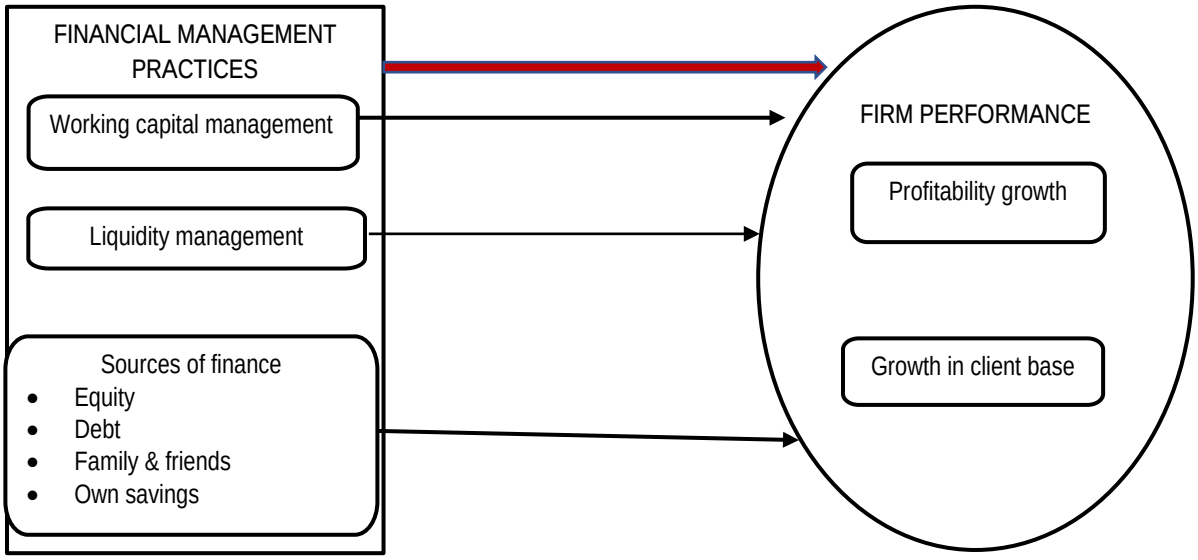

Figure 4.1: Conceptual framework of the study

The conceptual framework of the study shown in Figure 6.1 displays that financial management practices such as working capital management and liquidity management practices have positive implications for firm performance indicators such as profitability and growth in the client base of 3D printing firms in South Africa. Furthermore, the conceptual framework depicts that sources of finance such as equity, debt, family and friends and own savings also have positive implications for profitability and growth in

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the client base of 3D printing firms in South Africa. Previous studies on the challenges of 3D printing SMEs have been conducted in countries such as USA, Germany, Italy, Norway and Bangladesh among others, while South Africa SMEs have not received much attention in research.

The conceptual framework depicted in Figure 6.1 plays a pivotal role in addressing a discernible knowledge gap that has been identified in the existing literature. This literature gap revolves around the lack of comprehensive exploration into the specific financial management practices, sources of finance, and challenges encountered by 3D printing Small and Medium-sized Enterprises (SMEs) in South Africa. Remarkably, previous studies have tended to overlook the intricacies of this particular context, leading to an insufficient understanding of the financial dynamics within the context of 3D printing SMEs in the South African business landscape.

The framework is strategically designed to bridge this knowledge gap by providing a structured and comprehensive elucidation of the relationships between financial practices, sources of finance, and firm performance indicators. Within the unique context of 3D printing firms in South Africa, the framework seeks to uncover and highlight the interconnections and influences of financial decisions on key performance metrics. By doing so, it aims to fill the void in the literature and contribute to a more nuanced understanding of how financial strategies impact the operational landscape of 3D printing SMEs in this specific region.

This targeted approach is crucial for several reasons. Firstly, it recognizes the distinctive nature of the 3D printing industry within the South African context, acknowledging that generic financial models may not adequately capture the challenges and opportunities faced by businesses in this sector. Secondly, by focusing on financial management practices, sources of finance, and challenges, the framework

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provides a holistic perspective that goes beyond traditional financial analyses. It considers the multifaceted nature of financial decision-making and its implications for firm performance.

4.11 CHAPTER SUMMARY

This chapter presented theoretical literature, empirical literature and conceptual framework. Based on the empirical literature, the study concludes that financial management practices such as working capital management, liquidity management practices and financing sources could positively impact the performance of SMEs in the 3D printing sector in terms of profitability/growth and growth in client base.

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CHAPTER 5: METHODOLOGY

5.1 INTRODUCTION

This chapter presents the methodological approaches used in the study, commencing with a discussion of research paradigms and the choice of interpretivist research paradigm, the exploratory research design and its justification, the inductive research approach and its justification, and the qualitative research approach and its justification. Other segments of the research methodology comprise the target population, sample size, data collection processes and also ethical issues addressed during the process of collecting data. Data analysis techniques such as thematic analysis are also discussed in this chapter.

5.2 RESEARCH PARADIGM

A research paradigm describes the worldview that influences the assumptions, beliefs, and methodologies researchers employ in conducting their studies (Kaushik & Walsh, 2019). The concept refers to the core principles and philosophies that govern the comprehension, creation, and verification of knowledge within a specific discipline or area of study (Kamal, 2019). The three primary research paradigms employed in social research are positivist, interpretivist, and pragmatic (Davies & Fisher, 2018). The positivist research paradigm is based on the premise that an objective reality exists independently of human perception and commonly utilises quantitative methods for the purpose of collecting empirical data, testing hypotheses, and establishing causal relationships between variables (Kekeya, 2019). However, the interpretivist research paradigm acknowledges the subjective nature of reality and places emphasis on gaining an understanding of the social and cultural contexts in which individuals interpret their experiences (Romani et al., 2018). In addition, the pragmatic research

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paradigm places emphasis on practical problem-solving and the integration of various perspectives and methods (Kaushik & Walsh, 2019). Pragmatic research employs a mixed methods approach that integrates quantitative and qualitative methods, enabling the comprehensive examination of both numerical and contextual aspects of phenomena (Kankam, 2019).

Research paradigms are formulated based on distinct ontological and epistemological assumptions. Ontological assumptions are concerned with the fundamental nature of reality and the existence of phenomena being investigated (Kaushik & Walsh, 2019). These assumptions are based on the researcher's perspectives on the existence, nature, and manner in which things exist (Kaushik & Walsh, 2019). Positivism adopts an ontological stance of objectivism, asserting the existence of an external and objective reality that is independent of human perception (Kamal, 2019). Moreover, interpretivism is based on the ontological belief that reality is subjective and is experienced through an individual's consciousness (Romani et al., 2018).

The epistemological assumptions, as stated by Saunders et al. (2019), refer to the researcher's beliefs regarding the origins of knowledge, the methods employed to acquire knowledge, and the standards utilised to assess its credibility. The epistemological framework of positivism posits that knowledge can be acquired through the systematic process of observation, measurement, and the rigorous application of scientific methods (Kekeya, 2019). The interpretivist epistemology places a strong emphasis on comprehending the lived experiences, meanings, and social constructions of individuals through the use of qualitative methods. It also recognises the importance of subjective interpretations and acknowledges the role of the researcher in shaping knowledge (Romani et al., 2018).

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5.2.1 Justification for interpretivist research paradigm

This study adopted the interpretivist research paradigm to understand the role of financial management practices and sources of finance on profitability and client base expansion among 3D printing SMEs in South Africa, with justifications based on its ontology and epistemology.

Ontologically, interpretivism recognises the existence of multiple subjective realities, emphasising that individuals construct their own meanings and interpretations of the world (Romani et al., 2018). In the context of financial management practices and sources of finance, this paradigm acknowledges that the experiences and perceptions of finance officers, senior managers and managers of 3D printing SMEs in South Africa shape their opinions on financial management practices and sources of finance in terms of how and the extent to which they enhance their firms' profitability and increase in client base.

Epistemologically, interpretivism emphasises the importance of subjective knowledge, social interactions, and qualitative research methods to understand the phenomenon under investigation (Romani et al., 2018). For this study, the use of qualitative methods of data collection, such as structured interviews, helped the researcher to gain an in-depth understanding of how and the extent to which financial management practices, such as working capital management and liquidity management practices, enhance profitability and increase in client base of 3D printing SMEs in South Africa. Furthermore, the use of structured interviews enabled the researcher to understand how and the extent to which sources of finance such as equity, debt, family and friend and also own savings enhance profitability and increase in client base of 3D printing SMEs in South Africa. Finally, the adoption of structured interviews enabled the researcher to gain an in-depth understanding of the challenges confronting 3D printing SMEs in managing working capital, liquidity and sources of finance.

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5.3 RESEARCH DESIGN

The research design refers to the overall structure and plan that guides the execution of a research study. It outlines the framework and methods employed to address research questions or objectives and achieve the study's goals (Creswell, 2014). This study adopted the exploratory research design. According to Casula et al. (2019), an exploratory research design aims to explore a relatively unexplored phenomenon to gain a deeper understanding (Wright et al., 2016). Exploratory research design is also used when there is limited existing knowledge or understanding of a particular phenomenon (Carter et al., 2023). The choice of an exploratory research design is justified because the role of financial management practices and sources of funding on profitability and client base expansion among 3D printing SMEs in South Africa is under-explored, which requires in-depth research.

5.4 RESEARCH APPROACH

The inductive and deductive research approaches are two different approaches used in research. Deductive research involves moving from general theories or hypotheses to specific observations or data (Casula et al., 2021). The deductive research approach follows a top-down approach, where researchers start with a theory or hypothesis and then collect data to test or confirm it (Casula et al., 2021). Inductive research involves moving from specific observations and data to broader generalisations and theories (Azungah, 2018). The inductive research approach follows a bottom-up approach, where researchers start with collecting and analysing empirical data and then develop theories or patterns based on their observations (Liu, 2016).

For this study, the inductive research approach was adopted. The choice of the inductive research approach was justified because the researcher dwelled on collecting

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and analysing data based on structured interviews to develop patterns, new insights and conceptual frameworks on the role of financial management practices and sources of finance in enhancing profitability and client base expansion among 3D printing SMEs in South Africa.

5.5 RESEARCH METHOD

Quantitative and qualitative research methods collect, analyse, and interpret data (Beins, 2017). The quantitative research method is centred around the analysis of numerical data to measure variables, identify patterns, and produce objective and generalisable findings (Walter & Anderson, 2016). Quantitative research uses structured data collection methods, such as surveys, and relies on statistical analysis to derive conclusions (Goertzen, 2017). In contrast, qualitative research endeavours to comprehend the intricacy of human experiences and social phenomena (Busetto et al., 2020). The qualitative research method is based on the analysis of non-numerical data, such as interviews, observations, or textual analysis. It aims to uncover subjective meanings and contextual insights, allowing for a comprehensive understanding of a particular phenomenon (Hennink et al., 2020).

In this study, the qualitative research approach was adopted. This is because the researcher relied on non-numerical data in structured interviews to gain an in-depth understanding of the role of financial management practices and sources of finance on profitability and client base expansion among 3D printing SMEs in South Africa.

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5.6 TARGET POPULATION AND SAMPLING

This section presents the study's target population, sample size and sampling techniques used for selecting study participants.

5.6.1 Target population and sampling frame

The target population comprises all the units with characteristics of interest to the researcher (Saunders et al., 2019). The target population of this study comprised employees of 3D printing SMEs in South Africa. The estimated number of 3D printing SMEs in South Africa is approximately one thousand, two hundred (1,200). Out of the target population of 1,200 3D printing SMEs in South Africa, the sampling frame comprised of 3D printing SMEs that participated in the 23rd Annual RAPDASA Conference held from 9–11 November 2022. The total number of employees of 3D printing firms and institutions participating in the conference was two hundred and seventy-five (275).

5.6.2 Sample size

According to Boddy (2016), smaller sample sizes are ideal since qualitative research methods are meant to gain an in-depth understanding of a particular phenomenon under investigation. Malterud et al. (2016) also add that sample sizes of qualitative research between 5–30 are appropriate if they provide in-depth information on the investigated phenomenon. For this study, the sample size comprised twenty (20) 3D printing SMEs that participated in the 23rd Annual RAPDASA Conference. For each of these twenty (20) 3D printing SMEs, the researcher selected a finance officer, senior manager or manager to participate in the study. The choice of twenty (20) participants was justified on the premise of achieving data saturation. Data saturation is a qualitative

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research concept indicating the point at which collecting additional data ceases to yield new insights. In the context of this study, after gathering data from twenty (20) participants, there was no new knowledge emerging from the questions being asked, hence data saturation was achieved.

5.6.3 Sampling technique and procedure

A purposive sampling technique was used in the selection of 3D printing SMEs and participants of the study. Purposive sampling is a non-probability sampling technique used to select participants based on specific criteria or characteristics relevant to the research objectives (Campbell et al., 2020). Rather than selecting participants randomly, purposive sampling involves deliberately choosing individuals or groups with the desired qualities or information necessary to provide valuable insights for the study (Andrade, 2021). In this study, the researcher purposefully selected 3D printing SMEs in South Africa that have been actively involved in 3D printing operations for more than one year. Furthermore, the purposive sampling technique was justified for selecting participants who possess in-depth knowledge about financial management practices and sources of finance and their influence on profitability and client base increase among 3D printing SMEs in South Africa. In this regard, the researcher purposively selected finance officers, senior managers and managers of 3D printing SMEs in South Africa for the study.

The researcher used the conference attendance list to identify 3D printing SMEs in South Africa with positions such as senior manager, manager and finance officer which therefore served as the inclusion criteria. Therefore, the exclusion criteria comprised of 3D printing SMEs in South Africa without positions such as senior managers, managers and finance officers. For 3D printing SMEs that were eligible for inclusion, emails were sent to them seeking for their consent to participate in the study.

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5.7 DATA COLLECTION

In this section, the researcher presents the data collection instruments used for data collection and also the data collection procedure.

5.7.1 Data collection instruments

A structured interview guide was used as the instrument for data collection. A structured interview is a research method that involves a predetermined set of standardised questions asked of participants consistently and systematically. It follows a formalised interview guide, ensuring that all participants are asked the same questions in the same order. This approach allows for a more controlled and structured data collection process, facilitating comparability and reliability of participant responses. In this study, the structured interview was grouped under four sections.

The first section examined the demographic data of participants such as age, gender, highest educational qualification, current work or position in the firm, category that best describes the current 3D printing firm, ethnic origin of participant and also number of years spent working in 3D printing SMEs in South Africa. The second question comprised five open-ended questions on working capital management practices, their influence on profitability, client base expansion, and challenges in working capital management. The third section comprised nine open-ended questions about sources of finance and their influence on profitability and growth in client base and challenges in seeking financing. The fourth section comprised six open-ended questions on liquidity management practices, their impact on profitability and growth in client base, and the challenges faced by 3D printing SMEs in managing liquidity.

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5.7.2 Data collection procedure

The researcher used online Google Forms for the data collection from participants of 3D printing SMEs in South Africa. The approved structured interview guide was converted to Google Forms and then sent to emails of the finance officers, senior managers and managers of 3D printing SMEs that were purposefully selected by the researcher for this study. There was no possibility of face-to-face interviews due to the challenges of distance confronted by the researcher in the data collection process. The data collection process lasted for four months since there were delays in the online interview responses from the participants. However, frequent email reminders were helpful in the data collection process.

5.8 VALIDITY AND RELIABILITY ASSURANCE

Validity and reliability are critical considerations in research. Validity refers to the extent to which a research instrument accurately measures the intended constructs or variables (Heale & Twycross, 2015). It ensures that the data collected aligns with the research objectives and provides meaningful insights. On the other hand, reliability assurance focuses on identifying and minimising sources of measurement error and inconsistency in social science measurements (Mohamad et al., 2015). It ensures that the research instrument produces consistent and dependable results. By establishing validity and reliability, researchers can enhance the credibility and trustworthiness of their findings, allowing for more robust interpretations and conclusions.

5.8.1 Validity assurance

Validity assurance was achieved in this qualitative research study by adopting the theoretical assessment of validity approach proposed by Saunders et al. (2018). The

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study focused on examining the role of financial management practises and sources of finance, including working capital management, liquidity management, equity, debt, family and friends, and own savings, in relation to profitability and the expansion of the client base among 3D printing SMEs in South Africa.

The assessment of validity approach centres on evaluating the extent to which operational measures effectively capture the fundamental nature of constructs (Hayashi et al., 2019). To establish face validity, the researcher exercised meticulous attention to detail when defining and operationalising the constructs within the particular context of the 3D printing industry (Cypress, 2017). The task required ensuring the operational definitions were properly aligned with the constructs to depict the intended concepts accurately.

Content validity, however, refers to the degree to which the questions asked accurately capture the concept being assessed (Hong et al., 2019). Expert opinions from academia and industry were sought to ascertain content validity. Experts evaluated the measurement items and confirmed that they accurately reflected the intended concepts, aligning with the operational definitions. The expert feedback provided additional support for the content validity of the constructs examined, such as working capital management, liquidity management, source of finance (equity, debt, family and friends, own savings), profitability and client base expansion.

Finally, in the context of qualitative research, the concepts of credibility, trustworthiness, and dependability are pivotal for explaining and ensuring validity. Credibility, emphasizing the accuracy and believability of findings, is bolstered through strategies such as prolonged engagement and participant checking. These methods were essential to establish that the study faithfully captures the authentic perspectives and experiences of participants, thus contributing to the credibility and, consequently,

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the validity of the research. Trustworthiness, addressing the overall integrity of the study, was also vital for validating the qualitative study. Ensuring transparency, ethical conduct, and honest representation of the research process.

5.8.2 Reliability assurance

Ensuring reliability is a crucial factor to be taken into account in qualitative research that investigates the impact of financial management practices and sources of finance (such as working capital management, liquidity management, equity, debt, family and friends, and own savings) on profitability and the expansion of the client base within the context of 3D printing SMEs in South Africa. Specific measures were implemented during this study to ensure the robust reliability of the structured interviews.

One potential threat that has been identified is interviewer bias, which could emanate from the personal belief and actions of the interviewer during the data collection process (Adhabi & Anozie, 2017). According to Adhabi and Anozie (2017), the interviewer's facial expressions and tone of voice could affect the participant's responses to the interview, leading to biases and thereby affecting the result of the study. However, since this study used an online interview approach that did not involve face-to-face interactions, the potential threat of interviewer bias was handled appropriately.

Furthermore, this study aimed to address the concern of ambiguous and imprecise questions, which could potentially compromise the reliability of the findings (Cohen et al., 2017). Considerable attention was devoted to the meticulous development of interview questions to ensure their precision and clarity, thereby minimising potential misunderstandings or inconsistencies in participants' responses. The interview protocol underwent a rigorous refinement process, benefitting from the invaluable

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insights provided by experts in academia and industry. Their expertise contributed to enhancing the overall coherence and lucidity of the interview protocol. These conscientious efforts aimed to bolster the reliability of the study by reducing any possible sources of misinterpretation or variation in participants' answers.

Finally, within the context of this qualitative study, reliability assurance was achieved by ensuring dependability which enhanced the stability and consistency of the research findings. The use of audit trail contributed to enhancing dependability, thereby reinforcing the reliability the qualitative research. Audit trail involves systematically documenting the research process, encompassing decisions made during data collection, analysis, and interpretation. This detailed record served as a transparent trail, allowing others to follow the researcher's steps. An explicit audit trail contributed to the dependability of the study, as the research process is well-documented and traceable.

5.9 ETHICAL APPROACHES

Several ethical considerations were carefully addressed during the data collection process, encompassing informed consent, confidentiality, and anonymity.

Informed consent was obtained by explicitly outlining the study's objectives and ensuring that participation in the research was entirely voluntary. Each employee of the 3D printing company willingly chose to participate.

Confidentiality was meticulously upheld, with interview responses exclusively used for research purposes. The collected data from Google Forms underwent transcription and was securely stored in an encrypted One Drive Cloud Database, safeguarding confidentiality and thwarting unauthorised access.

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To ensure anonymity, measures were integrated into the structured interviews to safeguard participants' identities, excluding personal details like names, phone numbers, and staff IDs. Furthermore, once participants completed the online interviews, all corresponding emails were promptly removed from the system. These conscientious, ethical practices were implemented to uphold the integrity of the study and safeguard the rights and privacy of the participants.

5.10 DATA ANALYSIS

Thematic analysis was used in analysing data gathered from participants from 3D printing firms in South Africa. According to Clark et al. (2015), thematic analysis is a method of analysing qualitative data, such as interviews, by identifying patterns or themes in data. Nvivo is a software tool for conducting thematic analysis (Clark et al., 2015). The thematic analysis process using Nvivo software for analysing qualitative data gathered from interviews is explained as follows.

The first stage in the thematic analysis process comprised data preparation by transcribing data from the interview responses attained from the participants (Castleberry & Nolen, 2018). The second stage of thematic analysis is data familiarisation. Data familiarisation involved thoroughly reading through the transcribed data to understand the data and get good cues for identifying themes (Crowe et al., 2015). The third stage is the creation of codes, which involves assigning labels to interview data segments that can potentially emerge as themes (Lawless & Chen, 2019). Codes were therefore created using the NVIVO software using the ‘nodes” features.

The fourth stage involved the generation of themes from the codes by identifying the emerging patterns from the data that were relevant for responding appropriately to the

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research objectives (Lawless & Chen, 2019). The study further refined themes to ensure that they were very relevant for achieving the objectives of the study. The fifth stage involved using Nvivo software to create data visualisations such as word clouds and tree charts to represent the identified themes (Majumdar, 2022) visually. The sixth stage involved analysing the themes identified and supporting them with relevant quotations from participants to explain the identified themes appropriately (Terry et al., 2017). The final stage involved reporting the findings based on the objectives and research questions using the themes, supporting quotes, and interpretations based on the qualitative data gathered from interviews (Terry et al., 2017).

5.11 CHAPTER SUMMARY

This chapter described the methodology used for the study that helped to achieve the objectives. The interpretivist research paradigm was justified based on its epistemological, axiological and ontological assumptions. The exploratory research design, inductive research approach and qualitative research method were also appropriately justified.

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CHAPTER 6: RESULTS AND DISCUSSIONS

6.1 INTRODUCTION

This chapter presents the results of the study and also discusses it with relevant literature. A total of twenty (20) managers and employees of 3D printing SMEs in South Africa participated in the study. Since the study was concerned with financial management practices and their relevance to profitability and expansion of client base, the researcher selected managers and employees with requisite skills in financial management, which comprised finance or account officers, senior managers and managers of 3D printing SMEs in South Africa. Interview guides served as the data collection instruments. Thematic analysis was used to analyse the data gathered through interviews.

6.2 RESPONSE RATE

A 100% response rate was attained for this study. This is because all the 20 finance officers, managers and senior managers of 3D printing SMEs who were purposefully selected participated in the study.

6.3 DEMOGRAPHIC DATA OF RESPONDENTS

Results from Table 6.1 below present the demographic data of the participants. From the results, most participants were between the ages of 41–50 years (60%), 30% were between the ages of 30–40 years, and 10% were between the ages of 51–60 years. Regarding gender distribution, it was found that 70% of participants were males, while females constituted 30%. For educational level, it was found that 65% of participants have attained their master's degree, 20% their bachelor's or advanced diploma, and

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15% their doctorate. In terms of work title, 60% of the participants are finance officers, 30% are managers, and 10% are senior managers of 3D printing firms in South Africa. The results also showed that 40% of participants work with 3D material supplier firms, 35% with 3D design and tool-making firms, and 25% with 3D software and related technology firms. For ethnic origin, it was found that 60% are black South Africans, 20% are white South Africans, and another 20% are other Black Africans. The result also showed that 40% have worked in 3D printing firms for a period of 6–10 years, 25% have worked in 3D printing firms for 11–15 years, 20% have worked in 3D printing firms for 16–20 years, and 15% of participants have worked in 3D printing firms for 1–5 years.

Table 6.1: Demographic data of respondents

Age	Frequency	Percentage (%)
30–40 years	6	30
41–50 years	12	60
51–60 years	2	10
Total	20	100
Gender	Frequency	Percentage (%)
Male	14	70
Female	6	30
Total	20	100
Highest educational qualification	Frequency	Percentage (%)
Bachelor's/Advanced Diploma	4	20
Masters	13	65
Doctorate	3	15
Total	20	100

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Work Title	Frequency	Percentage (%)
Senior Manager	2	10
Manager	6	30
Finance Officer	12	60
Total	20	100
Firm Category	**Frequency**	**Percentage (%)**
Design and tool making	7	35
3D Software and related technologies	5	25
3D material supplier	8	40
Total	20	100
Ethnic Origin	**Frequency**	**Percentage (%)**
Black South African	12	60
White South African	4	20
Other Black African	4	20
Total	20	100
Number of years in 3D printing	**Frequency**	**Percentage (%)**
1–5 years	3	15
6–10 years	8	40
11–15 years	5	25
16–20 years	4	20
Total	20	100

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6.4 THEMATIC ANALYSIS PROCESS

Thematic analysis was conducted using the Nvivo software tool to analyse qualitative data obtained from interviews with participants in 3D printing firms in South Africa. The analysis process involved data preparation, familiarisation, code creation, theme generation, data visualisation, theme analysis with supporting quotations, and reporting of findings. This approach allowed for a comprehensive exploration of the research objectives by systematically identifying patterns and themes in the data. Using Nvivo facilitated efficient data organisation and visual representation, enhancing the analysis process. The resulting themes and interpretations provided valuable insights into the role of financial management practices and sources of finance on profitability and client base expansion among 3D printing SMEs in South Africa.

6.5 WORKING CAPITAL MANAGEMENT AND BUSINESS PERFORMANCE

This section presents and discusses results on how and the extent to which working capital management practices affect business performance in terms of profitability and growth in client base among 3D printing SMEs in South Africa.

6.5.1 Working capital management and profitability

Working capital management practices involve managing the short-term assets and liabilities of firms comprising their cash, inventory, accounts payable and accounts receivables (Aktas et al., 2015). Effective working capital management in organisations significantly impacts their profitability (Pais & Gama, 2015). Among 3D printing firms that participated, themes were identified on how and the extent to which working capital management practices affect profitability. The themes identified are discussed with relevant literature in the following subsections.

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6.5.1.1 No-credit policy

From the responses, one of the strategies used to ensure that working capital management enhances profitability is the adoption of no-credit policies. Most participants explained that they ensure that whatever 3D printing product or service they offer is paid consistently to strengthen their accounts receivables. **Participant 12,** a finance officer in a 3D printing supplier firm, reiterated that the no-credit policy enables his firm to make a profit consistently because they avoid any debt in their business operation, be it short-term or long-term. To further explain, **Participant 16**, also a finance officer in a 3D design and tool-making firm, also attested that his firm's no-credit policy has positively influenced the profitability of his firm because it reduces the risk of customer debt.

The finding that adopting a no-credit policy in working capital management enhances profitability in the context of 3D printing firms aligns with the principles of effective working capital management and the potential benefits it can bring to a business (Kasozi, 2017). Lamptey et al. (2017) argue that one crucial aspect of working capital management is managing accounts receivable, which refers to the credit extended to customers for the sale of goods or services. By adopting a no-credit policy, 3D printing firms effectively minimise their accounts receivable and avoid potential customer debt. The literature on working capital management provides additional insights into the impact of effective credit management on profitability (Andren & Jankensgard, 2015). Studies have shown that reducing the credit period or adopting stricter credit policies can improve firms' profitability (Hofmann et al., 2022). Furthermore, adopting a no-credit policy can also help reduce administrative costs associated with credit management (Singh et al., 2021). The process of credit evaluation, monitoring, and collection requires resources and adds complexity to the firm's operations (Singh et al., 2021). By eliminating credit-related activities, the 3D printing firms in the finding can

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streamline their processes, reduce administrative costs, and focus on core business activities, positively impacting profitability.

6.5.1.2 Hiring competent finance officers

According to the responses from the interviews, some participants mentioned that hiring competent finance officers ensures that working capital management affects profitability to a greater extent. The explanation was that competent finance officers are essential for formulating good policies on working capital, ensuring that cash flow is optimised, analysing financial data of 3D printing firms and mitigating risks associated with the operations of 3D printing firms. Some of the respondents were quoted in this manner:

“I will say that competent finance officers can help my firm to achieve good profits through efficient working capital management because they can help to come up with sound working capital management practices that align strategically with the objectives of the 3D printing firm”. (**Participant 8**).

“Well, in my opinion, when the finance officer is competent, as a 3D printing supplying firm, we will always be able to manage our cash flow properly and make more profits. The finance officer can give us advice on our cash inflows and outflows and also how we can maintain adequate liquidity for our short-term operational obligations”. (**Participant 10**).

“Competent finance officers possess strong analytical skills to analyse financial data and identify trends, patterns, and potential risks associated with working capital management. They conduct financial analysis, assess key performance indicators, and

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provide insights and recommendations to mitigate risks and improve profitability". (**Participant 14**).

The finding that hiring competent finance officers is considered a strategy to enhance profitability through effective working capital management aligns with the importance of skilled financial professionals in managing a company's financial resources. The literature supports the significance of policy formulation in working capital management. For instance, a study by Alshatti (2015) found that firms with well-defined working capital policies, including credit management, demonstrated higher profitability. Similarly, Iqbal and Zhuquan (2015) highlighted the importance of efficient working capital policies in achieving higher profitability and stock returns.

Research supports the positive impact of efficient cash flow management on profitability. For example, a study by Linh and Mohanlingam (2018) found a positive relationship between the cash conversion cycle and profitability, suggesting that shorter cash conversion cycles lead to higher profitability. This highlights the importance of skilled finance officers in optimising working capital and cash flow to enhance profitability (Rosenbaum & Pearl, 2021).

The literature emphasises the role of financial analysis and risk management in working capital management. For instance, a study by Zietlow et al. (2018) found that firms with better financial analysis and risk management practices had lower levels of investment in working capital and higher profitability. Skilled finance officers can identify potential risks, such as credit defaults, inventory obsolescence, and liquidity constraints, and implement appropriate strategies to mitigate these risks and enhance profitability (Zietlow et al., 2018).

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6.5.2 Working capital management and growth in client base

Working capital management can significantly impact the increase in client base among 3D printing firms in South Africa. By effectively managing their working capital, these firms can enhance their ability to attract and retain clients. The following subsection discusses themes identified based on participant responses and their discussion with relevant literature.

6.5.2.1 Timely delivery of 3D products and services

According to participant responses, it could be deduced that working capital management practices of 3D printing firms contribute to growth in client base by ensuring timely delivery of 3D products and services to customers. **Participant 2,** for instance, asserted that as a 3D printing material supply firm, they always ensure that their inventory levels for 3D printing materials are in the right proportion, ensuring quick delivery times to customers. **Participant 2** was quoted as follows:

“You know, we deal with 3D printing materials, and because of the demand for these materials for manufacturing 3D printing products, we also make sure that our inventory levels are standard so we can always be trusted by our clients. This has helped to maintain and even expand our client base because clients always get what they want in the right quantity”.

However, **Participant 4,** who’s firm deals with design and tool making, also explained that the ability of his firm to deliver 3D designs and products to clients on time boosts customer trust, which also contributes to increasing their client base. **Participant 4** was quoted in this manner:

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“My firm deals in the designing of 3D designs using Computer-Aided Design (CAD) software and also develops 3D products based on client requirements and specifications. And I must say that timely delivery of products and services to clients have increased our client base over the past two years. This is because we usually get a lot of referrals from our satisfied client base”.

The finding aligns with the importance of working capital management practices in ensuring the timely delivery of 3D products and services, which, in turn, contributes to the growth of their client base. Delivering products and services on time is essential for customer satisfaction and retention (Meesala & Paul, 2018). According to the literature, timely delivery is often considered a critical factor in customer satisfaction and plays a significant role in customer loyalty and repeat business (Meesala & Paul, 2018). When 3D printing firms effectively manage their working capital, particularly inventory levels, they can ensure the availability of materials or components required for timely production and delivery. Maintaining optimal inventory levels helps prevent stockouts and enables firms to fulfil customer orders promptly (Nguyen et al., 2018). Studies suggest that effective inventory management positively impacts delivery speed, reducing lead times and enhancing customer responsiveness (Song et al., 2020). By optimising working capital through inventory management, 3D printing firms can meet customer demand promptly, fostering customer satisfaction and expanding the client base.

Furthermore, the literature agrees that timely delivery builds customer confidence and trust in the firm's ability to meet their needs (Utami, 2015). Satisfied customers are more likely to recommend the firm's products and services to others, expanding the client base through referrals (Utami, 2015). Positive word-of-mouth referrals play a significant role in attracting new customers and can result in long-term business growth for 3D printing firms.

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6.5.2.2 Customer relationship management

Based on the responses from the interviews, customer relationship management was identified as a strategy that enhances the achievement of an expanded client base to a greater extent through working capital management. This is because most participants asserted that managing their working capital constituted building solid relationships with the customers through good customer service, finding out customer needs and ensuring that customers are happy with the 3D-printed products and services received. **Participant 1** mentioned that his 3D printing firm, which is involved in 3D printing software and other technologies, effectively communicates with customers to identify their challenges with using 3D printing software and provide prompt responses to address their concerns. **Participant 1** was quoted in this manner:

"Yes, I will say good customer relationships have benefited my firm in terms of growth in client base. We always ensure that customers are well engaged to find out what exactly they want and how we can be of help to them with regards to anything that has to do with 3D software and other technologies. As our customers get satisfied with our services, they recommend us to other 3D printing firms, and this has been good for us by increasing our client base".

The finding from participant responses regarding the role of customer relationship management (CRM) in increasing the client base of 3D printing firms aligns with the importance of building strong customer relationships and providing excellent customer service. Research indicates that customer satisfaction positively affects customer loyalty and increases the likelihood of repurchase and referral behaviours (Barreda et al., 2015). In this regard, by effectively managing their working capital and focusing on CRM, 3D printing firms can enhance customer satisfaction through personalised service, responsiveness, and addressing customer needs. The participant's mention of effective communication with customers to identify their challenges and provide prompt

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responses reflects the importance of proactive customer engagement (Payne & Frow, 2016). Effective CRM practices involve actively listening to customer feedback, addressing their concerns, and providing timely support (Payne & Frow, 2016). By engaging in two-way communication, 3D printing firms can understand customer needs, tailor their offerings, and provide valuable solutions. This fosters customer trust, loyalty, and positive experiences, leading to an increase in the client base (Reinartz et al., 2004).

Satisfied customers can become brand advocates and refer the firm's products or services to others. Positive word-of-mouth referrals significantly impact customer acquisition and can grow the client base (Anshari et al., 2019). Again, the participant's mention of customers recommending their firm to other 3D printing firms highlights the power of positive customer relationships and their potential influence on client base growth. By delivering exceptional customer service, addressing customer needs, and building solid relationships, 3D printing firms can stimulate positive word-of-mouth referrals and expand their client base.

6.6 SOURCES OF FINANCE AND BUSINESS PERFORMANCE

This section presents and discusses results on how and the extent to which source of finance affect the business performance in terms of profitability and growth in client base among 3D printing SMEs in South Africa. 3D printing SMEs in South Africa use different sources of finance to fund the operations of their 3D printing businesses. The sources of finance used by 3D printing SMEs comprise equity, debt, borrowing from family and friends and personal savings. This section presents and discusses results on how and the extent to which each of the sources of finance affects the profitability and growth in client base of 3D printing SMEs in South Africa.

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6.6.1 Equity and profitability

This section presents and discusses results on how and the extent to which equity as a source of finance affect the business performance in terms of profitability and growth in client base among 3D printing SMEs in South Africa.

Equity financing involves selling ownership shares in the business to investors in exchange for capital (Gombers & Lerner, 2010). The impact of equity financing on profitability can vary depending on the terms of the investment and the performance of the business. Themes and discussions on how and the extent to which equity as a source of finance affects the profitability of 3D printing SMEs in South Africa is presented in the following subsections.

6.6.1.1 Flexibility and focus on firm operations

From the responses, it was deduced that equity financing enhances the profitability of 3D printing SMEs by allowing them to avoid debt which comes with interest and principal payments. The respondents further asserted that equity financing gives their firms the flexibility to focus more on their operations to make more profits, thereby decreasing the pressure associated with the repayment of debts and their related interest rates. **Participant 16** was quoted as follows:

“When we have access to equity financing, it helps our firm to focus more on our operations and tap into more opportunities in the market without worrying about repayment of loans and their huge interest rates”.

Participant 19 further asserted that equity gives their 3D printing SMEs more opportunities to make profits because it becomes easier to expand and upgrade their technology to gain a more competitive advantage.

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The finding of the study was consistent with the literature. This is because studies have shown that equity financing provides SMEs access to vital capital for growth initiatives (Dowling et al., 2019). According to a study by Beck (2013), equity financing allows firms to overcome financial constraints and pursue investment opportunities that contribute to long-term profitability. Equity financing also offers financial flexibility by reducing the financial leverage of SMEs. This flexibility enables businesses to allocate resources towards strategic initiatives without the burden of fixed interest and principal payments (Islam et al., 2019).

6.6.1.2 Pressure to perform

According to the responses, equity financing affects profitability to a greater extent because it pressures 3D printing firms to make profits and sustain the interest of investors. The respondents further explained that as investors become shareholders, they always require value for their money which brings much focus on operational efficiency, product quality and innovation. **Participant 12** mentioned that investors who become shareholders due to equity financing come on board with expertise, market networks, and partnerships geared towards maximising the profitability of 3D printing SMEs. Similarly, **Participant 15** said that investors' expectations are high when they engage in equity financing, and because they are always looking for results, 3D printing firms are also motivated to improve their operations and maximise profitability continually.

The finding was in congruence with the literature. Studies have shown that equity investors pressure SMEs to improve operational efficiency (Maulana & Rusmita, 2019). Investors' expectations for returns drive SMEs to adopt efficient production processes and optimise resource allocation (Maulana & Rusmita, 2019). In addition, equity financing facilitates innovation in SMEs. Research by Dasilas and Papasyriopoulos

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(2015) indicates that equity financing positively affects innovation in small firms. Shareholders' demands for long-term growth encourage SMEs to invest in research and development, promoting technological advancement and maintaining a competitive edge in the 3D printing sector. Furthermore, access to shareholders' expertise and networks, as highlighted by Dasilas and Papasyriopoulos (2015), can benefit SMEs by aiding market penetration and fostering strategic partnerships. Shareholders often bring industry knowledge, business connections, and managerial experience that can facilitate entry into new markets and enhance profitability.

6.6.2 Equity and growth in client base

In this section, the researcher presents result on how and to what extent equity as a source of finance affects growth in the client base of 3D printing SMEs in South Africa. The section also discusses the results of the study with relevant literature.

6.6.2.1 Access to funds

According to responses from the participants, equity financing provides 3D printing SMEs in South Africa with substantial funds to seize growth opportunities and attract new customers. The participants further explained that by securing equity investment, SMEs in 3D printing can access capital that can be allocated towards marketing efforts, research and development, and innovation.

According to **Participant 20,** with access to equity funding, 3D printing SMEs can expand their product lines, offering a wider range of solutions and attracting a more extensive customer base. **Participant 18** added that equity funding could provide adequate funds to help 3D printing firms in South Africa enter new domestic and international markets, expanding their reach and capturing new customer segments.

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Similarly, **Participant 12** attested that equity financing can enable SMEs in 3D printing to invest in improving customer service, fostering customer satisfaction and loyalty, thereby enhancing growth in the client base.

The findings were consistent with the literature. A study conducted by Baldock & Mason (2015) found that equity financing can positively impact SME growth. By accessing equity investment, SMEs can secure substantial funds to expand product lines, enter new markets, and invest in marketing efforts. These growth initiatives are essential for attracting new customers and expanding market share (Baldock & Mason, 2015). Furthermore, a study by Wijetunge (2016) emphasised the role of external equity investment in providing SMEs with the necessary capital to invest in customer service improvements. By enhancing customer experiences and satisfaction, SMEs can attract new customers and foster loyalty (Boaz et al., 2018).

6.6.2.2 Strategic investors

According to the responses from the participants, equity financing helps SMEs in the 3D printing sector in South Africa expand their client base to a greater extent as investors provide more than just financial support. The participants explained that most investors provide equity financing and bring valuable expertise, guidance and industry network connections that help expand their customer base. **Participant 9** was quoted in this manner.

“In my opinion, I will say that the investors who come to provide the equity finance use their experience and contact networks to help 3D printing SMEs to get access to new customers. These investors also provide share ideas with managers of 3D printing firms on strategies that can be applied to help improve customer service and thereby expand the client base”.

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Participant 14 was quoted as follows.

“Equity finance investors help 3D printing firms to expand their customer base because they offer good insights into target markets, customer preferences and emerging trends that help managers of 3D printing SMEs to refine their marketing strategies and effectively attract new customers”.

The finding was in congruence with other studies. For instance, a study by Eldridge et al. (2021) highlighted the value of strategic investors in providing expertise and industry connections to SMEs. Strategic investors often possess extensive networks and knowledge within the industry, which can be leveraged to access new customers. Their insights into target markets, customer preferences, and emerging trends can help SMEs refine their marketing strategies and effectively attract new customers (Fraser et al., 2015). Another study by Kele et al. (2017) emphasised the role of strategic investors in providing guidance and mentorship to SMEs. The expertise and guidance offered by these investors can assist SMEs in developing effective customer acquisition strategies, identifying growth opportunities, and implementing best practices (Kele et al., 2017).

6.6.3 Debt and profitability

This section presents and discusses results on how and the extent to which debt as a source of finance affect the business performance in terms of profitability and growth in client base among 3D printing SMEs in South Africa. Debt financing involves borrowing money from lenders, such as banks or financial institutions, and making regular interest and principal payments (Yazdanfar & Ohman, 2015). In this section, the study presents thematic results on how and the extent to which debt as a source of finance affects the profitability of 3D printing SMEs in South Africa.

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6.6.3.1 Increased financial leverage

The responses found that debt financing affects the profitability of 3D printing SMEs by allowing them to grow and expand their business operations, thereby making more profits. Most respondents explained that debt financing kept them on their toes to take their business operations seriously because they needed to make more profits to repay the interest and principal within the agreed period with the financing institution. A conversation ensued between the researcher and **Participant 4** in this manner.

Researcher: So, can you explain to me further how exactly debt financing affects the profitability of your 3D printing firm?
Participant 4: "Yes, I think that debt comes with a lot of obligations, and even to get debt as a source of financing means that your business is profitable to some extent. Because, before you are given the loan, they have to check your ability to repay before the loan is given to you. So, once you get the loan, you work with it in a way that you can make more profits so that the loan can be paid with its interest".

Researcher: Are there instances where debt can negatively affect the profitability of a 3D printing firm?
Participant 4: "I will say it depends on the 3D printing firm and its strategy. For my firm, for instance, before we take debt as a source of finance, we have a detailed strategy that has been tried and tested on exactly how the loan will be used to maximise profitability. So we think of not only the short-term profit but also the long-term so that the right decisions can be made".

The conversation between the researcher and **Participant 4** demonstrates that debt affects the profitability of 3D printing firms if the right strategies are implemented to enhance both short-term and long-term profit maximisation. The finding was consistent with the literature. This is because a study by Boadi et al. (2017) emphasises that debt

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can be a valuable tool for funding growth and enhancing profitability in SMEs. Debt financing allows SMEs to access additional capital for investment, expansion, and technological advancements. This aligns with the findings of Obuya (2017), who suggest that debt can positively influence firm performance and value creation.

6.6.3.2 Loan repayment challenges

When participants were asked how much debt affects profitability, most of them mentioned that the problems associated with loan repayments negatively affect profitability. Some respondents did explain that although debt enables 3D printing firms to get adequate funding to expand their business operations, the uncertainties in the market can lead to failures in sales projections, which can affect profitability and the ability to repay loans with interest. **Participant 7** was quoted as follows.
“I think the extent to which debt enhances profitability will depend on how 3D printing firms are able to deal with market uncertainties and make more profits, to be able to repay their loans”.

Similarly, in the opinion of **Participant 11,** debt can affect profitability to a greater extent if only 3D printing firms have effective marketing campaigns to enhance their sales volume to enable them to avoid loan defaults and increase their creditworthiness. **Participant 11** further explained that a lack of ability to meet repayment obligations could decrease the creditworthiness of 3D printing SMEs in having access to future loans.

The study's finding was consistent with the literature as Worokinasih and Potipiroon (2019) highlight the importance of creditworthiness and debt payments in accessing future financing. Failure to meet debt obligations can negatively affect a firm's credit score, limiting its ability to obtain favourable financing terms or secure additional

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funding (Osano & Languitone, 2015). This also aligns with the findings of Calabrese et al. (2022), who emphasise the role of credit history in accessing credit markets. In the context of the dynamic 3D printing industry, maintaining a positive credit history is crucial. Market uncertainties and technological advancements require continuous access to capital for growth and innovation.

6.6.4 Debt and growth in client base

This section presents and discusses results with literature on how and the extent to which debt as a source of finance affects growth in the client base of 3D printing SMEs in South Africa.

6.6.4.1 Accessible funds for firm improvement

According to responses, debt financing can enhance client base growth since such funds can be used for marketing purposes. Most participants attest that 3D printing firms can use debt financing to invest in advertising campaigns, digital marketing strategies, and promotional activities to enhance brand visibility and attract new customers. Furthermore, the participants did attest that SMEs in the 3D printing industry can utilise debt funds to develop new and improved products, enhance existing offerings, or explore novel applications of 3D technology to attract more customers. **Participant 17** was quoted in this manner.

“Debt financing is appropriate for getting more clients when used strategically to market and also improve the product offerings, thereby making 3D printing firms more competitive”.

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Participant 20 also added that debt financing could be used to invest strategically in improving customer services to enhance customer satisfaction, thereby increasing the customer base of 3D printing firms.

This finding was consistent with the literature since researchers such as Aminu and Shariff (2015) have emphasised the positive relationship between debt financing and marketing efforts of SMEs, leading to an expanded customer base. Debt financing allows SMEs to allocate funds towards advertising campaigns, digital marketing strategies, and promotional activities, enhancing brand visibility and attracting new customers (ElDeeb et al., 2021). This aligns with the general understanding that effective marketing can drive customer acquisition and business growth. Studies by Civelek et al. (2020) highlighted the role of debt financing in facilitating technological advancements and product innovation. Access to debt capital enables SMEs to invest in developing new products and improve existing offerings. This enables them to attract customers seeking cutting-edge 3D printing solutions and maintain a competitive edge in the market. Furthermore, studies by Mazanai and Fatoki (2011) highlighted the positive impact of debt financing on customer service improvement. Debt financing can be allocated to enhance customer support, streamline processes, and invest in technology that enables personalised and efficient customer experiences. This, in turn, can lead to increased customer satisfaction, positive word-of-mouth, and customer loyalty (Fatoki & Asah, 2011).

6.6.4.2 Repayment requirements

In as much as debt as a source of finance could enhance client base growth among 3D printing SMEs, some participants believed that the challenges of 3D printing firms in meeting repayment requirements could affect the extent of expanding the customer base. Some respondents did assert that when 3D printing firms are supposed to pay

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high-interest rates on the principals, it could bring about financial strains, making it difficult for 3D printing firms to use debt finance to engage in marketing campaigns that could bring about new customers. To explain this further, a conversation ensued between the researcher and **Participant 16** in this manner.

Researcher: In your opinion, to what extent does debt finance enhance growth in the client base despite the repayment requirements?
Participant 16: “Yes, I will say that the repayment requirements can affect the budget of 3D printing firms to attract new customers and expand the client base. For instance, when the repayment is short, like three to six months, it will be difficult to get the results when we invest in marketing campaigns because it takes time to attract new customers and expand the client base. So because of the pressure to repay, we may not be able to invest in marketing. Rather our attention will be focused more on products that already have the market, so we can sell fast and repay on time to avoid any penalties on late repayments”.

The finding is consistent with the literature because a study by Ohman and Yazdanfar (2017) found that high debt levels can limit SMEs' ability to invest in growth initiatives, including marketing and product expansion. The repayment obligations associated with debt financing can divert financial resources away from customer acquisition efforts, hindering the ability to attract new customers. In the context of customer acquisition, a study by Ding et al. (2017) found that excessive debt levels can negatively affect SMEs' ability to improve customer service and meet customer demands. Limited financial resources may restrict investments in technology, training, and customer support, hindering attracting and retaining customers (Block et al., 2018).

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6.6.5 Family and friends and profitability

In this section, the researcher presents result on how and to what extent family and friends as a source of finance affect business performance of 3D printing firms in terms of profitability and growth in client base. Family and friends as a source of financing involve borrowing money from friends or family members willing to invest in the business. This section discusses results with relevant literature on how and the extent to which family and friends as a source of finance affect the profitability of 3D printing SMEs.

6.6.5.1 Flexibility of terms

According to responses received, family and friends as a source of financing affect profitability because there is easy access to funds, and the repayment terms are flexible compared to debt. The responses further revealed that family and friends as a source of financing are good for addressing specific growth needs of 3D printing firms at certain points in time. **Participant 6** contended that funding from family and friends is more flexible and allows some 3D printing firms to adequately deal with problems associated with short-term financial needs. Furthermore, **Participant 9** stated that family and friends, as a source of funding, help to support the profitability of 3D printing firms as its flexible nature in terms of both access and repayment, helps to deal with pressing financial needs that are associated with day-to-day operations of 3D printing SMEs, thereby contributing to profitability.

Studies by Nguyen et al. (2022) emphasise the importance of informal financing, such as family and friends, for small businesses, particularly in accessing capital quickly and with flexible terms. These financing arrangements can provide agility, allowing SMEs to respond promptly to growth opportunities and improve profitability (Nguyen et al.,

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2022). Furthermore, research by Mpofu and Sibindi (2022) highlights the non-financial support obtained through informal financing, including advice, guidance, and industry connections. Leveraging the knowledge and networks of family and friends as investors can be particularly valuable for 3D printing SMEs in South Africa, where market penetration and partnerships are vital for success. The personal relationships and trust involved in financing by family and friends create a supportive environment that can contribute to the growth and profitability of SMEs (Allen et al., 2019).

6.6.5.2 Lack of access to adequate financing

Although family and friends as a source of financing affect the profitability of 3D printing SMEs positively, responses from the participants indicate that the extent of its contribution to profitability is low. Most participants stated that the funding from family and friends is inadequate to deal with the high-cost demands associated with the 3D printing business operations in South Africa. Some participants explained that funding from family and friends can be helpful when there is a need for short-term financial needs. **Participant 10** was quoted as follows.

“I think that the family and friends' funding is not adequate enough for funding integral operations of 3D printing SMEs. This is because the funding is usually small and much cannot be done with them in terms of seizing bigger opportunities in the 3D printing industry in South Africa”.

The finding of the study was consistent with the literature. Family and friends often have limited financial resources and may not be equipped to meet the substantial funding requirements of 3D printing SMEs (Kim et al., 2017). Family and friends may have their own financial obligations and limitations, which can restrict the amount of capital they can contribute to a business venture (Forkuoh et al., 2015). Inadequate funding from family and friends may lead to difficulties in scaling up operations,

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investing in new technologies, and expanding market reach, which can impact profitability (Adebisi et al., 2015). Research by Khan (2015) highlights that personal networks, although valuable, may have limited financial capacity to support 3D printing SMEs. Additionally, Amornkitvikai and Harvie (2018) emphasise that family and friends often face their own financial constraints, making it challenging for them to provide substantial funding. Consequently, these limitations result in difficulties for 3D printing SMEs to expand their operations and invest in new technologies.

6.6.6 Family and friends and growth in client base

This section presents results on how and the extent to which family and friends as a source of finance affect growth in the client base of 3D printing SMEs in South Africa. The section also discusses results attained in congruence with relevant literature.

6.6.6.1 Access to funds

According to responses that were attained, the funds accessed from family and friends are easily accessible without going through any rigorous creditworthiness processes. In this regard, funds from family and friends are used for improving the customer service of 3D printing SMEs, which are geared towards attracting new customers. Furthermore, most participants attest that, funds from family and friends to a greater extent, enhance the expansion of the client base of 3D printing SMEs in South Africa. The participants explained that apart from offering financial support, family and friends go a step further to be involved in marketing campaigns by using their networks to market products and services of 3D printing SMEs. Some participants were quoted as follows.

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“I will say that funding from family and friends does not give you any excessive pressure in terms of repayment deadlines or equity-related obligations. Because of the good relationships that we tend to have with family and friends, we are able to involve them in helping in our marketing campaigns by also using their networks and connections to promote our 3D printing products and services so that we can increase our client base” (**Participant, 19)**.

“I believe that the family and friends' support goes beyond the funds they provide for some of our operations. They help us in various dimensions to make sure that we are getting more clients. Some family and friends share our products and services on their social media handles just to create awareness of what we do so as to get some clients for us” (**Participant, 12)**.

The finding is consistent with the literature because studies have highlighted the vital role that family and friends play in providing financial resources to entrepreneurs, especially in the early stages of business development (Bordeaux et al., 2021). These informal funding sources are often more accessible and involve fewer creditworthiness processes than formal financing options like bank loans or venture capital (Bordeaux et al., 2021). The finding that family and friends not only offer financial support but also contribute to the growth of 3D printing SMEs through their involvement in marketing campaigns is consistent with research emphasising the significance of social networks and word-of-mouth marketing in entrepreneurial success (Abbasi et al., 2017). The networks and connections of family and friends can serve as valuable resources for reaching potential customers and expanding the client base of 3D printing SMEs (Nielsen, 2020).

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6.6.7 Own savings and profitability

In this section, the researcher presents result on how and to what extent own savings as a source of finance affects business performance in terms of profitability and growth in client base of 3D printing SMEs in South Africa.

6.6.7.1 Reduced reliance on external financing

The responses inferred that utilising own savings as a source of finance for 3D printing SMEs in South Africa reduces reliance on external financing, such as debt or equity financing, and subsequently positively impacts profitability. The participants explained that SMEs in the 3D printing industry can avoid interest payments and reduce the financial burden on their operations by avoiding debt. Some participants also attested that SMEs can retain full ownership and control by not seeking external equity financing, avoiding dividend payments and preserving profitability.

Participant 14 did assert that using personal savings as a source of financing gives their 3D printing firm control over their finances and operations because they do not have to deal with any external investors in terms of equity or debt. **Participant 14** was further quoted as follows.

“When we use our personal savings to reinvest in the 3D printing firm, we have more control over our firm operations, and there is no pressure on the profits we earn. This is because all our returns from reinvestment come back to us, and we do not need to pay equity percentages or pay loans with interest from our profits”.

The finding of the study was in congruence with the relevant literature. By relying on own savings, SMEs can avoid interest payments and dividend obligations, enhancing their profitability (Abbasi et al., 2017). This notion is consistent with the pecking order

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theory, which suggests that internal financing, such as own savings, should be prioritised over external financing due to the associated costs (Agyei et al., 2020). A study by Baker et al. (2020) found that SMEs that relied on internal financing rather than external debt had higher profitability. This aligns with the idea that avoiding debt can reduce financial burdens and improve cash flow, thus positively affecting profitability. Furthermore, research by Khan and Anuar (2018) indicated that SMEs with higher internal funds allocated a greater proportion of their earnings to research and development, marketing, and capital investments. These investments can enhance competitiveness, innovation, and profitability (Omondi & Jagongo, 2018).

6.6.8 Own savings and growth in client base

This section provides the results and discussions on the literature on how and to what extent personal savings as a source of finance affect growth in the client base of 3D printing SMEs in South Africa.

6.6.8.1 Improved financial stability

Based on the responses, it could be deduced that utilising own savings to finance a 3D printing SME in South Africa enhances its financial stability and provides the necessary resources to invest in emerging growth opportunities. Some participants further asserted that by having a sufficient financial cushion, owners and managers of 3D printing firms can allocate funds towards marketing campaigns to attract new clients and expand their client base. Other participants also mentioned that using their own savings allows 3D printing SMEs to invest in new product development, enabling them to offer innovative solutions that cater to evolving customer needs. **Participant 2** explained that when personal savings are being used for marketing campaigns geared towards attracting new customers, there is no external pressure from lenders regarding

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repayment schedules, giving room for more market exploration at the pace of the 3D printing firms. Additionally, **Participant 5** did contend that using personal savings enables 3D printing firms to become more innovative in creating products that could attract more customers and increase the customer base.

The finding of the study is consistent with the literature. According to research, financial stability is crucial for SMEs as it enables them to withstand economic downturns, seize growth opportunities, and attract new clients (Morgan & Pontines, 2018). Access to own savings gives SMEs greater control over their financial resources, providing a buffer in times of uncertainty and enabling them to make strategic investments in marketing, product development, and customer acquisition (Omondi & Jagongo, 2018). Additionally, investing in marketing campaigns is essential for attracting new clients in the competitive 3D printing industry. A study by Nassr and Wehinger (2016) found that SMEs with higher marketing expenditures tend to have higher sales growth and a more extensive customer base. Allocating own savings towards marketing initiatives can help SMEs increase their brand visibility, reach a wider audience, and establish themselves as reputable players in the market.

Furthermore, investing in new product development is crucial for SMEs to stay competitive and meet the evolving needs of customers. Research by Zeebaree and Siron (2017) highlights that SMEs that invest in innovation and develop new products are more likely to attract new clients. Using own savings to fund product development can enable SMEs to offer innovative and high-quality 3D printing solutions, giving them a competitive edge in the market.

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6.6.8.2 Flexibility

Regarding the extent to which personal savings increases client base, most participants attest that using personal savings to a good extent helps increase the client base of 3D printing firms because it enhances flexibility in business decision-making. Some participants explained that without the need to satisfy external lenders, the business owners in 3D printing could allocate funds according to the firm's vision and growth priorities. Some participants said the following.

“I believe that flexibility associated with using personal savings as a source of finance allows business owners of 3D printing firms to invest in areas such as technology upgrades, research and development and marketing campaigns which have positive implications on attracting and increasing the client base”. (**Participants 13)**

“In my opinion, personal savings allow business owners of 3D printing SMEs to align their investments with their strategic goals and market demands, which enables them to adapt swiftly to changes, seize opportunities, and attract new clients in the dynamic and competitive 3D printing industry in South Africa”. (**Participant, 9).**

The finding is consistent with relevant literature. According to a study by Kijkasiwat (2021) on the financing choices of SMEs, internal funds allow business owners to have greater control over investment decisions, leading to improved business performance. The study emphasises that internal financing provides the flexibility to invest in growth opportunities that external financiers may overlook. Similarly, research by Myers and Majluf (1984) highlights the pecking order theory, which suggests that businesses prefer internal financing, such as own savings, over external financing to maintain control and avoid information asymmetry. This theory supports the notion that SMEs in the 3D printing industry in South Africa may opt for own savings to fund growth initiatives and attract new clients, as it allows them to retain decision-making authority

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and align investments with their specific goals and market dynamics (Kuruppu & Azeez, 2016). Additionally, the flexibility afforded by own savings can be crucial in rapidly evolving industries like 3D printing. A study by Sima et al. (2020) emphasises the importance of adapting to technological advancements and changing customer demands. With own savings, SMEs can quickly invest in upgrading their technology, exploring new applications, or entering emerging markets, enhancing their ability to attract new clients and gain a competitive edge.

6.7 LIQUIDITY MANAGEMENT PRACTICES AND BUSINESS PERFORMANCE

In this section, the researcher presents result on how and the extent to which liquidity management practices affect the business performance in terms of profitability and growth in client base of 3D printing SMEs in South Africa.

6.7.1 Liquidity management practices and profitability

This section presents results and discussions on how and the extent to which liquidity management practices affect profitability of 3D printing SMEs in South Africa.

6.7.1.1 Cash flow management

The responses identified cash flow management as a mechanism through which liquidity management practices affect profitability among 3D printing SMEs in South Africa. According to participants, 3D printing SMEs manage their liquidity and ensure sufficient cash flow to meet their short-term expenses and long-term financial obligations. Some participants explained that cash flow management is essential for dealing with costs such as raw materials procurement, equipment maintenance and

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paying workers' salaries to ensure the efficiency of 3D printing operations and achieve profitability. **Participant 19** mentioned that when cash flow is not managed correctly, the profitability of 3D printing SMEs will be adversely affected due to the disruptions associated with poor cash flow management. **Participant 19** was quoted as follows.

“Based on my experiences for the past five years in the 3D printing business, what I have realised is that when the cash flow is delayed or does not meet the operational targets, it affects the profitability of the firm. This is because the cash flow is what helps to sustain the 3D business in terms of procuring the needed raw materials, maintaining and repairing 3D machines and paying workers to feel motivated to work”.

Furthermore, some participants attest that cash flow management affects profitability among 3D printing SMEs to a greater extent when they can maintain accurate cash flow forecasts, optimise their inventory levels and have prudent payment arrangements with their customers. **Participant 12** further explained that some of the owners and managers of 3D printing firms could predict their cash flows accurately, enabling them to plan their inventory appropriately to ensure no shortages or excess inventory for raw materials. **Participant 12** was quoted as follows.

“When we are able to predict our cash flows accurately as 3D printing SMEs, we are able to balance our inflows and outflows, maintain good inventory levels and continue to provide our clients with the 3D printing products they need without any kind of shortages. This consistency helps to improve our profitability at all times and makes us financially stable”.

The finding is in congruence with the literature. A study by Smirat and Yousef (2016) investigated the impact of cash flow management on SME profitability and found a positive relationship between the two. The study highlighted that efficient cash flow

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management practices, such as monitoring cash inflows and outflows, reducing receivables collection time, and managing payables effectively, can enhance profitability (Smirat & Yousef, 2016). According to Uwonda and Okello (2015), accurate cash flow forecasting facilitates better decision-making, reduces the risk of financial distress, and improves overall financial performance. By clearly understanding future cash flows, SMEs can allocate resources efficiently and avoid excessive reliance on expensive external financing. Research by Katehakis et al. (2016) emphasises the importance of inventory management in SMEs. By accurately predicting cash flows, SMEs can plan their inventory levels accordingly, minimising stockouts and reducing carrying costs. A study by Soboleva et al. (2018) suggests that SMEs should adopt strategies to incentivise prompt payment, such as offering discounts for early settlement or implementing penalties for late payment. Such measures can improve cash flow stability and positively affect profitability.

6.7.1.2 Financial risk management

According to the responses from interviews, financial risk management is a liquidity management strategy used by 3D printing SMEs to achieve profitability to a greater extent. Most participants did assert that effective liquidity management is crucial for managing financial risks associated with their operations. Participant 11 explained that by maintaining sufficient cash reserves, their 3D printing SMEs could mitigate the impact of unexpected downturns in revenue or unforeseen expenses. The conversation between the researcher and Participant 11 further explained the extent to which financial risk management affects the profitability of 3D printing SMEs in this manner:

Researcher: As you rightly said, financial risk management is a liquidity-based practice that affects profitability. My follow-up question is; to what extent does financial risk management affect the profitability of your 3D printing firm?

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Participant 11: ***"****Well, I will say that financial risk management helps my 3D printing firm to maintain good liquidity levels, so I think to a good extent, it affects our profitability. So, this is how I see the whole thing when we fail to plan our finances, we will run into debt, and our profitability will be negatively affected. But with proper financial planning, making sure that we get money from our debtors quickly and maintain good cash flow helps my firm to maintain good profitability levels".*

From the conversation between the researcher and **Participant 11,** it could be rightly deduced that financial risk management as a liquidity management mechanism enhances the profitability of 3D printing SMEs positively through proper financial planning and maintaining good cash flows.

The finding of the study was consistent with the literature. According to Nikolov et al. (2019), effective liquidity management plays a vital role in managing financial risks and ensuring the profitability of SMEs. By maintaining sufficient cash reserves, SMEs can mitigate the impact of unexpected downturns in revenue or unforeseen expenses (Bassey et al., 2016). A study by Martinez-Sola et al. (2018) highlights that liquidity management is crucial for SMEs as it allows them to meet their short-term obligations and navigate financial difficulties. Adequate liquidity also enhances the firm's ability to seize opportunities and invest in growth (Martinez-Sola et al., 2018).

A study by Karadag (2015) emphasises the positive relationship between financial planning and SME profitability. Proper financial planning enables SMEs to anticipate future financial needs, identify potential risks, and make informed decisions contributing to profitability (Karadag, 2015). Maintaining good cash flows is a critical aspect of financial risk management for SMEs. Positive cash flows ensure sufficient liquidity to meet operational expenses, invest in growth opportunities, and manage financial risks. Research by Crovini et al. (2021) highlights the importance of cash flow

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management for SME profitability. Effective cash flow management minimises the risk of financial distress, reduces reliance on external financing, and improves overall financial performance.

6.7.2 Liquidity management practices and growth in the client base

This section presents the results and its discussions with literature on how and the extent to which liquidity management practices affect growth in the client base of 3D printing SMEs in South Africa.

6.7.2.1 Customer retention

According to the responses from participants, the effective management of liquidity among 3D printing SMEs helps them to have enough finances to meet customer demands. The participants further explained that by managing their cash flow and working capital efficiently, their SMEs can ensure they have the necessary funds to fulfil orders and deliver products on time, enhancing customer satisfaction and contributing to growth in the customer base. **Participant 7** was quoted in this manner:

“When we have enough liquidity, we are able to meet the expectations of our customers because there is no shortage of 3D printing products, which helps to build stronger relationships, maintain positive experiences and thereby increase the extent of loyalty on the part of customers”.

The finding was consistent with the literature. Majakusi (2016) argues that effective liquidity management is crucial for ensuring that SMEs have the necessary financial resources to meet customer demands promptly. By maintaining healthy cash flow and working capital, SMEs can allocate funds to procure raw materials, manage production

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processes, and fulfil orders efficiently (Majakusi, 2016). A study by Akinwumi et al. (2017) highlights that proper liquidity management enables SMEs to meet customer demands promptly, reducing lead times and improving overall customer satisfaction. Additionally, research by Ramachandran and Neelakrishnan (2017) emphasises the positive impact of cash flow management on on-time delivery performance in SMEs. Timely delivery enhances customer satisfaction and strengthens relationships, leading to repeat business and potential customer referrals (Ambroise et al., 2018).

6.7.2.2 Investment in marketing

From the responses, it could be deduced that liquidity management practices enhance the increase in client base to a greater extent among 3D printing firms through investment in marketing. Most participants attest that effective liquidity management practices enable their 3D printing SMEs to invest in marketing activities to attract new customers. For instance, **Participant 8** stated that by gaining a clear understanding of their liquidity levels, SMEs in the 3D printing industry in South Africa can allocate funds strategically towards targeted marketing campaigns, events, and promotions. **Participant 8** added that these marketing initiatives enhance brand visibility, engage potential customers, and showcase the unique value propositions of 3D printing products and services, which helps to attract new customers. In addition, **Participant 11** asserted that being able to allocate funds for marketing as a result of efficient liquidity management practices enables them to reach their target audience, generate leads and convert them to loyal customers over time.

The finding was consistent with previous studies since research by Ware (2015) emphasises the importance of marketing investments in attracting new customers and expanding the customer base. Effective liquidity management allows SMEs to allocate resources towards targeted advertising, digital marketing campaigns, participation in

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industry events, and promotional activities, which can drive customer acquisition (Bassey et al., 2016). Moreover, a study by Bassey et al. (2016) further highlights that effective marketing investments can positively impact customer perceptions, generate leads, and ultimately lead to customer loyalty and increased profitability. By aligning liquidity management practices with marketing strategies, 3D printing SMEs can create a virtuous cycle of attracting new customers, increasing revenues, and supporting sustainable growth**.**

6.8 WORKING CAPITAL, LIQUIDITY, AND FINANCE SOURCING CHALLENGES

In this section, the researcher presents result on the challenges that 3D printing SMEs in South Africa face in managing working capital, liquidity and sourcing finance. The results are also discussed in line with relevant literature.

6.8.1 Limited access to financing

According to the responses received, one of the challenges confronting 3D printing SMEs is limited access to financing. The participants explained that traditional financing sources, such as banks, often hesitate to provide loans or credit to 3D printing SMEs due to various factors like perceived risks, unfamiliarity with the technology, or insufficient collateral. **Participant 9,** for instance, stated that most 3D printing SMEs encounter difficulties obtaining the necessary funds to invest in essential areas such as acquiring advanced equipment, procuring high-quality materials, and implementing effective marketing strategies. **Participant 11** added that the absence of adequate financial support for 3D printing SMEs makes it challenging to expand their operations, innovate, and compete in the evolving 3D printing industry, hindering their growth potential and limiting their contribution to the local economy.

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The result of the study was consistent with the literature, a study by Ballard et al. (2018) examined the financing landscape for 3D printing SMEs. The research revealed that traditional lenders, such as banks, exhibited risk aversion towards these SMEs. The unfamiliarity of banks with 3D printing technology was identified as a critical factor contributing to their cautious approach. This lack of familiarity with the potential returns and market opportunities associated with 3D printing resulted in a reluctance to finance these SMEs (Ballard et al., 2018). As a result, 3D printing SMEs faced difficulties accessing the necessary capital to support their business operations, invest in growth initiatives, and attract new customers.

In another study, Rayna and Striukova (2021) investigated the specific financial challenges encountered by 3D printing SMEs in South Africa. The research highlighted the issue of limited collateral faced by these SMEs when seeking loans or credit. Unlike traditional manufacturing businesses that possess physical assets, such as machinery or inventory, 3D printing SMEs primarily rely on intangible assets, such as intellectual property and specialised skills. This unique characteristic of the 3D printing industry poses challenges when providing tangible collateral, as traditional lenders require (Rayna & Striukova, 2021). Consequently, 3D printing SMEs faced hurdles in obtaining the necessary funding, hindering their ability to invest in marketing efforts, expand their customer base, and foster business growth (Ahluwalia & Mahto, 2018).

6.8.2 Volatile input costs

According to study participants, in the context of 3D printing SMEs in South Africa, the cost of raw materials, including filaments and powders, poses significant challenges to working capital management. The participants explained that the volatility and unpredictability of raw material prices make it difficult to effectively manage their working capital, especially when demand for 3D printing products and services is

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uncertain. Some participants further attested that the market dynamics make demand and supply for 3D raw materials unstable, thereby increasing raw materials prices. **Participant 16** was quoted in this manner.

“The instability of prices of raw materials such as titanium, filaments, and cobalt, among others, makes it difficult for most 3D printing SMEs to manage their working capital since it affects the prices of 3D printing end products, and that when customers think that prices of 3D printing products are high, they refuse to purchase and that affects profitability”.

The result of the study was consistent with the literature. Sasson and Johnson (2016) explored the challenges faced by 3D printing SMEs in managing costs and forecasting production expenses. The research reveals that the uncertainty and unpredictability of raw material prices pose significant difficulties for SMEs in planning their budgets, accurately estimating project costs, and maintaining profit margins. This is particularly relevant for SMEs operating in dynamic markets with fluctuating demand, such as the 3D printing industry. The study emphasises the importance of effective cost management strategies, including strategic sourcing, supplier relationships, and inventory management, to mitigate the impact of volatile raw material costs on the financial performance of SMEs (Sasson & Johnson, 2016).

Savastano et al. (2016) support the notion that raw material costs play a critical role in the financial viability of 3D printing SMEs. The volatility and unpredictability of these costs pose challenges in budgeting, cost estimation, and maintaining profit margins. To address these challenges, SMEs in the 3D printing industry can focus on implementing effective cost management strategies, closely monitoring raw material prices, and exploring alternative sourcing options. By doing so, SMEs can enhance

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their financial stability, improve profitability, and navigate the dynamic nature of the 3D printing market.

6.8.3 Limited skills and expertise

The responses from the participants led to the identification of limited human resource skills and expertise as a challenge affecting the operations of 3D printing SMEs in South Africa. Most participants explained that the new technology in the country has resulted in limited educational programmes and training opportunities, leading to a scarcity of qualified personnel. The participants also attested that the limited human resource expertise in 3D printing hampers SMEs' ability to manage working capital, especially in optimising production processes effectively. In explaining how limited human resource expertise affects working capital management, **Participant 13** was quoted as follows.

“It is vital to note that skilled workers are crucial for operating and maintaining 3D printers, troubleshooting technical issues, and driving process improvements, and the limited skilled workers bring about lower productivity, quality control issues, and difficulties in implementing innovative practices. The lack of human resource expertise in 3D printing limits SMEs' ability to fully leverage their working capital and compete effectively in the 3D printing industry in South Africa”.

This study's finding was consistent with a study by Hossain et al. (2020) examining the barriers to adopting and implementing additive manufacturing technologies in South Africa. The research highlighted the scarcity of skilled workers as a significant challenge in successfully integrating these technologies. The study emphasised the limited availability of training programmes and educational resources specific to 3D printing, contributing to a shortage of skilled personnel in the field. Shahrubudin et al.

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(2020) also assert that scarcity of expertise hinders the adoption and effective utilisation of 3D printing technologies, limiting the productivity and competitiveness of SMEs operating in the 3D printing sector.

Supporting this finding, another study by Conner et al. (2015) focused on the challenges SMEs face in the 3D printing sector. The research emphasised the crucial role of skilled personnel in the industry. The study highlighted that the lack of skilled workers in operating and maintaining 3D printers, troubleshooting technical issues, and implementing process improvements adversely affects the productivity and efficiency of SMEs. This shortage of expertise leads to inefficiencies, quality control issues, and a diminished ability to effectively utilise working capital (Conner et al., 2015).

6.8.4 Marketing and sales challenges

According to responses from participants, marketing and selling 3D products and services is a crucial challenge for most 3D printing SMEs in South Africa since the extent of awareness and understanding of the technology remains limited. Most participants further explained that the relatively new nature of 3D printing in South Africa means potential customers may have limited knowledge of its capabilities and applications. **Participant 5** stated that the low awareness about 3D printing technology poses difficulties in effectively conveying the value proposition of 3D printing products and services and educating customers about its benefits. However, **Participant 14** added that since 3D printing technology is still gaining popularity in South Africa, marketing and selling 3D products and services to customers is slow, and it takes more time to sell 3D printing products to customers in most situations.

Relevant literature supports these findings. For instance, Marc (2020) emphasises the limited knowledge and understanding that customers often have regarding 3D printing

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due to its newness and innovative nature. This lack of awareness poses a marketing challenge for SMEs operating in the 3D printing industry. Educational efforts are necessary to overcome this challenge and familiarise potential customers with the capabilities and applications of 3D printing. Marc (2020) further supports this notion, emphasising the need to educate customers about the advantages and possibilities of 3D printing.

Building awareness, trust, and acceptance among potential customers is a crucial task for SMEs operating in the 3D printing industry (Prath, 2021). This process involves addressing scepticism and demonstrating the value and ROI of 3D printing (Prath, 2021). Providing evidence of the benefits, cost savings, and customised solutions that 3D printing can offer through case studies, testimonials, and pilot projects becomes essential (Ben-Ner & Siemsen, 2017).

6.8.5 Equipment maintenance and upgrades challenges

The responses identified the cost of equipment maintenance and upgrades as a challenge confronting 3D printing SMEs in South Africa. According to participants, most 3D printing SMEs lack adequate financial resources to invest in the latest technologies and keep pace with advancements in the 3D printing industry. **Participant 17** explained that maintenance costs can be burdensome, particularly for 3D printing SMEs with limited budgets. **Participant 19** added that financial constraints among 3D printing SMEs result in the lack of access to the most efficient and innovative equipment, potentially limiting the ability of 3D printing SMEs to meet customer demands and fully capitalise on the opportunities presented by 3D printing technology.

The result was consistent with the literature. Laplume et al. (2016) specifically focus on the financial hurdles SMEs face when adopting 3D printing technology. Their research

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identifies high capital costs as a significant challenge, as smaller businesses may struggle to allocate sufficient financial resources for purchasing and upgrading equipment. These expenses can strain the financial stability of SMEs, potentially limiting their ability to invest in other critical areas of their operations (Laplume et al., 2016).

Similarly, Rogers et al. (2016) examined the financial considerations of implementing additive manufacturing technologies, including 3D printing. Their study highlights the substantial initial investment required for equipment acquisition and the ongoing costs related to maintenance and upgrades (Rogers et al., 2016). Ford and Despeisse (2016) assert that financial burdens can significantly impact the profitability of SMEs, as they may need to allocate a considerable portion of their financial resources to cover these expenses.

6.9 CHAPTER SUMMARY

This section presents a summary of the chapter. The findings of the study demonstrate that effective working capital management practices have a positive impact on the profitability of 3D printing SMEs. Specifically, adopting no-credit policies enables these firms to strengthen their accounts receivable, improving profitability. Moreover, the study reveals that hiring competent finance officers enhances the relationship between working capital management and profitability in 3D printing SMEs to a greater extent. Additionally, the findings highlight that working capital management practices are crucial in expanding the client base of 3D printing SMEs by ensuring the timely delivery of products and services to customers. Customer relationship management is identified as a strategic approach that further enhances the achievement of an expanded client base through effective working capital management to a greater extent. Regarding sources of finance, equity financing emerges as a significant factor affecting the

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profitability of 3D printing SMEs. It allows these firms to avoid debt and associated interest and principal payments while exerting pressure to generate profits and sustain investor interests. Debt financing, although providing opportunities for growth and expansion, has a limited impact on profitability due to repayment challenges faced by 3D printing SMEs. As a source of financing, family and friends offer flexible repayment terms but lack sufficient funds to address the high-cost demands of 3D printing business operations. On the other hand, utilising own savings contributes positively to profitability by reducing reliance on external financing and controlling profits for reinvestment.

Furthermore, equity financing facilitates substantial funds for 3D printing SMEs to seize growth opportunities and attract new customers. It also offers investors' expertise, guidance, and industry network connections, contributing to the expansion of the client base. Although beneficial for marketing purposes, debt financing is limited by repayment requirements. Funds from family and friends, easily accessible and used for improving customer service, also aid in expanding the customer base through their involvement in marketing campaigns. Utilising own savings provides financial stability and resources for investing in emerging growth opportunities, leading to an increased customer base through new product development.

The result of the study showed that liquidity enhances the profitability of 3D printing firms by ensuring sufficient cash flow to meet their short-term and long-term financial obligations. The study also indicates that liquidity management practices enhance profitability to a greater extent by managing financial risks associated with their firms' operations. The study results showed that liquidity management practices enable SMEs to ensure they have the necessary funds to fulfil orders and deliver products on time, thereby enhancing customer satisfaction and contributing to growth in the customer base. The study also indicates that liquidity management practices increase

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the client bases of 3D printing firms through investment in marketing campaigns to attract new customers. The study found that 3D printing SMEs face the following challenges in managing working capital, liquidity and sourcing finance: limited access to financing, volatile input costs, limited skills and expertise, marketing and sales challenges and also equipment and maintenance upgrade challenges.

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CHAPTER 7: CONCLUSIONS AND RECOMMENDATIONS

7.1 INTRODUCTION

This study examined the role of financial management practices and sources of finance on the performance of 3D printing SMEs in South Africa. The study was guided by five research objectives and questions supported by a conceptual framework. Data was gathered through the use of interviews. Responses from interviews were analysed through the utilisation of thematic analysis. This chapter provides conclusions derived from the results and recommendations for policy, practice and future studies.

7.2 CONCLUSIONS

This section presents conclusions derived from the research questions addressed through thematic analysis. The findings discussed in Chapter 6 are succinctly summarised in Table 7.1, followed by an in-depth narrative that offers comprehensive insights and interpretations.

Table 7.1: Conclusions based on research questions

Objectives	Research Question	Themes Identified	Conclusion
1a. Examine how and to what extent working capital management practices affect the business performance of 3D printing SMEs in South Africa.	RQ1: How and to what extent do working capital management practices affect the business performance of 3D printing SMEs in South Africa?	No credit policy Hiring competent finance officers	The researcher concludes that a combination of prudent financial policies, such as no-credit policies, and the presence of competent finance officers is crucial for effective working capital management and also helps to achieve profitability to a

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			greater extent among 3D printing SMEs in South Africa.
		Timely delivery of 3D products and services Customer relationship management	The researcher concludes that the timely delivery of 3D products and services to customers and effective customer relationship management enhances the expansion of the client base to a greater extent among 3D printing firms in South Africa.
2a1.Ascertain how and the extent to which equity as a source of finance affects the business performance of 3D printing SMEs in South Africa.	RQ2A1: How and to what extent does equity affect the business performance of 3D printing SMEs in South Africa?	Flexibility and focus on firm operations Pressure to perform	The researcher concludes that equity financing contributes positively to profitability and, to a greater extent, by enhancing flexibility and focus on firm operations and pressure to perform on the part of 3D printing SMEs in South Africa.
		Access to funds Strategic investors	The study concludes that equity financing enhances expansion in client bases to a greater extent because it enables 3D printing SMEs to seize growth opportunities and attract new customers. Moreover, investors support 3D printing SMEs in terms of marketing expertise, guidance and industry networks.
2a2. Ascertain how and the extent to which debt as a source of finance affects the profitability of 3D printing SMEs in South Africa.	RQ2A2: How and to what extent does debt as a source of finance affect the profitability of 3D printing SMEs in South Africa?	Increased financial leverage Loan repayment challenges	The study concludes that although debt contributes positively to the profitability of 3D printing firms, its extent is minimal because of problems associated with the repayment of loans.

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		Accessible funds for the firm improvement Repayment requirements	The researcher concludes that debt finance can be invested in marketing campaigns for 3D printing firms, but the challenges in meeting repayment requirements could affect the extent to which debt finance enhances customer base expansion.
2a3. Ascertain how and the extent to which family and friends as a source of finance affect the profitability of 3D printing SMEs in South Africa.	RQ2A3: How and to what extent do family and friends as a source of finance affect the profitability of 3D printing SMEs in South Africa?	Flexibility of terms Lack of access to adequate financing	The study concludes that although family and friends as a source of finance contribute to profitability, its extent is low since funds from family and friends are not adequate to deal with the high costs associated with the operations of 3D printing firms in South Africa.
		Access to funds	Based on the results, the study concludes that family and friends' finance contributes positively to expanding the client base and, to a greater extent, due to the easy accessibility of funds and the marketing support from family and friends.
2a4. Ascertain how and the extent to which own savings as a source of finance affects the profitability of 3D printing SMEs in South Africa.	RQ2A4: How and to what extent does own savings as a source of finance affect the profitability of 3D printing SMEs in South Africa?	Reduced reliance on external financing	The researcher concludes that own savings contribute positively to profitability and to a greater extent by avoiding reliance on external funding and also having total control over profits for reinvestment into firm operations.
		Improved financial stability Flexibility	The study concludes that own savings enhance the customer base expansion positively and to a greater extent since 3D printing firms

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			can invest in marketing campaigns to attract new customers and meet customer needs without the pressure of loan repayments.
3a: Examine how and to what extent do liquidity management practices affect the profitability of 3D printing SMEs in South Africa	RQ3A: How and to what extent do liquidity management practices affect the profitability of 3D printing SMEs in South Africa?	Cash flow management Financial risk management Customer retention Investment in marketing	The study concludes that liquidity management practices contribute positively to profitability to a greater extent through effective management of financial risks and also meeting both short- and long-term financial obligations. The researcher concludes that liquidity management practices contribute positively to growth in the client base and, to a good extent, by having the required funds to operate effectively to achieve customer satisfaction and invest in marketing campaigns to attract new customers.
4: Explore the challenges that 3D printing SMEs in South Africa face in managing working capital, liquidity, and sourcing finance.	RQ4: What challenges do 3D printing SMEs in South Africa face in managing working capital, liquidity, and sourcing finance?	Limited access to financing Volatile input costs Limited skills and expertise Marketing and sales challenges Equipment maintenance and upgrades challenges	The study concludes that 3D printing SMEs face the following challenges in managing working capital, liquidity and sourcing finance: limited access to financing, volatile input costs, limited skills and expertise, marketing and sales challenges and also equipment and maintenance upgrade challenges.

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5. Ascertain how 3D printing SMEs in South Africa can be assisted in overcoming working capital, liquidity, financing and other financial management challenges.	How can 3D printing SMEs in South Africa be assisted in overcoming working capital, liquidity, financing and other financial management challenges?	Refer to recommendations to practice and policy	N/A

7.2.1 Conclusion on RQ1

The first research question sought to understand how and the extent to which working capital management practices affect the business performance of 3D printing SMEs in South Africa. The study found that adopting no-credit policies enables firms to strengthen their accounts receivable and achieve profitability. The study also found that hiring competent finance officers ensures that working capital management affects the profitability of 3D printing SMEs to a greater extent. From the findings, the researcher concludes that a combination of prudent financial policies, such as no-credit policies, and the presence of competent finance officers is crucial for effective working capital management and also helps to achieve profitability to a greater extent. In this regard, by maintaining a strong focus on cash flow, reducing credit risks, and leveraging financial expertise, 3D printing firms in South Africa can enhance profitability.

The study also found that working capital management practices contribute to growth in the client base by ensuring the timely delivery of 3D products and services to customers. The study also identified customer relationship management as a strategy that enhances the achievement of the expanded client base to a greater extent through working capital management. Based on the results, the researcher concludes that the timely delivery of 3D products and services to customers, as well as effective customer

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relationship management, enhances the expansion of the client base to a greater extent among 3D printing firms in South Africa.

7.2.3 Conclusion on RQ2

The second research question sought to understand how and the extent to which equity as a source of finance affects the business performance of 3D printing SMEs in South Africa. The results indicated that equity financing enhances profitability by allowing them to avoid debt which comes with interest and principal payments. The findings also indicated that equity financing affects profitability to a greater extent because it pressures firms to make profits and sustain the interest of investors. Based on the results of the study, the researcher concludes that equity financing contributes to profitability positively and to a greater extent by enhancing flexibility and focus on firm operations and also pressures 3D printing SMEs in South Africa to perform.

The study also sought to explore how and the extent to which equity as a source of finance affects growth in the client base of 3D printing SMEs in South Africa. The study found that equity financing provides them with substantial funds to seize growth opportunities and attract new customers. The study also found that equity financing helps SMEs in the 3D printing sector in South Africa to expand their client base to a greater extent because investors provide support in terms of expertise, guidance and industry network connections. The study concluded that equity financing enhances expansion in client bases to a greater extent because it enables SMEs to seize growth opportunities and attract new customers. Moreover, investors support 3D printing SMEs in terms of marketing expertise, guidance and industry networks.

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7.2.4 Conclusion on RQ3

The third research question sought to explore how and the extent to which debt as a source of finance affects the business performance of 3D printing SMEs in South Africa. The results showed that debt financing affects profitability by allowing them to grow and expand their business operations, thereby making more profits. However, the extent to which debt financing enhances profitability is minimal due to problems associated with loan repayments. The study concludes that although debt contributes positively to the profitability of 3D printing firms in South Africa, its extent is minimal because of problems associated with the repayment of loans.

The study further sought to ascertain how and the extent to which debt as a source of finance affects growth in the client base of 3D printing SMEs in South Africa. The study found that debt financing can enhance client base growth since such funds can be used for marketing purposes. The study also indicated that although debt as a source of finance could enhance client base growth, the challenges of 3D printing firms in meeting repayment requirements could affect the extent of expanding the customer base. The researcher concludes that debt finance can be invested in marketing campaigns, but the challenges in meeting repayment requirements could affect how much debt finance enhances customer base expansion.

7.2.5 Conclusion on RQ4

The fourth research question explored how and the extent to which family and friends as a source of finance affect the business performance of 3D printing SMEs in South Africa. The results indicated that family and friends, as a source of financing, affect profitability because there is easy access to funds, and the repayment terms are flexible compared to debt. However, the extent to which family and friends as a source of

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finance contribute to profitability is low because funds from family and friends are inadequate to deal with the high-cost demands associated with business operations. From the results, the study concludes that although family and friends as a source of finance contribute to profitability, its extent is low since funds from family and friends are inadequate to deal with the high costs associated with the operations of 3D printing firms in South Africa.

The study also sought to explore how and the extent to which family and friends as a source of finance affect growth in the client base of 3D printing SMEs in South Africa. The results showed that funds from family and friends are easily accessible and could be used for improving the customer service of 3D printing SMEs. The results also indicated that family and friends' finance enhances the expansion of the customer base to a greater extent because family and friends are also involved in marketing campaigns by using their networks to market products and services of 3D printing SMEs. Based on the study's results, the study concludes that family and friends' finance contributes positively to the expansion of the client base and, to a greater extent, due to the easy accessibility of funds and the marketing support from family and friends.

7.2.6 Conclusion on RQ5

The fifth research question sought to understand how and the extent to which own savings as a source of finance affect the business performance of 3D printing SMEs in South Africa. The results showed that own savings enhance profitability by reducing reliance on external financing and avoiding interest payments associated with debt. The results further showed that own savings as a source of finance contribute positively to a greater extent because it enables 3D printing SMEs to have total control over their profits and reinvest back into their firm operations. The researcher concludes that own

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savings contribute positively to profitability and to a greater extent by avoiding reliance on external funding and also having total control over profits for reinvestment into firm operations.

The study further sought to understand how and the extent to which own savings as a source of finance affects growth in the client base of 3D printing SMEs in South Africa. The study found that utilising own savings to finance a 3D printing SME in South Africa enhances its financial stability and provides the necessary resources to invest in emerging growth opportunities. The results also showed that using own savings could increase the customer base to a greater extent by investing in new product development, enabling them to offer innovative solutions that cater to evolving customer needs. The study concludes that own savings enhance the customer base expansion positively and to a greater extent since 3D printing firms can invest in marketing campaigns to attract new customers and meet customer needs without the pressure of loan repayments.

7.2.7 Conclusion on RQ6

The sixth research question sought to understand how and the extent to which liquidity management practices affect the business performance of 3D printing SMEs in South Africa. The result of the study showed that liquidity enhances the profitability of 3D printing firms by ensuring sufficient cash flow to meet their short- and long-term financial obligations. The study also indicates that liquidity management practices enhance profitability to a greater extent by managing financial risks associated with their firm operations. Based on the results, the study concludes that liquidity management practices contribute positively to profitability to a greater extent through effective management of financial risks and also meeting both short- and long-term financial obligations among 3D printing firms.

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The study also sought to ascertain how and the extent to which liquidity management practices affect the growth in the client base of 3D printing SMEs in South Africa. The results of the study showed that liquidity management practices enable SMEs to ensure that they have the necessary funds to fulfil orders and deliver products on time, thereby enhancing customer satisfaction, which contributes to growth in the customer base. The study also indicates that liquidity management practices increase the client base to a greater extent through investment in marketing campaigns to attract new customers. From the results, the researcher concludes that liquidity management practices contribute positively to growth in the client base to a good extent by having the required funds to operate effectively to achieve customer satisfaction and also invest in marketing campaigns to attract new customers.

7.2.8 Conclusion on RQ7

The seventh research question sought to understand the challenges that 3D printing SMEs in South Africa face in managing working capital, liquidity and sourcing finance. Based on the results, the study concludes that 3D printing SMEs face the following challenges in managing working capital, liquidity and sourcing finance: limited access to financing, volatile input costs, limited skills and expertise, marketing and sales challenges and also equipment and maintenance upgrade challenges.

7.2.9 Conclusions on the conceptual framework

The conceptual framework, illustrated in Figure 6.1, outlines the relationships between financial management practices, sources of finance, and firm performance indicators within the context of 3D printing SMEs in South Africa. Specifically, it highlights the positive implications of effective working capital and liquidity management practices on key performance indicators such as profitability and growth in the client base.

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Additionally, the framework suggests that diverse sources of finance, including equity, debt, family and friends, and personal savings, also contribute positively to profitability and the expansion of the client base for 3D printing firms in South Africa. The study's findings affirm the conceptual framework by identifying and addressing challenges faced by 3D printing SMEs in managing working capital, liquidity, and sourcing finance. These challenges include limited access to financing, fluctuations in input costs, insufficient skills and expertise, obstacles in marketing and sales, as well as difficulties in equipment and maintenance upgrades. The recognition of these challenges reinforces the conceptual linkages proposed in the framework, substantiating the impact of financial management practices and sources of finance on firm performance indicators. Moreover, the study underscores its uniqueness by exclusively focusing on 3D printing SMEs in South Africa, a dimension not covered in prior research. This distinctiveness contributes to filling existing knowledge gaps in the literature. By concentrating on the specific context of 3D printing in South Africa, the study provides valuable insights into the financial dynamics of this niche sector, offering a nuanced perspective that enriches the understanding of financial challenges and opportunities faced by 3D printing SMEs. Therefore, the results not only align with the conceptual framework but also contribute to the advancement of knowledge in this specialized domain.

7.3 RECOMMENDATIONS

Based on the conclusions of the study, the study provides recommendations for policy and practice.

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7.3.1 Recommendations for policy

Firstly, due to the challenge of limited financing for 3D printing firms in South Africa, governments and financial institutions should develop specialised financing programmes tailored to the needs of 3D printing SMEs. These programmes can include loan guarantees, subsidies, and incentives to encourage lending and reduce perceived risks associated with the technology.

Secondly, due to the challenge of limited skills and expertise in 3D printing SMEs in South Africa, policy initiatives should foster collaboration between 3D printing SMEs, educational institutions, and industry associations. This can facilitate knowledge sharing, skills development, and joint research and development efforts to address the skills gap and enhance overall industry competitiveness.

Thirdly, due to the marketing and sales challenges confronting 3D printing SMEs, policy initiatives should support marketing and awareness campaigns to educate potential customers, investors, and the general public about the benefits and applications of 3D printing technology. This can be achieved through industry partnerships, public-private collaborations, and funding for promotional activities.

Lastly, governments can promote the adoption and diffusion of 3D printing technology by providing incentives, tax breaks, and grants for SMEs investing in 3D printing equipment and software. Encouraging technology adoption can contribute to increased competitiveness and profitability in the sector.

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7.3.2 Recommendations for practice

Firstly, 3D printing SMEs should explore alternative financing options beyond traditional banks, such as venture capital, angel investors, crowdfunding, or government grants. This can help overcome the limited access to financing and provide the necessary funds for growth and working capital management.

Secondly, 3D printing SMEs should prioritise cash flow management and develop robust systems to monitor and control working capital components, including inventory, receivables, and payables. This can help optimise liquidity, improve profitability, and ensure timely delivery to meet customer demands.

Thirdly, to address the limited human resource skills and expertise, SMEs should actively invest in training programmes and educational initiatives related to 3D printing technology. This can help develop a pool of qualified personnel who can effectively manage working capital, optimise production processes, and drive innovation.

Furthermore, 3D printing SMEs should focus on creating awareness about the capabilities and applications of 3D printing technology. This can be achieved through targeted marketing campaigns, participation in industry events, collaborations with educational institutions, and leveraging social media platforms. Increased awareness can help expand the client base and drive business growth.

Finally, SMEs should allocate resources for regular equipment maintenance and upgrades despite financial limitations. This can help ensure optimal performance, improve efficiency, and keep up with advancements in the 3D printing industry. Effective maintenance and technology upgrades can contribute to long-term profitability and competitiveness.

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7.3.3 Recommendations for future studies

Based on the results and conclusions of the study, the researcher recommends the need for future researchers to expand the scope of this study by examining the potential of adopting advanced technologies, such as blockchain and artificial intelligence, in improving liquidity management and working capital optimisation in 3D printing SMEs and assess the benefits and challenges of implementing these technologies and their impact on profitability.

The researcher also recommends that future researchers examine the influence of collaboration and networking among 3D printing SMEs on their liquidity management practices and overall profitability. Future researchers can also evaluate the impact of partnerships, alliances, and industry networks on accessing resources, sharing knowledge, and expanding customer bases.

Furthermore, future researchers can examine the effects of market factors, such as demand fluctuations, competition, and technological advancements, on the liquidity management practices and profitability of 3D printing SMEs. Researchers can therefore investigate how 3D printing SMEs can effectively adapt to market changes and uncertainties to maintain financial stability and achieve sustainable profitability.

7.4 CONTRIBUTIONS OF THE STUDY

This section presents the significance or contributions of the study in terms of policy, practice and theory. This study is significant because of at least two major findings which are no-credit policy as the preferred working capital management practice and hiring competent finance officers enhances profitability.

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7.4.1 Contributions to theory

This study advances the pecking order theory body of knowledge. The pecking order theory, proposed by Myers and Majluf in 1984, suggests that firms have a hierarchy of financing preferences, preferring internal financing (such as retained earnings) over debt, and debt over equity. It goes on to explain that when internal funds are insufficient, firms resort to external financing, starting with debt and moving to equity as a last resort.

The results of the research identifies no-credit policy as the preferred working capital management practice. The identification of a no-credit policy as the preferred working capital management practice contributes to advancing the pecking order theory in several ways. Firstly, by opting for a no-credit policy, the 3D printing firms are essentially relying on internal financing to manage their working capital needs. This supports the notion that firms prefer internal financing, such as cash reserves or retained earnings, over external sources of financing like debt or equity. Secondly, the avoidance of credit reflects a desire to minimize financial risk. By not taking on debt, the 3D firms reduce the risk of default and associated costs like interest payments. This aligns with the pecking order theory's idea that firms prefer financing methods that minimize risk. Thirdly, the pecking order theory also considers the impact of information asymmetry on financing decisions. It says that firms may avoid debt financing because it signals negative information to external investors. Choosing a no-credit policy could be a way 3D printing firms avoid signalling financial distress or poor creditworthiness to external stakeholders. Also, a no-credit policy indicates that the 3D firms are efficiently managing their operations to generate sufficient cash flow to meet working capital requirements without relying on external sources. This efficiency in operations aligns with the pecking order theory's emphasis on internal financing as the preferred option.

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7.4.3 Significance to practice and policy

The finding of the study is also significant in that it identifies some policy elements and best practices for ensuring profitability. For example, the findings indicate that hiring competent finance officers enhances profitability. For 3D printing small firms, this result can contribute to practice and policy in several ways.

Firstly, small 3D printing firms can use this insight to prioritize hiring competent finance officers who possess the skills and knowledge necessary to effectively manage the company's finances. This could involve seeking individuals with experience in financial analysis, budgeting, forecasting, and strategic financial planning. Secondly, recognizing the importance of competent finance officers can lead 3D printing firms to invest more in developing the skills and expertise of their finance team. This could involve providing training programs, encouraging professional development opportunities, and offering competitive compensation packages to attract top talent. Also, competent finance officers can play a crucial role in guiding financial decision-making within 3D printing firms. Their expertise can help in assessing investment opportunities, evaluating financial risks, and implementing sound financial strategies to enhance profitability and sustainable growth. Another value of this finding is in terms of compliance and risk management. The fact is, finance officers play a critical role in ensuring compliance with financial regulations and managing financial risks. By hiring competent professionals, 3D printing firms can strengthen their internal controls, mitigate risks, and avoid costly penalties associated with non-compliance. In addition, competent finance officers can improve the 3D firm's ability to access external financing options, such as loans or investment capital, by presenting well-prepared financial statements, forecasts, and business plans to potential lenders or investors.

The finding is also useful for policy advocacy. The finding can also inform policymakers about the importance of supporting initiatives aimed at enhancing financial literacy and

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expertise among small business owners and finance professionals in the 3D printing industry. This could involve developing training programs, providing access to resources and mentorship, and fostering collaboration between industry stakeholders and educational institutions.

In summary, the results indicating the positive impact of hiring competent finance officers can inform strategic decisions, improve financial management practices, and contribute to the development of supportive policies for small 3D printing firms, ultimately enhancing their profitability and long-term success.

7.5 SUMMARY

This chapter presented the conclusions of the study based on results gathered from interview responses. Dwelling on the conclusions, the researcher provided recommendations for policy, practice, and future studies. Therefore, the recommendations provided are useful for policymakers in 3D printing, owners and managers of 3D printing, and future researchers interested in financial management and profitability issues of 3D printing firms in South Africa.

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APPENDIX

INTERVIEW GUIDE FOR DATA COLLECTION

Dear respondent. I am Edinam, A. I am a PhD student from Central University of Technology (CUT) Free State in South Africa. My supervisor is Professor Dennis Yao Dzansi from the same university. I am researching the topic: Impact of financial management practices on the performance of 3D printing SMEs and the moderating effect of sources of finance. I would be very grateful for your assistance in completing the questions below. Please read the statements carefully and mark **x** the number corresponding to your choice. The study is entirely for academic purposes; hence any information provided would be considered valuable and confidential. It is hoped that you will be as candid as possible. Thank you.

SECTION A: DEMOGRAPHIC DATA								
	Please mark appropriate answer with X in the applicable box							
1.	Your age (in years)							
2.	Your gender	1 Male				2 Female		
3.	Your highest qualification	1 Advanced Certificate	2 Diploma	3 Bachelors/ AdvDiploma	4 Honours/ PGDiploma	4 Masters	5 Doctorate	6 Other (specify)
4.	State the work you do in the firm							
5.	Which category best describes your current 3D printing firm	1 3D Machine Reseller	2 3D Material Supplier	3 Consulting	4 3D Software & related Technologies	5 Design and Tool Making	6 Other (specify)	
6.	Please indicate your ethnic origin	1 Black South African	2 Other Black African	3 White South African	4 Indian/Asian	5 Coloured	6 Other (specify)	
7.	Please indicate the number of years you have been in 3D printing							

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Section B: Working capital management and firm performance (profitability and growth in client base)

Working capital management deals with managing a company's assets and liabilities in a way that ensures that cash flows are maintained to help meet the operational needs of a firm.

1. In your current 3D printing firm, what are some of the practices put in place to enhance working capital management?
2. Does working capital management contribute to profitability in your 3D printing firm?

2b. If yes, how and to what extent does working capital management contribute to profitability in your 3D printing firm?

3. In your opinion, does working capital management affect growth in the client base in your 3D printing firm?

3b. If yes, how and to what extent does working capital management affect growth in the client base in your 3D printing firm

4. What are some of the challenges faced by your 3D printing firm in managing working capital?
5. In your opinion, how could the challenges identified be resolved.

Section C: Sources of finance and firm performance (profitability and growth in client base)

Sources of finance are the various approaches or mechanisms through which firms can access funding for their businesses. Examples of sources of funding include: debt (money borrowed to finance a business that will be paid back with interest), equity (financing a company to own a share percentage of the company), funds from family and friends, and personal savings).

6. What are some of the sources of finance used by your 3D printing firm to fund business operations/projects?
7. *How and to what extent does equity as a source of finance affect the profitability of 3D printing SMEs in South Africa?*

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8. How and to what extent do family and friends as a source of finance affect the profitability of 3D printing SMEs in South Africa?
9. How and to what extent does own savings as a source of finance affect the profitability of 3D printing SMEs in South Africa?
10. How and to what extent does own savings as a source of finance affect the profitability of 3D printing SMEs in South Africa?
11. How and to what extent does debt as a source of finance affect growth in the client base of 3D printing SMEs in South Africa?
12. How and to what extent do family and friends as a source of finance affect growth in the client base of 3D printing SMEs in South Africa?
13. How and to what extent does own savings as a source of finance affect growth in the client base of 3D printing SMEs in South Africa?
14. What are some of the challenges faced by your 3D printing firm in managing sources of finance?

Section D: Liquidity management and firm performance (profitability and growth in client base)

Liquidity management means determining how much of a company's assets are in cash or can be quickly converted into cash without suffering any loss in value so that short-term liabilities can be met.

15. What are some of the liquidity management practices utilised in your current 3D printing firm?
16. How does liquidity management enhance profitability of your 3D printing firm?
17. To what extent does liquidity management enhance growth in the client base of your 3D printing firm?
18. How does liquidity management contribute to growth in the client base in your current 3D printing firm?
19. To what extent does liquidity management contribute to growth in the client base in your current 3D printing firm?
20. What are some of the challenges faced by your 3D printing firm in managing liquidity?

Thank you for participating in this study

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