How Iranian information communication and technology (ICT) companies are valued

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ABSTRACT

There Limited research exists on the valuation of Information Communication and Technology (ICT) in Iran, with most studies focusing on implementation and adopting a quantitative approach. Alishahi et al. (2014), Abedi (2014), and Mohammadi and Goudarzi (2022) contended various valuation perspectives in sectors like manufacturing, resource extraction, and insurance. However, a critical gap remains unaddressed—the absence of theoretical or empirical studies on the valuation of ICT companies in Iran. International literature, primarily from developed countries, often evaluates ICT sector using quantitative methods, neglecting the nuanced aspects of ICT valuation through a qualitative lens.

This study aims to fill this gap by empirically investigating the valuation process of Iranian ICTs. The research draws insights from Western literature and practices of German professional ICT valuation advisors before conducting a primary empirical study involving Iranian valuation advisors. Employing an interpretivist methodology and a qualitative, semi-structured interview approach, this explanatory investigation explores the perspectives of 16 German ICT valuation practitioners and 10 Iranian counterparts. Thematic analysis was used to analyse the findings of the participants, and reveals six main themes, including applicable valuation methods, dominant methods, and justifications, understanding the ICT valuation process, the significance of scenarios, sensitivity analysis, and simulations in valuation, risk evaluation of ICT firms, and methods for presenting the final valuation conclusion.

The contribution from the research highlights a misalignment between applied valuation methods in Iran and theoretical principles, as well as disparities in the valuation process compared to insights from theory and German professionals. This study contributes to academic knowledge by proposing a conceptual framework for assessing Iranian ICT companies based on its findings. Despite potential limitations such as researcher bias, a small sample size, and the singular perspective of one-on-one interviews, these were mitigated through the application of appropriate research methodologies. This research provides valuable insights for academics, practitioners, and policymakers involved in the ICT valuation domain.

Keywords: Valuation, information communication and technology, ICT, Iran, Germany, valuation methods, valuation process, ICT project analysis

Declaration

I declare that the work in this thesis was carried out according to the University of Gloucestershire regulations and is original except where indicated by specific reference in the text. No part of the thesis has been submitted as part of any other academic award. The thesis has not been presented to any other educational institution in the United Kingdom or overseas.

Any views expressed in the thesis are those of the author and do not represent the university.

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Dedication

This thesis is dedicated to my wife, Maggie, and our son Arsis.

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Performing this doctoral research was a long journey that would not have been possible without various key people, organisations, and institutions.

First, I am thankful to my wonderful wife, who allowed me to tackle such a long journey, and my friends, who supported my decision to pursue a doctoral degree. Furthermore, I would like to thank my supervisors: Prof. Dr Malcolm Prowle, for his valuable advice and support in conducting this research from the beginning, and Prof. Dr Doaa Aly for her helpful comments.

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Hossein Yousefi

Table of Contents

List of Figures

List of Tables

List of Equations

List of Abbreviations

β	Beta of Firm
β_L	Beta Levered
β_U	Beta Unlevered
BSM	Black-Scholes-Merton Model
CAPM	Capital Asset Pricing Model
CC	Cash and Cash Equivalents
CF	Cash Flow
CIV	Calculated Intangible Value
CoC	Cost of Capital
D	Market Value of the Firm's Debt
DCF	Discounted Cash Flow
DDM	Dividend Discounted Model
D&A	Depreciation and Amortization
Div	Dividend Expected to be Paid by Company
Div_1	Forward Dividend
E	Market Value of the Firm's Equity
EBIT	Earnings Before Interest and Tax
EBITDA	Earnings Before Interest, Taxes, Depreciation, and Amortisation
EPS	Earnings Per Share
$E[R_M]$	Expected Market Return
EV	Enterprise Value
EV	Exit Value
FCF	Free Cash Flow
FCFE	Free Cash Flow to Equity

FCFF	Free Cash Flow to Firm
G_c	Growth Cost (Promotion Costs)
g	Growth Rate
ICT	Information Communication and Technology
K	Strike price of the option
LBE	Lost Benefit Equivalent
LTD	Long-Term Debt
MVA	Market Value of Tangible and Intangible Assets
MC_i, MV_i	Market Capitalisation or Total Market Value of ICT Firm
N	Number of Cash Flows, Terminal Date, Periods
N(d)	Cumulative normal probability density function
NI	Net Income
NPV	Net Present Value
OCF	Operating Cash Flow
OPM	Option Pricing Models
P/E	Price-Earnings Ratio
P/E_1	Forward Price-Earnings
P_0	Current Price
P/S	Price-Sales Ratio
PMV	Post Money Valuation
PV	Present Value
$\rho_{i,M}$:	Correlation of ICT with Market
r	Interest Rate, Discount Rate, or Cost of Capital
r_D	Cost of Debt
r_E	Cost of Equity

$\mathbf{r_f}$	Risk-Free Return
RFR	Relief-From-Royalty
$\mathbf{r_i}$	Required Return or Cost of Capital of ICT
RoI	Expected Return on Investment
ROV	Real Option Valuation
RP	Risk Probability
$\mathbf{r_{wacc}}$	Discount Rate from Weighted Average Cost of Capital
S	Current price of underlying assets
T	expiration date of option
$\boldsymbol{\tau}$	Tax Rate
$\boldsymbol{\tau_c}$	Marginal Corporate Tax Rate
$\boldsymbol{\sigma}$	Standard Deviation (Volatility) of Return of ICT Firm
$\boldsymbol{\sigma^2}$	Variance of Return
$\boldsymbol{\sigma_i}$	Volatility of ICT
$\boldsymbol{\sigma_M}$	Volatility of Market
V	Value of Existing Business
$\mathbf{V_0}$	Total Current Value
$\mathbf{V_N}$	Terminal Value
WACC	Weighted Average Cost of Capital

Chapter One
Introduction

1.1 Research overview

In the current landscape, Information and Communication Technologies (ICT) have orchestrated transformative changes in communication, information accessibility, work dynamics, commerce, and social interactions (Roztocki et al., 2019). This digital revolution, while reshaping societal structures and fostering macroeconomic growth, has notably overlooked the valuation processes and risk considerations related to ICTs, especially in emerging countries (Roztocki et al., 2019). The market value of firms in the valuation landscape of Iranian ICT companies, characterised by limited data availability and a small practitioner community, remains largely unexplored (Tahernia and Nawaser, 2021; Salamzadeh and Kesim, 2017; Xiao et al., 2013). This journey commenced with a realisation of the lack of research in this area, particularly in a developing country (Wahab et al., 2020) like Iran, and seeks to fill this gap and comprehensively understand the valuation details of Iranian ICT firms.

1.2 Importance of the research

The significance of this research lies in addressing the gap in the valuation practices of ICT firms in Iran. Despite the critical role of ICT in emerging economies like Iran, existing literature lacks in-depth analysis and discussion, resulting in gaps in academic coverage (Ragupathy, 2011). As the ICT sector in Iran undergoes rapid growth, driven by factors like the Covid-19 crisis, there is an urgent need to establish appropriate valuation methodologies to understand the sector's intrinsic worth (ITU, 2020; Barrutia & Echebarria, 2021; Heidari et al., 2022; Klein & Todesco, 2021). This digital revolution has not only redefined interpersonal connections but has also played a substantial role in macroeconomic growth and societal development (Roztocki et al., 2019). However, a significant gap persists in understanding the intricacies of ICTs, especially in emerging countries, where crucial aspects such as valuation processes, discount rate considerations, and perceptions of unsystematic risks remain inadequately addressed.

The importance of this research is underscored by the unique challenges faced by the Iranian ICT sector. The valuation landscape of Iranian ICT companies remains largely unexplored, with limited attention from both researchers and the industry itself (Tahernia and Nawaser, 2021; Salamzadeh and Kesim, 2017; Xiao et al., 2013). Accessing relevant data proves to be a challenging endeavour, compounded by the scarcity of publicly available information and private firms' reluctance to disclose pertinent details (Osterhues, 2010). Moreover, the relatively small ICT valuation community in Iran leaves stakeholders with minimal resources and guidance to navigate these challenges effectively.

In response to these critical concerns, this study endeavours to undertake a comprehensive exploration of the valuation methodologies employed for established Iranian ICT firms. Furthermore, it seeks to ascertain the market value of medium and small-sized ICT firms in Iran. Through this endeavour, the study aims to shed light on the complex processes involved in valuing ICT enterprises within the Iranian context, offering valuable insights for practitioners and policymakers alike. It also extends beyond borders, aiming to forge a deep understanding of the prevailing paradigms and practices in Western developed countries' ICT valuation arena. The researcher intends to illustrate the practical valuation of this dynamic sector by contrasting methods employed in the West with insights obtained from senior-level Iranian ICT valuation practitioners.

The backdrop against which this study unfolds is significantly shaped by the disruptive force of the Covid-19 pandemic. Traditional work settings grapple with unprecedented challenges, thrusting ICT firms into the limelight (Rahiem, 2020). The expansion of ICT companies in the market emphasises the urgent need to assess their intrinsic worth and determine efficacious valuation methodologies. This endeavour gains particular significance due to the stark disparities between conventional enterprises and the rapidly evolving ICT sector.

As the role of ICTs continues its inexorable expansion on the global stage, their valuation transcends the theoretical realm and assumes paramount practical implications (Yang et al., 2020; Yang et al., 2022). This research not only seeks to bridge existing knowledge gaps but also aims to shed light on the complex valuation processes underpinning this ever-evolving landscape.

The scarcity of studies on ICT valuation in Iran, highlighted by the results of the search across various databases, points to a critical gap in academic coverage (Ragupathy, 2011). Given the significant impact of the ICT industry on the growth and productivity of emerging

countries, particularly in the Middle East, there is a compelling need for in-depth analysis and discussion, further emphasised by the dearth of research in this field (Niebel, 2018; Zaidan, 2017; Shirazi et al., 2009). This study, with its empirical investigation using interpretivist and phenomenological perspectives, aims to contribute substantially to the scholarly discourse on Iranian ICT valuation. It aspires to be the first comprehensive investigation of this crucial topic, offering valuable insights that can shape the future trajectory of the Iranian ICT sector.

1.3 Motivation for the Study

The motivation behind this study stems from several key factors. Firstly, I chose Germany and Iran as the geographical focus for this research because I am Iranian born but have lived and worked in Germany for several years. Secondly, as a finance lecturer at German business schools, I recognised the importance of gaining an in-depth understanding of valuation processes to enhance my knowledge and teaching capabilities in the finance field. Thirdly, there is a notable gap in research regarding the valuation of ICT firms in developing countries, particularly in Iran. This realisation prompted me to investigate the valuation practices of ICT firms in a developed nation like Germany and compare and contrast them with practices in Iran. The overarching aim of the study was to conduct a comprehensive examination, starting with an extensive literature review, followed by empirical research in Germany, and concluding with an exploration of the valuation methodologies employed by Iranian advisors in the ICT sector. Through this endeavour, I seek to contribute valuable insights to the field of finance and bridge the gap in understanding between developed and developing countries' valuation practices.

1.4 Research gap

As the researcher began this journey with a clear purpose in mind, noticed a lack of research on how Information and Communication Technology (ICT) companies are valued in Iran. The researcher investigated into various databases multiple times, eagerly seeking insights into how the ICT sector is valued in Iran. Surprisingly, there was not a single study on this topic. To uncover hidden treasures of knowledge, the researcher used the "Publish or Perish" software, casting a wide net with diverse titles and keywords related to ICT valuation. Yet, the digital ocean yielded only a few research, illuminating the underscoring the limited

exploration of Iranian literature from diverse valuation perspectives across sectors like manufacturing, resource extraction, intellectual capital, and insurance. Noteworthy contributors to this literature include Tahernia & Nawaser (2021), Akhavan et al. (2012), Nur Alishahi (2013), and Mohammadi & Goudarzi (2022).

However, the landscape shifted when investigating into ICT research, revealing a few collections of titles covering the emergence of ICT, project success of ICTs in Iran, ICT in basic education, and the impact of ICT on production in Iran. Various authors, including Soltani (2020), Tondro et al. (2022), Kian (2019), and Moshiri (2017), contributed to this limited body of work.

These findings underscored a critical gap in the literature, prompting the researcher to examine deeper into the ICT industry in Iran. The need for further qualitative research became apparent, as the absence of comprehensive studies begged for exploration.

This study is poised to address this gap by examining how valuation specialists perceive and evaluate ICT enterprises, with a keen focus on industry-specific nuances in the valuation process. In doing so, it aspires to breathe new life into the current body of knowledge, offering invaluable insights to professional valuation practitioners, managers, and academics alike.

Chapter Two of this study meticulously dissects the shortcomings in the existing literature. However, it's paramount to emphasise the distinctive contribution this research aims to make. The academic landscape concerning the valuation of ICTs in Iran lies largely uncharted, rife with open questions awaiting scholarly exploration. This study endeavours to fill this gap, building upon the existing literature and empirical investigations, thus enriching the ongoing academic discourse.

There are several unique features of this study that set it apart from previous research:

- This study pioneers the exploration of Iranian ICT valuation, adopting an interpretivist ontological view and a phenomenological epistemology.
- The study adopts a novel two-empirical-view model, which enables analysts to transform personal experience views into applicable valuation models for ICTs to support the complex valuation of such companies.

- To the best of the researcher's knowledge, at the time this research was conducted, no extant literature existed on the topic of ICT valuation in Iran with a specific focus on the Iranian ICT market.
- Amid the rapidly evolving ICT landscape, this study provides current views and insights, coinciding with the global Covid-19 pandemic, offering contemporary insights into the ICT sector and practitioner predictions about future markets.
- While previous research has predominantly centred on the USA, Australia, the UK, and selected European countries, this study sets out to bridge this geographical gap, offering a comprehensive exploration of ICT practition in Iran. Additionally, it ventures to compare and contrast two different nations, shedding light on the divergent utilisation and perspectives in Iran and Germany.

1.5 Research aim

This study aims to conduct a critical evaluation of Iranian information communication and technology (ICT) valuation practices. To achieve this aim, this study involves a multi-phased approach, beginning with a literature review to understand valuation theories, followed by empirical investigations in Germany to contrast Western practices, and culminating in an exploration of the valuation methodologies employed by Iranian practitioners.

1.6 Research objectives

The following research objectives have been developed to help conduct this research process and offer a basis for the research design:

First research objective: To critically evaluate the models, effectiveness, and justifications of valuation strategies used for ICT firms, assessing valuation practices in Germany compared to other developed countries as derived from the existing literature.

Second research objective: To critically analyse how these models have been used in the ICT valuation process in Iran, and contrasting the practices observed in Germany, especially given the differences between the two countries.

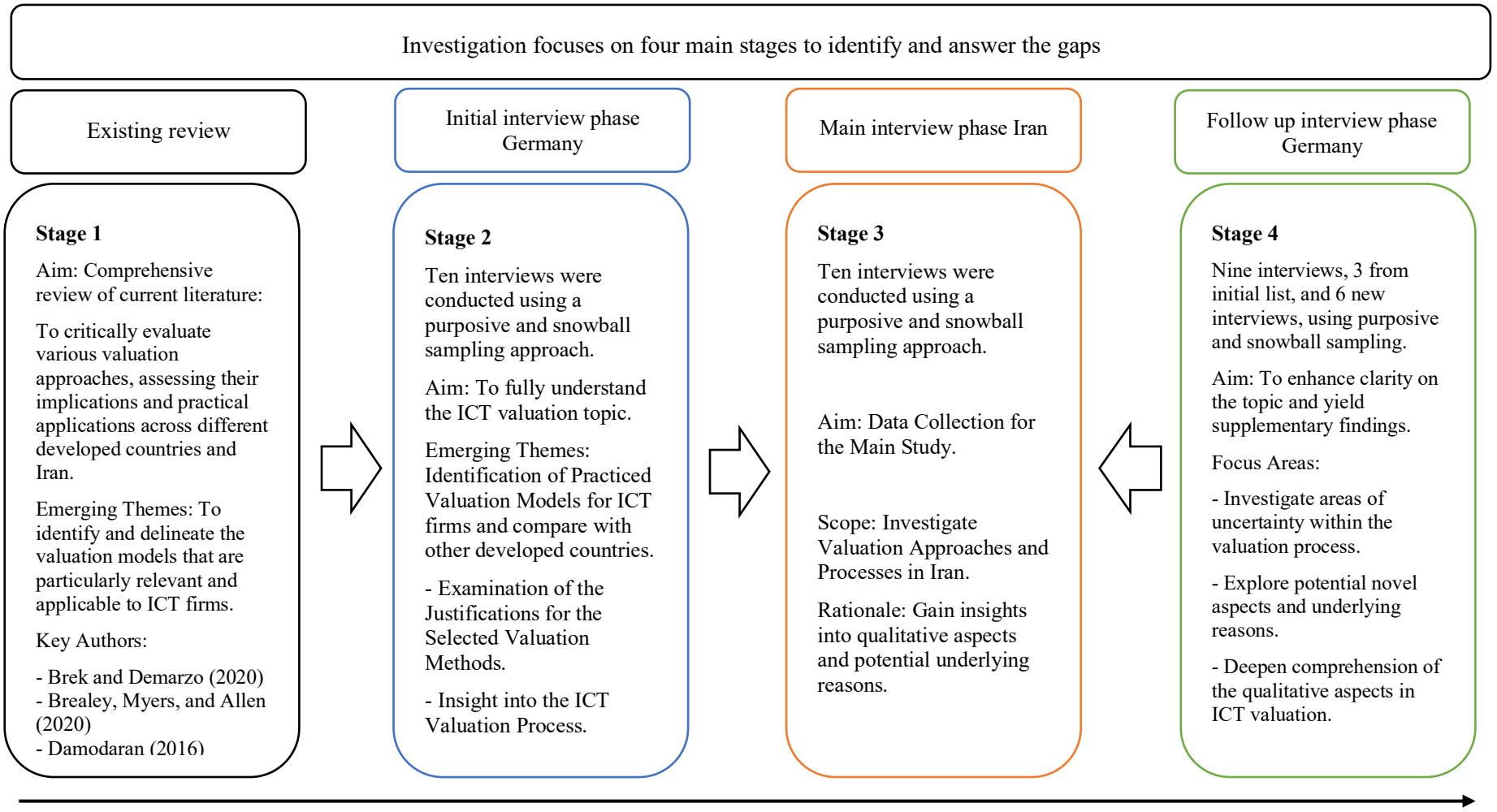
Third research objective: From the findings generated, provide a new academic insight as to how Iranian ICT companies are valuated.

1.7 Approach to the research

The research design employed a careful four-stage approach to address the identified gap in understanding ICT valuation in Iran. Each stage was strategically crafted to sequentially contribute to the main goal of comprehensively separating the complexities associated with valuing Information Communication and Technology (ICT) enterprises. The first stage involves studying the literature review. The second stage involves studying the German specialists' views about ICT valuation empirically, and the third stage involves studying how Iranian specialists value ICT enterprises, and the last stage enhances clarity on the topic and yields supplementary findings.

Figure 1.1 visually summarises the structured progression of the study's investigation, emphasising the identification of gaps and the subsequent targeted strategies to fill these gaps.

Figure 1-1. Investigation focuses on four main stages to identify and answer the gaps



Source: Author's illustration

Stage 1: Literature Review and Theoretical Framework: The first stage centred on an extensive exploration of existing literature, with a primary focus on the theories of finance and valuation. This phase involved a systematic review of current literature to identify and acquaint the researcher with various valuation methods. Notably, valuation theories that have been suggested for valuing ICTs were underpinned and explored as a crucial framework for the fundamental valuation process, comparing valuations across developed countries (Penman, 2015). This review explored into the latest Western publications on ICT firms' valuation, referencing key works such as those by Berk & DeMarzo (2020), Brealey et al. (2020), and Damodaran (2016). A thorough selection process yielded 21 relevant articles from diverse databases, forming the theoretical foundation for subsequent stages.

Stage 2: Empirical Exploration in Germany: The second stage shifted the focus to an empirical examination of valuation methods, drawing insights from an advanced financial centre and developed country—Germany. The rationale for selecting Germany is grounded in the fact that the researcher lives and works in Germany. Additionally, Germany, recognised as a developed country and the 'powerhouse of Europe,' gained heightened importance following Brexit (Laitinen et al., 2020; Bartkowiak & Ratajczak, 2019). After reviewing the current literature and conducting the first phase of empirical exploration, a lack of certain approaches (i.e., option pricing) in the German and Iranian contexts became apparent. This study aims to explore why certain approaches are used and why others are not. This stage sought to understand how German advisors valued ICT firms, providing valuable empirical perspectives to complement the theoretical framework established in Stage 1 and whether their practices deviated from that in other developed countries.

Stage 3: Unveiling the ICT Valuation Process in Iran: The third stage, the core of the research, was dedicated to understanding the ICT valuation process in Iran. Employing an empirical review, the researcher contrasted insights from Iranian ICT valuation specialists with the existing literature and empirical findings from German specialists. This stage aimed to compare and construct an academically suggested conceptual framework, laying the groundwork for future valuations of Iranian ICT firms.

Stage 4: Clarification and Supplementary Insights: The final stage included a series of nine follow-up interviews with German specialists. This phase aimed to enhance clarity on

emerging themes in the valuation process, identify potential oversights and differences with other developed countries, and gather supplementary insights. The interviews, conducted with experienced specialists, served as a crucial validation mechanism for the data collected throughout the study. The main goal was to ensure a clear and comprehensive understanding of the ICT valuation process in Iran, refining the conceptual framework established in the earlier stages. Through this thorough four-stage approach, this research aimed to contribute significantly to the understanding of ICT valuation, filling critical gaps in the existing literature and paving the way for future research in this dynamic field.

1.8 Research contribution

This study aims to contribute to the knowledge of ICT firm valuation in Iran by identifying effective and appropriate models through triangulation of the current literature, empirical evidence from German specialist practices, and Iranian valuation specialists' experiences. This study is the first of its kind, and its findings help to close the significant knowledge gap in the ICT valuation process in Iran. Additionally, the study provides a suggested conceptual framework for future ICT firm evaluation in Iran.

The **literature review contributes** to the identification of different ICT valuation methodologies, such as the income approach (discounted cash flow), the market approach, option pricing models, the replacement approach, and the venture capital valuation method. It also identifies the process and components of the valuation, including financial planning development, cost of capital techniques, and risk assessment based on theory and past empirical studies. After reviewing theoretical studies and examining examples from various Western countries where these valuation methods have been applied, the focus shifts to Iran and the implementation of valuation methods. The review of the literature helps to uncover further criteria to identify and evaluate available models that are applicable to ICT valuation and identify gaps in the valuation theory.

The **methodological contribution** includes interviews with German valuation advisors to gain an in-depth understanding of the applicable methodology and their perspective on ICT valuation. The focus is on identifying the dominant practiced valuation methods and the use of different techniques and components in the valuation process of ICT firms. Subsequently,

the research investigates the valuation process in Iran and presents the viewpoint of experienced Iranian specialists on ICT valuation in Iran.

The **implications** are drawn from primary data, including the triangulation of the published empirical study's findings with German practice findings and the obtained empirical study's results from Iranian advisors. These findings are used to present a suggested conceptual framework for the Iranian ICT firms' valuation process.

This study's findings focus on external financial valuation advisory experience and perspective at the senior level. The aim is to understand how the market value of ICTs has been assessed and bridge the gap between theory and practice. This study provides academia and practitioners with new and updated frameworks to grasp relevant Iranian ICT business valuation methodologies and optimally assess risk and related mitigation options when valuing ICT enterprises in Iran.

This social constructivist study encountered **limitations**, particularly the potential for researcher biases inherent in the subjective nature of research within the small community of ICT valuation. To address this, the researcher prioritised providing a thorough understanding of specialists' experiences instead of generating generalised outcomes, incorporating triangulation analysis from theory, the German context and Iran. Recognising the constraints, the study aimed to offer critical insights, acknowledging the limitations of one-to-one interviews in capturing singular viewpoints. To mitigate this, researchers used open and follow-up questions to examine deeper into each participant's perspective.

1.9 Thesis structure

This section outlines the structure of the remaining chapters of the study.

Chapter Two provides the literature themes associated with the research of the valuation theories and examines the current relevant existing studies about the ICT valuation methods and process. The literature review provides the existing valuations applicable to the ICT valuations. Different studies (Damodaran, 2012; Demirakos et al., 2004; Focardi & Fabozzi, 2004; Imam et al., 2013; Octav, 2020; Peterson & Fabozzi, 2002; Thomas & Gup, 2010) suggested that different firms in various sectors must be appraised using different matrices to find the current value. For example, certain income approaches are ideal for sectors with

predictable cash flows. On the other hand, long-growth firms should use other criteria if they will only make earnings after a tipping point. Then, there are industries such as tangible-based firms, where book value and asset approaches are the most effective. Internal measurement techniques are employed in the valuation of industries that are already producing profits and steadily growing. Because each industry has its own set of variables, the valuation approach must reflect that (Berk & DeMarzo, 2017; Brealey et al., 2020; Aswath Damodaran, 2016; Levy & Alderson, 1998; Penman, 2006; Pike & Neale, 2009).

Chapter Two also delves into a review of applied valuation methods, citing examples from different Western countries. It subsequently provides an overview of Iran's economy, financial structure, and the ICT sector within the country. The chapter concludes by underscoring the imperative nature of investigating ICT valuation in the Iranian context.

Chapter Three reviews the interpretivist approach to using semi-structured interviews. The sampling methods of purposive and snowball were applied to approach the target participants of this study, and the process of the interview questions' guidance and information leaflet was developed considering the ethical considerations of the University of Gloucestershire guidelines. The sample participants of the study consisted of a series of sequences of empirical data collection for understanding of the ICT valuation from 16 German specialists in two phases. Then, it moved on to the main study, which included 10 interviews with Iranian valuation specialists. All the participants were senior-level external valuation advisors with 8 to 25 years of experience, were valuation specialists, and had experience with ICT valuation. The thematic method of data analysis has been employed for examining the findings.

Chapter Four of this study presents a comprehensive examination of the primary findings derived from the research conducted among Iranian and German ICT valuation specialists. The central objective of this chapter is to address the three key research objectives by assessing the methodology employed for valuing ICT companies and the underlying justifications. The chapter investigates deeply into the multifaceted evaluation process, encompassing detailed scenario analysis, sensitivity analysis, and the use of Monte Carlo simulation methods. Moreover, this chapter offers insights into the outcomes of risk assessments conducted during the valuation process, the intricate calculations pertaining to discount rates, and the manner in which growth rates are considered. In an additional dimension, the chapter draws a comparison and contrast between Iranian investigations and

the perspectives of German practitioners concerning ICT valuation, as captured through interviews. This study also evaluates the pertinent valuation methodologies in practical application for the future assessment of ICT firms as well as elaborates on how the results yielded by these methods are articulated. Furthermore, the chapter extensively explores specific issues and challenges that analysts should remain attentive to throughout the valuation process.

Chapter Five is dedicated to the discussion and analysis of the data collected from literature and during the empirical phases of the research, which involved the point of view of Iranian and German specialists. The chapter examines the research findings and their connection to the existing literature, highlighting how findings contribute to the research objectives using the triangulation analysis method, as developed by the researcher. The chapter extends its horizon by offering suggestions drawn from empirical insights from Iran and Germany and confirmed by literature. These suggestions delineate ways in which the valuation of Iranian ICT companies can be enhanced in the future. In essence, this chapter furnishes invaluable perspectives from Iranian and German ICT valuation specialists, grounded in practical experience. It accentuates the contributions to knowledge embedded within the conceptual framework for forthcoming valuations of Iranian ICT ventures. Additionally, the chapter explores the challenges specialists confront throughout the valuation process, meticulously examining avenues for improvement and enhancement.

Chapter Six serves as a concluding chapter that provides a summary of the different chapters. It presents a concise overview of the research objectives and their corresponding answers, drawing upon existing literature and empirical evidence. Additionally, it outlines the areas in which this study contributes to both knowledge and practice. The chapter also discusses the limitations of the research and suggests future avenues for ICT valuation research, with a focus on applying the conceptual framework in theory and practice. Finally, the section concludes with a summary of the researcher's journey over the past five years working on this study.

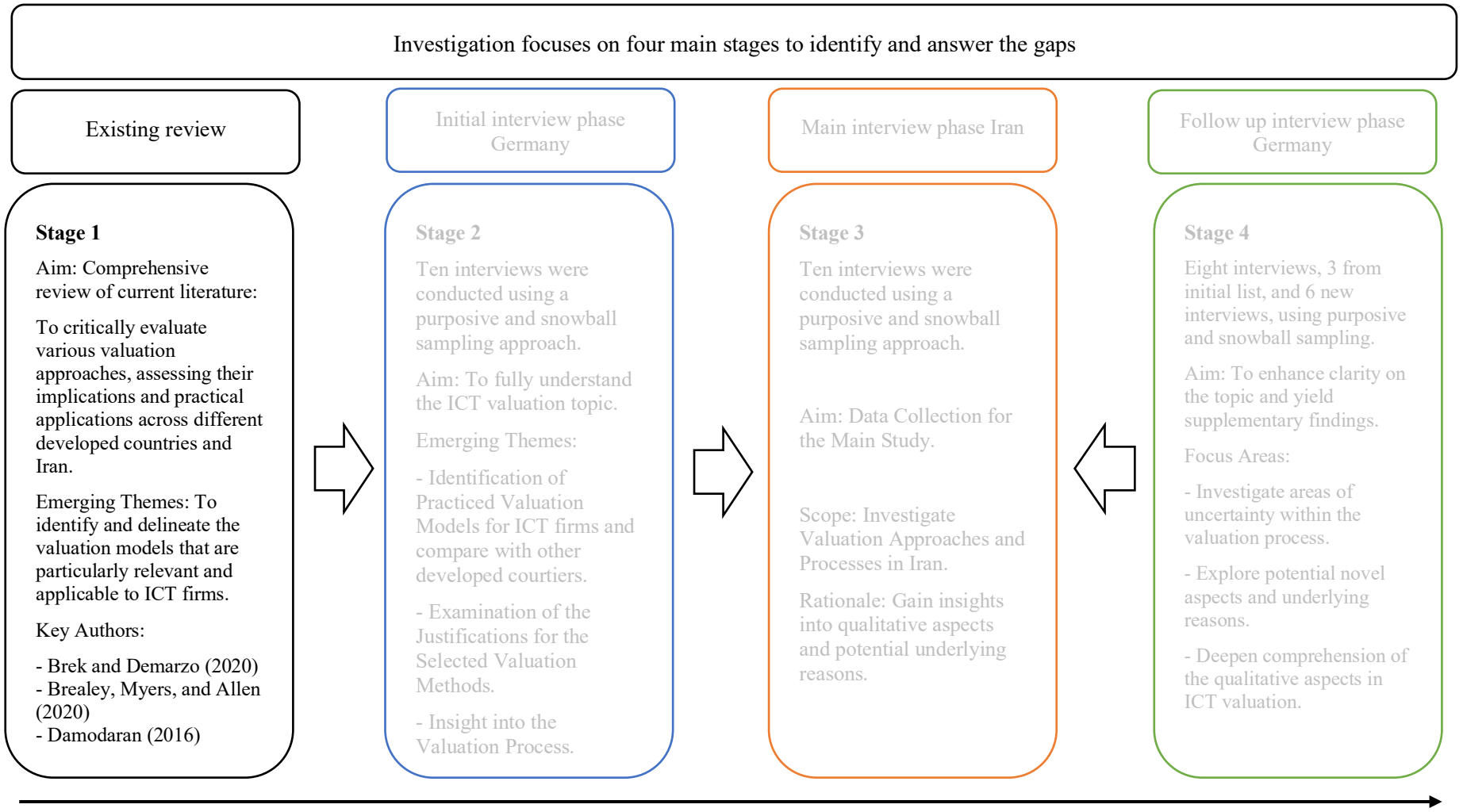
Chapter Two
Literature review

2.1 Introduction

This chapter aims to identify emerging themes and critically evaluate the existing knowledge and main theoretical valuation models used to value ICT firms in other countries and specifically in Iran. The researcher initiated an in-depth examination of the existing literature employing a systematic literature review (SLR) method. Section 2.1.1. detailed the criteria employed for acquiring current studies. The literature review focuses on theoretical methods for ICT valuations, examining various valuation theories and their applicability in Western countries, along with examples. The chapter provides an in-depth analysis of Iran as the primary subject of study, focusing on financial structure and specifically on the assessment of ICTs within the country. Through this review, the researcher could identify gaps in existing studies and establish research objectives. The literature review provides a theoretical framework for ICT valuation and helps the researcher to understand the different methodologies used in previous studies, recognise their limitations, and identify areas for further investigation (Baker, 2016).

As illustrated in Figure 2-1, this section is the initial stage of the investigation from current literature for the research topic.

Figure 2-1. Stage 1, the review of the current literature



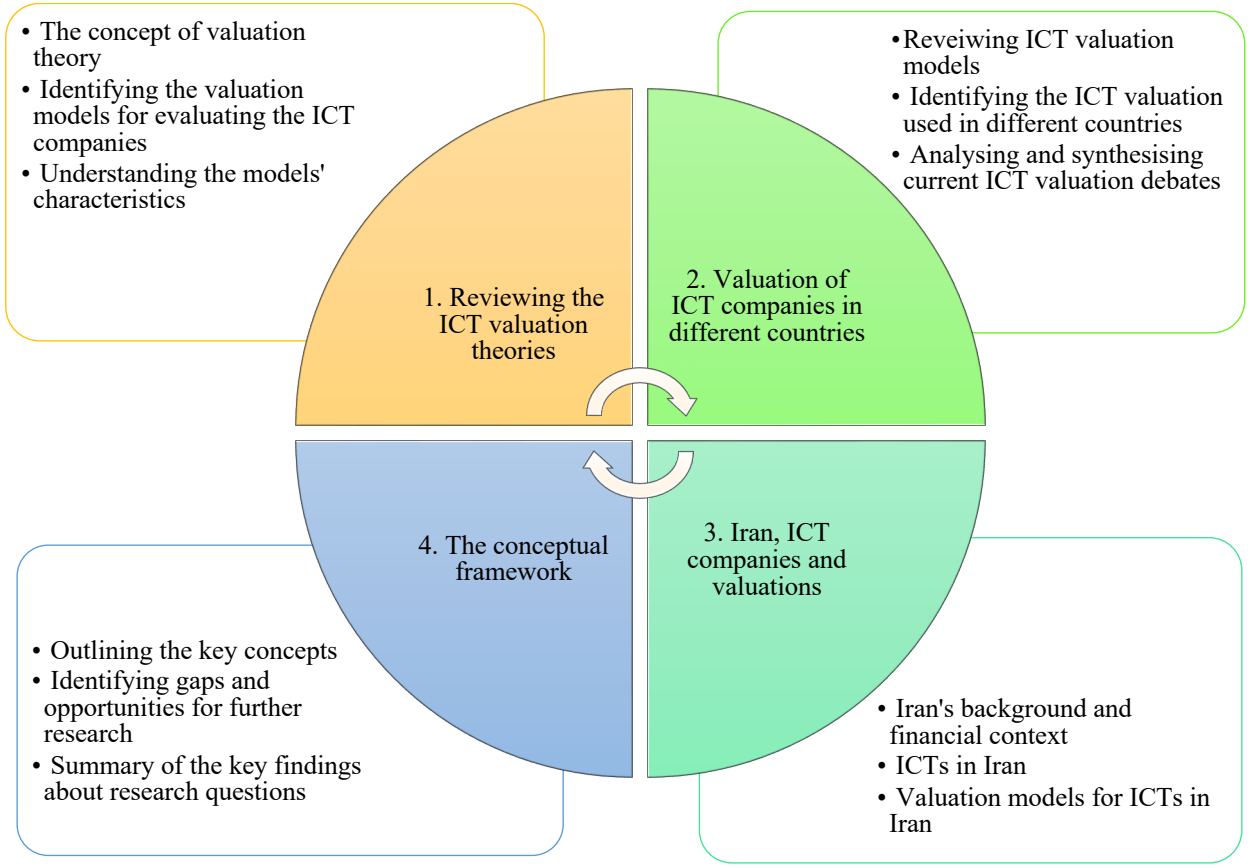
Source: Author's illustration

The section reviews existing literature on ICT company valuation, including various valuation methods used in different countries. This analysis provides a foundation for identifying the main valuation models and theoretical principles underpinning them. The review examines Iran's economic, financial, and political context, including the challenges ICT companies face, such as limited access to capital, political instability, and economic sanctions. The section also reviews the valuation theories and practices in Iran with those in other countries, focusing on ICT company valuation.

The literature review concludes by presenting a conceptual framework for the study and summarising key findings. The conceptual framework outlines key concepts and variables used to analyse the valuation of ICT companies in Iran, while the conclusions provide a basis for further research.

Figure 2-2 has been created to visualise the key concepts and the literature map, enabling a better understanding of the different areas of research. It depicts the connections between the components of this literature review.

Figure 2-2. The literature review map



Source: Author's illustration

2.2 Approach to literature review

This section presents the aspects of the research process, including the literature search strategy, study selection and analysis, establishment of the comprehensive review of existing knowledge.

2.2.1 Systematic Literature Review (SLR): Literature search method

Numerous reviews in the field of literature search strategies have been conducted, with the systematic literature review being widely recognised as the most prevalent in business studies (Dudovskiy, 2018; Tranfield et al., 2003). Hence, to achieve the research aim of this study, the systematic literature review methodology was employed. The systematic literature review is a rigorous and comprehensive approach, characterised by a well-defined methodology. Typically, this type of review entails an exhaustive and unbiased examination of all accessible literature sources.

A Systematic Literature Review (SLR) stands apart from other forms of literature reviews due to its distinctive characteristics. SLR is distinguished by its capacity to offer an exhaustive and in-depth exploration of the chosen literature. The primary objective of a systematic literature review is to discern the core ideas and concepts relevant to the study, ultimately paving the way for the development of a well-informed research strategy.

In systematic review:

a) Pervasive search of the specific research field.

b) Grouping of sources into categories:

- very relevant, based on sound research,
- very relevant, weak research
- low relevance, or too general

c) Giving a step-by-step report on the search method used, decisions taken and derived conclusions.

Using the Systematic Literature Review (SLR) method, the researcher could effectively identify, select, and meticulously evaluate research in order to address a well-defined research question pertaining to ICT valuation gaps (Dewey & Drahota, 2016). A key

distinguishing feature of a systematic review is the use of a precisely defined protocol or plan that explicitly outlines the criteria prior to commencing the study.

2.2.2 Systematic literature review method and data

To acquire an up-to-date insight pertaining to the research topic and its associated questions, this study undertook a Systematic Literature Review (SLR) to systematically identified and selected pertinent papers from various databases. Furthermore, the researcher precisely executed a series of steps encompassing data collection, search processes, and quality assessments of the studies. These systematic endeavours were aimed at both theoretically and empirically explaining the challenges inherent in information communication and technology valuation, as well as pinpointing gaps in the existing literature.

2.2.3 Data collection and search approach

The data collected for this study was sourced from open-access databases, focusing on titles and keywords that were particularly pertinent to the valuation topic. To compile a comprehensive and detailed summary of relevant publications, initial searches were conducted using various academic databases, including Google Scholar, WorldCat.org, ABI/INFORM Global, Crossref, and ArticleFirst. The search methodology employed to retrieve papers published within the timeframe of 2000 to 2024 is presented in Table 2-1.

Table 2-1. Search term

Title words	**Keyword and Abstract search terms**
"Valuation", "Valuing",	("valuing" OR "ICT" OR "Information Communication Technology" OR "Information Technology" OR "Technology Companies" OR "Intangible Assets" OR "Challenges" OR "Assets" OR "Assessment" OR "Equity" OR "Start-up" OR "Valuation Model" OR "IPO Valuation" OR "Venture Capital" OR "Software Valuation")
Year	0 - 2024

Source: Author's illustration

The initial automated search yielded a total of over 5500 results, as illustrated in the Table 2-2, obtained from various databases. Subsequently, the search was refined by considering factors such as language and the number of papers found.

Table 2-2. Total number of papers identified from the search (year: 0 – 2024)

Database	**Refine the search**	**Language**	**Number of papers found**
Google Scholar:	In title and keywords	All	2488 papers
WorldCat.org:	Best match in title and keywords	English	2064 papers
ABI/INFORM Global:	Best match in title and keywords	English	498 papers
Crossref:	In title and keywords	All	202 papers
ArticleFirst:	Best match in title and keywords	English	334 papers

Source: Author's illustration

2.2.4 Study selection and assessment

The subsequent phase involved screening the titles and abstracts, as the initial automated search yielded a considerable number of unrelated or overly general results, which did not contribute significantly to comprehending the challenges associated with ICT valuation. Following the elimination of irrelevant findings, the process shifted to manual selection of potentially pertinent papers. This selection procedure involved several steps:

a) Title, Keywords, and Abstract Review: The initial step entailed reviewing the titles, keywords, and abstracts of the articles.

b) Selection Based on Inclusion Criteria: Papers were chosen based on predefined inclusion criteria.

c) Quality Assessment: A thorough quality assessment was carried out.

d) Full Article Review: Finally, selected articles underwent a comprehensive review by reading the entire paper.

This multi-step process involved manual filtering, beginning with a title scan, followed by abstract examination, and concluding with quality assessment, all guided by distinct criteria aimed at narrowing the scope and selecting relevant subjects.

Table 2-3. Quality assessment criteria

Article	**Assessment criteria**
Title filtering	- The article should be written in the English language - The topic should be related to valuation methods or process - Eliminating non-research papers - Eliminating potential duplicates
Abstract filtering	Articles are scientifically relevant to valuation methods or processes. The content of the article should define theories, empirical application of valuation challenges.
Entire article filtering	The author read the entire article to assess the quality of the article according to low relevance (too general), relevant (weak research), very relevant (good research) criteria.

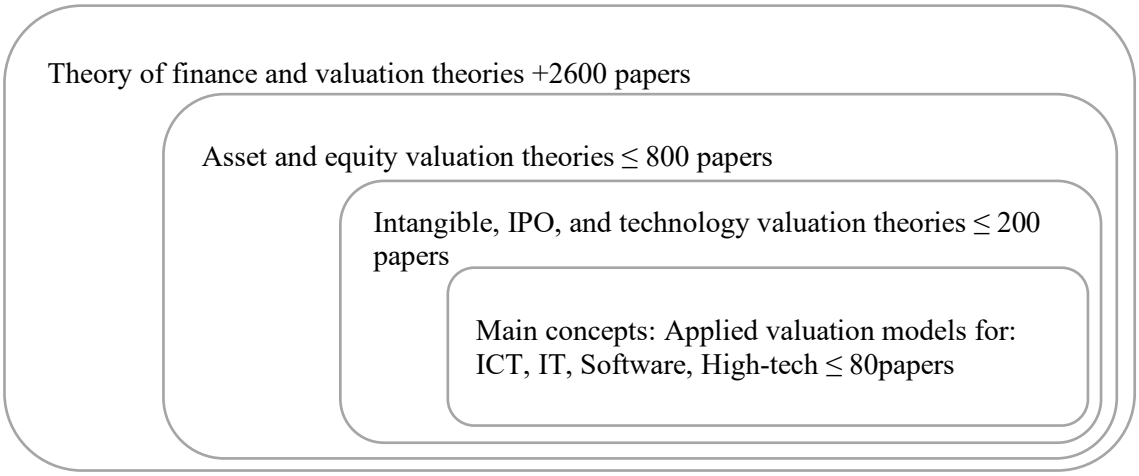
Source: Author's illustration

2.2.5 Analysis of articles

The process undertaken to identify potentially relevant papers is visually depicted in the Figure 2-3. The culmination of this process results in the categorisation of articles into three groups: those of low relevance, medium relevance, and high relevance.

After applying the predefined criteria and excluding articles that did not meet the specified criteria, the researcher left with a total of 203 papers from the initial list. Among these, 122 articles were deemed to have lower relevance, while only 81 articles emerged as demonstrating both strong research quality and direct relevance to the current topic.

Figure 2-3. Literature search and selection process



Source: Author illustration

In summary, the research process commenced with an in-depth review of data science and relevant theories, providing a solid foundation in theoretical understanding. Subsequently, an extensive review and analysis of existing literature, knowledge, and previous methodologies were conducted. This was followed by the qualitative collection of primary data, capturing real-world practices.

2.3 Review of current publications on valuation theories for ICTs

Valuation is a crucial process in finance that helps assess the value of companies and assets. According to Berk and DeMarzo (2020) and Ross et al. (2020), valuation involves determining the intrinsic or market value of an asset. The process assists investors, analysts, and managers in making informed decisions regarding strategic initiatives such as mergers, acquisitions, and investments (Brealey et al., 2020). The valuation of ICT companies, especially those in the high-tech, platform, and software industries, has always been a subject of significant interest for investors, entrepreneurs, and analysts alike.

Valuing ICT companies presents unique challenges due to their rapid growth, intangible assets, and evolving business models. To derive accurate and meaningful valuations, various valuation theories have been analysed in the literature. This chapter aims to review current publications about the valuation of ICT companies, examine the valuation theories used, understand their concepts and reasoning, and identify the most applicable valuation models for evaluating ICT companies.

The past two decade has witnessed a burst of research on the valuation of manufacturing and tech companies. Researchers have examined the valuation practices applied by market participants, the impact of intangible assets on valuation, and the valuation approaches that best capture the unique characteristics of ICT firms. Several authors have contributed significantly to this area of study, including Damodaran (2009), and Koller et al. (2010), among others. Damodaran's insights on valuing tech companies highlights the significance of cash flow forecasting, risk assessment, and the incorporation of optionality in the valuation process. In addition, Koller, Goedhart, and Wessels, focus was around cash flow-based methods of ICT valuation and a thorough assessment of growth opportunities.

The discounted cash flow model employs company's income-based approach to calculate the present value of a company's future cash flows by applying appropriate risk discounting. This approach helps in assessing the risks and returns related to an investment opportunity and facilitates the comparison of investment alternatives to identify the most profitable option (Berk & DeMarzo, 2020).

In contrast, older valuation methods, such as asset-based and cost-based approaches, rely on the cost theory. These methods consider the cost of assets or the cost of replacing those assets to estimate a company's value (Grant, 2017). While these methods are still used today,

replacing method may not provide as accurate a valuation as other models like the income valuation model, which considers more variables and employs more sophisticated techniques.

Modern valuation theory indicates that managers should invest in enterprises with a positive net present value to attract investors and generate more capital (Pike & Neale, 2009). According to IVS, valuation strategies can be broadly classified into three categories: asset-based, income-based, and market-based (IVS, 2020). Each strategy has its advantages and disadvantages and is suitable for various assets and enterprises (Damodaran, 2012).

Overall, each valuation theory has its strengths and weaknesses, and the choice of which theory to use depends on the specific circumstances of the valuation. For example, discounted cash flow theory may be more suitable for valuing companies with potential and predictable cash flows, while relative valuation theory may be more suitable for valuing companies in industries with a lot of comparable companies (Brigham & Houston, 2009; Brigham & Houston, 2019). Asset-based valuation theory may be more suitable for valuing companies with a lot of tangible assets, while option pricing theory may be more suitable for valuing companies with many options of intangible assets or flexibility in their operations. Behavioural finance theory may better explain why an asset's or company's value deviates from its fundamental value due to market sentiment and investor behaviour (Graham & Harvey, 2001; Vishwanath, 2007, Ryan, 2007).

Theories of valuation in finance are not universally applicable across countries, as various factors such as economic conditions, financial regulations, and cultural values can influence their implementation. Moreover, traditional valuation methodologies that consider the tangible assets may not be well-suited for valuing companies in the dynamic ICT sector, which undergoes frequent changes in market conditions and rapid technological advancements (Pierre-Louis, 2018). The valuation of companies with intangible assets, such as patents, copyrights, and trademarks, presents challenges and may be challenging to incorporate into valuation models (Imam et al., 2008). Additionally, forecasting future earnings proves difficult due to the ICT industry's high competition and sensitivity to market shocks (Benou et al., 2007). Accurately determining the value of an ICT business necessitates the application of various theoretical valuation approaches along with practical knowledge. Regular revaluation is also crucial to ensure the company remains competitive and appealing to investors (Arayssi & Jizi, 2019).

While Western countries have developed criteria for valuing modern technologies to ensure comparability and verification (Almabekova et al., 2018), developing countries may not have legally regulated valuation methods for ICT companies (Rothman, 2020). According to the study by Almabekova et al. (2018), a confident procedure and complementary rule are needed for ICT valuation in developing countries.

Other valuation methods, like real options valuation and venture capital method can help, as suggested by Barrutia and Echebarria (2021) and Camilleri (2021). However, other researcher claimed that the valuation of a technology business is the process of determining the asset and profit prices obtained by the company through effective management (Arayssi & Jizi, 2019). Within the valuation using tools such as scenario, sensitivity analysis, and simulation techniques may employed to cover the flexibility and help to understand the uncertainty in the ICT industry, and to better forecast future earnings and estimate the potential impact of market shocks (Hansson et al., 2006).

2.4 Reviewing the potential valuation theories for ICTs and their concepts

Several valuation theories have been analysed in the context of ICT companies. These theories differ in their underlying assumptions, inputs, and methodologies. Valuing companies in the ICT sector is a complex and dynamic process that requires careful consideration of various factors (Azka & Faturohman, 2020; Hennessy, 2017; Kossecki et al., 2017; Shehab, 2020; Soliman, 2019; Taghavifard & Radmard, 2019; Wilhelm, 2020). Some of the prominent valuation theories based on a review of western published literature, this section presents the primary suggested theoretical methodologies for valuing ICT companies. Following is a discussion and evaluation of the valuation approaches from prior scholars and empirical findings for valuing ICT companies. Each of these valuation approaches includes detailed methods of application. The valuation models begin with the income approach, with a specific focus on the Dividend Discount Model (DDM) and the Discounted Cash Flow Model (DCF). This section also covers the assessment of risk for the ICT project. Subsequently, the discussion shifts to the market approach, where the researcher explores the three main multiple valuations. Moving forward, the study observe into the option-based valuation methods and followed by cost approach, with particular attention given to the Replacement Method. Finally, the Venture Capital Method is introduced as an alternative

option in response to concerns about its applicability. Given the fact that this study is qualitative in nature, all the formulas and in-depth quantitative calculations for each model are provided in Appendix 8.1.1.

2.4.1 Income approach: Dividend discounted model (DDM)

The Dividend Discount Model (DDM) valuation approach is used to find the intrinsic value of any asset that pays dividends (Brealey et al., 2020). The Two-Stage DDM is the valuation method utilised for valuing a company's value by forecasting its price based on the sum of its upcoming dividend payments (Penman,1998). Additionally, it can be employed to evaluate the entire company by discounting all anticipated future cash flows. This method is frequently applied to well-established businesses that have a history of making residual cash dividend payments while undergoing moderate growth. While the model allows for flexibility in growth rate adjustments, it should be exercised with caution since it is highly responsive to various inputs (Berk & DeMarzo, 2020; A Damodaran, 2016). DDM involves the prediction of future dividends for an ICT company and subsequently discounting them back to their present value.

The DDM valuation approach has received criticism due to a significant limitation in its ability to assess non-dividend paying ICT companies, thus rendering the model inapplicable even in scenarios where potential growth is feasible, such as ICT companies which focus on the intangible assets to generate future benefits and not paying dividend in most cases (Fernández et al., 2002). The DDM's value calculation is dependent on several assumptions regarding growth rate, required rate of return, and pay-out rate, which calculating any of these component wrongly can lead to inaccuracies in its application (Ross, 2015). Despite its widespread use for estimating the value of shares for publicly traded companies, the DDM has been also criticised for failing to account for the effects of share buybacks on company value, which can significantly impact shareholder value (Damodaran, 2012). The Dividend Growth Model violates the Modigliani-Miller Theorem, which posits that under certain assumptions, the value of a firm is independent of its dividend policy (Ryan, 2007). Due to its limitations, the DDM is not frequently utilised by analysts. Nevertheless, the DDM retains its usefulness as a valuation tool for companies that distribute dividends, particularly those operating in slow or no-growth conditions.

2.4.2 Income approach: Discounted free cash flow method (DCF)

The discounted free cash flow (DCF) method is a financial valuation model used to determine the value of a business. DCF bases its estimates on the expected future cash flows of the enterprise. The DCF method is widely used to value high-tech businesses (Graham & Harvey, 2001). To calculate the present value of projected cash flows, the method applies a discount rate that reflects the opportunity cost of investing in the business, which discounts future cash flows back to their current value. The DCF method considers various factors such as revenue growth, expenses, capital expenditures, and working capital requirements to arrive at an estimate of future free cash flows, which is then discounted to the present value. Various sources from theory and practice support these input criteria, including, Berk and DeMarzo (2020) and Brealey et al. (2020). The DCF method is considered a flexible valuation model that can accommodate various scenarios, such as changes in growth rates, discount rates, or terminal values (Penman, 2015). Mielcarz and Wnuczak (2011) conducted a study to explore the prevalent and significant approaches for valuing ICT businesses.

The findings indicated that the most used and important method for valuing such businesses is the DCF-based entity approach. This preference is likely attributed to the unique and rapidly evolving business models often seen in the ICT sector, which pose challenges when applying traditional valuation methods. Allee et al. (2020) conducted a survey involving 172 specialists, revealing the respondents' preference for using the DCF model in valuing intellectual properties. The significance of the firm's intangible assets in value creation is explored in valuation studies. Nevertheless, challenges arise in measuring these intangible assets, including the complexity of establishing a clear trail of evidence to substantiate the concerned asset and uncertainties regarding the future benefits it may yield (Ryan, 2007). Similarly, Ritter and Wells (2006) found a positive correlation between the value of intangible assets, such as those in ICT firms, and future period income. Daneshgar et al. (2013) argued that larger organisations tend to adopt a long-term perspective when making software acquisition decisions, while small independent software vendors (ISVs) with substantial intellectual property rights are linked to sales growth. Consequently, multiple studies suggest employing the DCF method for valuing ICT assets with a focus on future benefits (Fernandez, 2019; Maltry & Kuhner, 2017; Yousefi, 2021).

Although the DCF model is a useful tool for estimating future cash flows, it relies on several assumptions and uncertainties, which may affect the accuracy of its estimates (A Damodaran, 2016). Moreover, the model has some limitations, such as excluding critical costs and the potential for inaccuracies due to perpetual growth rate and discount rate estimations (Velez-Pareja, 2007). Furthermore, the model may show a *paper profit* that compromises the authenticity of the business data, which serves as the basis of valuation (Erb, 2020). Additionally, according to Boer (2002), discount valuation models are susceptible to estimations related to the perpetual growth rate and discount rate. Any minor growth and discount rate changes will fluctuate wildly on the fair value and make it inaccurate.

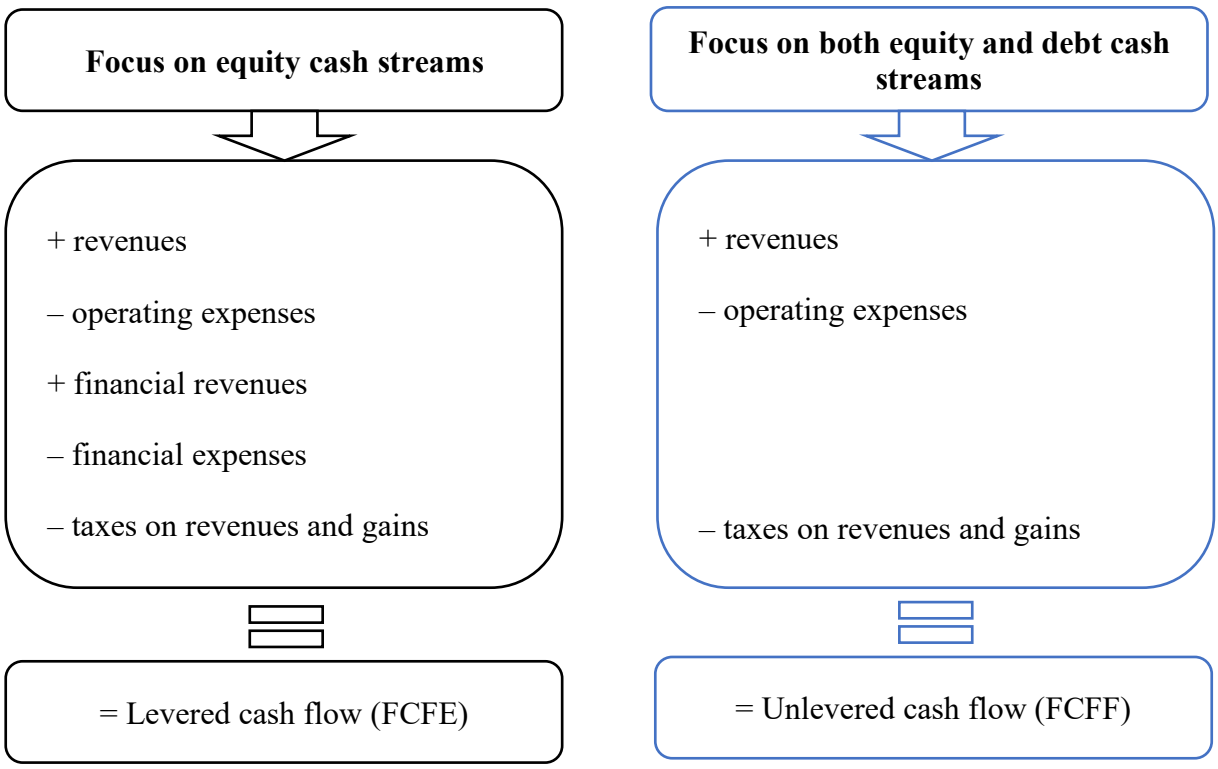
When considering future income, it is crucial to observe four parameters very closely, as noted by Reilly (2008); and Tkachenko et al. (2018). These parameters include ICT's expected cash flow and earnings, the period expected to generate income, the present value of future income, and the risk and discount rate of realising future income.

Estimating cash flows is a crucial step in determining the intrinsic value of an ICT company using the DCF model, and analysts should pay close attention to identifying the relevant cash flow components and estimating them accurately (Fernandez, 2019).

Identifying the relevant cash flow streams can be challenging for companies with complex financing structures, such as those in the ICT industry with more uncertainties (Brigham et al., 2017). There are two different methods for calculating the free cash flows: Using free cash flow to the equity (FCFE) for valuing equity investments and free cash flow to the firm (FCFF) for valuing the entire company is a common practice. However, for internal valuations of ICT companies, a direct estimation of all incoming and outgoing free cash flow streams may be necessary (Becker, 2020; Maltry & Kuhner, 2017).

Behringer (2007), presented methods for calculating levered (FCFE) and unlevered (FCFF) cash flows. Levered cash flow considers the impact of debt financing on a company's cash flow, while unlevered cash flow represents a company's cash flow without considering the effects of debt. Figure 2-4 visually presents the methodologies employed in calculating levered and unlevered cash flows.

Figure 2-4. Method of calculating levered and unlevered cash flows



Source: Author's illustration data adopted from Behringer (2007).

When valuing the total value of a firm, the free cash flow to the firm (FCFF) is used instead of free cash flow to equity (FCFE). FCFF represents the amount of cash flow available to all capital providers, including both equity and debt holders. Therefore, the discount rate used to calculate FCFF is typically the weighted average cost of capital (WACC), reflecting the cost of equity and debt financing (Berk & DeMarzo, 2020; Brealey et al., 2020).

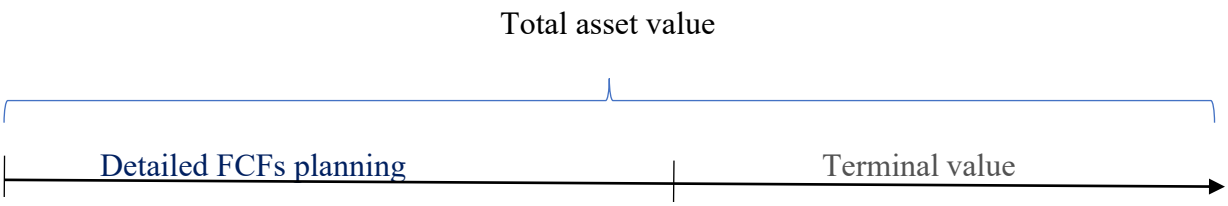
Cash flow analysis is a vital tool employed in various valuation processes, including those concerning information and communication technology (ICT) companies (He & Calder, 2020). One crucial component of the FCFF formula is net working capital, which represents the disparity between current assets and liabilities. Changes in net working capital have a direct impact on cash flow and free cash flow, making it imperative for analysts to consider such alterations when evaluating a company's worth. Investing in net working capital is often indispensable for most projects, and firms may need to maintain a minimum cash balance to handle unforeseen expenses. Consequently, analysts must take into account changes in net

working capital from the previous year to determine the cash flow available to capital providers (Graham & Dodd, 2009; Graham & Harvey, 2001).

When evaluating a capital budgeting decision in the field of ICTs, it is crucial to take into account both the project's operating cash flows (OCF) and its investment cash flows (ICF) (Peterson & Fabozzi, 2002). It is important to differentiate between earnings and cash flow because earnings include non-cash charges such as depreciation and amortisation, whereas free cash flow represents the actual impact of the project on the company's available cash. By considering all these factors, companies can make well-informed decisions that accurately reflect the project's impact on their financial position (Berk & DeMarzo, 2017; Brealey et al., 2020; Damodaran, 2012; A Damodaran, 2016).

The study by (Givoly et al., 2009) criticises the accuracy of analysts' cash flow forecasts compared to their earnings forecasts, noting that cash flow forecasts improve at a slower rate. Additionally, cash flow forecasts offer limited insights into anticipated changes in working capital and can be seen as a simplistic extension of analysts' earnings forecasts. Attempting to estimate expected accruals based on the disparity between earnings and cash flow forecasts does not enhance the detection of earnings management. Cash flow projections play a vital role in valuation methodologies like the discounted cash flow (DCF) method, and typically, a two-phase model is employed to value ICT firms. This concept has been discussed in various publications by Berk and DeMarzo (2020) and Brealey et al. (2017). Figure 2-5 illustrates the Two-Phase Model used for comprehensive total asset value assessment in the context of applying the DCF method for ICT valuation.

Figure 2-5. Two-Phase Model for total asset value



Source: Author's illustration

Despite many scholars affirming the suitability of the DCF method for ICT valuation, accurately assessing risk and calculating the growth rate continue to pose significant challenges in the ICT valuation process. Academics over the past years developed different tools to consider the risk profile of the investments. The following section investigates into the risk estimations consideration in greater detail.

2.4.2.1 Risk analysis for ICTs

The process of risk analysis for ICT assets encompasses four methods, as covered in various publications: sensitivity analysis, scenario analysis, Monte Carlo analysis, and the risk-adjusted method (Dziwok, 2015; Kossecki et al., 2017; Pareek, 2012; Vayas-Ortega et al., 2020). Sensitivity analysis assists in determining the potential range of outcomes for different inputs and identifies areas where net benefits may not be positive (Effendi & Pratama, 2016; Loloei et al., 2012; Murali & Nath, 2016; Osiichuk, 2016; Sabattini & Vinh, 2014). Pareek (2012) and Kassa and CISA (2017) suggest that scenario analysis helps estimate the expected assessments of ICT components by analysing key variables.

On the other hand, Monte Carlo simulation is employed to evaluate the potential consequences of uncertain events and aids decision-makers in identifying and mitigating risks during the valuation of ICT assets (Bhargava et al., 2013; Priyam et al., 2013; Reyck et al., 2008). Razgaitis (2009) justifies that the risk-adjusted method considers various sources of risk, including technology, market, IP issues, and government policy and regulations. By employing these tools in various levels of DCF analysis, including cash flow projection, discount rate estimation, and growth rate estimation, analysts can enhance their decision-making process by estimating the cash flow volatility and riskiness of ICT assets. The subsequent section provides a more detailed explanation of the discount rate methods to consider risk in ICT valuation processes.

2.4.2.2 Discount rate analysis

The discount rate is a critical component of the valuation process and requires careful consideration and attention. It is often referred to as the cost of capital when companies seek funding from external investors. The discount rate used is typically the company's cost of capital or weighted average cost of capital (WACC). The WACC methodology is the most

commonly used method in international valuation processes (Berk & DeMarzo, 2017; Penman, 2015). Ryan and Ryan (2002) survey highlights the use of various methods in high-tech valuation processes, with the WACC being an advanced tool developed by academics and widely employed to assess the risk profile of investments in ICT firms (Abelson & Dalton, 2018). WACC considers both the cost of debt, representing financing cost from creditors, and the cost of equity, indicating the investment made by owners. The cost of debt can be determined from the financial statements of the ICT company, based on the amount of financing and the interest rate paid to creditors (Allee et al., 2020). However, estimating the cost of equity poses challenges due to uncertainty and limited information. One commonly used method for estimating the cost of equity is the capital asset pricing model (CAPM).

To create value for owners, ICT businesses' earnings must exceed the WACC (Ben-Menachem & Gavious, 2007). However, the CAPM, which is often used to estimate the equity cost of capital in the WACC model, has faced criticism for not fully taking into account the firm's risk profile (Hartwig, 2012; Truong et al., 2008). Table 2-1 presents the approaches to determine discount rates in DCF model, which are confirmed by theory (T) and practiced by practitioners (P) in this study. The method that finds applicability in the ICT valuation process, supported by both theory and practice (T/P), is the weighted average cost of capital (WACC). WACC is calculated as the sum of the cost of debt and the cost of equity. Furthermore, the Capital Asset Pricing Model (CAPM) is employed to estimate the cost of equity in the WACC method. Table 2-4 showcases a diverse array of methods for establishing discount rates, as validated by academic sources, and endorsed by industry practitioners, specifically tailored for the undertaking of ICT valuation.

Table 2-4. Approaches to determine discount rates confirmed by theory (T) and practice (P)

Applicability of discount rate methods in ICT valuation process evidence from theory and practice (T/P)		
The weighted average cost of capital (WACC) = Cost of debt + cost of equity	(T/P)	Gitman and Vandenberg (2000), Graham and Harvey (2001), Bastos and Martins (2007), Berk and DeMarzo (2020), Brealey et al. (2020).
Capital asset pricing model (CAPM)	(T/P)	Brusov et al. (2011), Frank and Shen (2016), Berk and DeMarzo, (2020), Brealey et al. (2020).

The CAPM is a widely accepted and intricate method for determining the equity cost of capital in practice (Schwarzbichler et al., 2018; Vayas-Ortega et al., 2020). However, it demands a more elaborate analysis and critical evaluation due to its complexities and limitations. The CAPM is used to calculate the anticipated return on an ICT investment, but critics have raised concerns about its practical application, citing a considerable margin of error (Ansari, 2000).

One of the primary criticisms of CAPM is its reliance on input variables such as the risk-free rate, beta coefficient for the specific investment (ICT in this context), and expected market risk premium, which introduces inherent uncertainties affecting result accuracy. Additionally, reliance on beta as a measure of systematic risk has been criticised by scholars like Fard and Falah (2015) and Truong et al. (2008) as impractical and irrelevant in practical investing.

However, some scholars view CAPM as a significant tool for predicting the cost of equity, with the primary challenge being calculating beta specifically for ICTs, capturing volatility in optimal returns. Studies like Festel and Wuermseher (2013) and St-Pierre and Bahri (2006) have focused on beta calculation, suggesting that it should adequately explain returns in the CAPM model. Beta represents systematic risk in CAPM computation and assesses the correlation of ICT returns with industry and market returns as a whole. Various methods exist for determining beta, including the accounting method, which uses historical data of ICT companies to compare their volatility with the market as a measure of systemic risk for the industry.

Although the CAPM model has faced criticisms from some scholars arguing that it is impractical for practical investing, it still provides valuable insights into how predicted expected returns of ICT companies align with market prices. Calculating beta for ICT enterprises has proven challenging (Froud & Williams, 2007), leading to the proposal of alternative methods based on empirical findings to estimate the beta factor. These alternative methods, including the accounting beta and the building-up strategy, aim to offer a more reliable estimation of beta for ICT companies, considering the industry's unique characteristics and dynamics. Table 2-5 illustrates a variety of approaches for estimating the beta factor within the CAPM framework, as outlined by academic sources and industry practitioners, for the purpose of ICT valuation.

Table 2-5. Various techniques to estimate beta factor in CAPM for the ICT valuation process in theory and practice (T/P)

Various techniques to estimate beta factor for CAPM and/or risk premium for the ICT valuation process, evidence from theory and practice (T/P)		
Indirect approach (peer group, industrial beta) Accounting beta Build up method Risk analysis through simulations	(T/P) (T/P) (T/P) (T/P)	Roque (2021), Modarres et al. (2009), Travassos et al., (2018), St-Pierre and Bahri (2006), Kahn & Lemmon (2016), Mergner & Bulla (2008)

This study identified different methods for calculating beta, which used to estimate the sensitivity of ICT business to the systematic risk. First method includes the industry peer group beta, serving as a benchmark for evaluating the performance of an ICT company. However, industry peer method has disadvantages, such as analysts-selection bias. Another approach is the accounting beta method, which uses the company's financial records to determine the cost of equity capital over time (Roque, 2021; Travassos et al., 2018). The build-up method estimates beta by adding different risk premia supplementation (Rosner et al., 1992). Practitioners' investigation in this study shows they used different methods such as Monte Carlo simulation to calculate a more accurate beta. The effectiveness of these methods depends on various factors such as the data used and the company's operating environment (Kahn & Lemmon, 2016; Mergner & Bulla, 2008).

2.4.2.3 Growth rate calculation

The growth rate is a critical component in the Discounted Cash Flow (DCF) model, enabling analysts to assess ICT company's potential return on investment and prospects. Estimating the cash flow growth rate involves considering various factors from an ICT company's records, such as revenue, free cash flow, market share, and comparisons with peer groups. In addition to the cash flow growth rate, the perpetual growth rate is another key consideration in the DCF model. To maintain a constant rate in perpetuity, analysts consider inflation and the overall economic growth rate. When employing the discounted dividend model, analysts also factor in the sustainable growth rate. This rate can be estimated by evaluating the amount of

equity reinvested back into the business (Christofi et al., 2015; Festel & Wuermseher, 2013; Xiao et al., 2013). Table 2-6 presents a range of methods for incorporating growth rate perspectives, as delineated by both academic sources and industry practitioners.

Table 2-6. List of the possible growth rate inputs from theory and practice (T/P)

Applicability of growth rate calculation in ICT valuation, evidence from theory and practice (T/P)		
Revenue growth rates	(T/P)	Berk and DeMarzo (2020), Brealey et al. (2020), Fernández et al. (2015), Christofi et al., (2015), Festel & Wuermseher, (2013), Xiao et al., (2013).
FCF growth rate	(T/P)	
Market share growth rate	(T/P)	
Peer group growth rate	(T/P)	
Inflation and interest rate base	(T/P)	

The application of the growth rate calculation in the DCF model has faced criticism, particularly when valuing ICT companies. Several factors contribute to this criticism, including the uncertainty surrounding predicting future growth rates, limited historical data, intense competition, assumptions about market share, and susceptibility to disruptive technologies.

2.4.2.4 Valuation of Intangible Assets in the ICT Sector

Given the substantial reliance of ICT companies on intangible assets for their operations and revenue generation, it is crucial to explore methods for valuing these intangibles. In this study, various suggested DCF-based valuation models for intangible asset valuations are considered. One such method is the Calculated Intangible Value (CIV), a DCF-based model that focuses on differences between a company's observed return on assets employed and what would be expected for either same-industry peers of similar size and structure or an industry average. By analysing these disparities, CIV captures the unique value contributed by intangible assets (Ryan, 2007; Aho et al., 2011; Titova, 2011). The challenges associated with the CIV method include the requirement for comparable firms within the industry, matching asset portfolios, and similar cost structures, made the measurement of CIV in

intangible valuations difficult (Aho et al., 2011; Ryan, 2007). Another suggested model is Lev's Knowledge Earnings, developed by Bruch Lev in 2001, which also relies on a DCF framework. It calculates net earnings after deducting charges related to monetary assets and the use of tangible assets, with the resulting excess earnings representing the value associated with intangibles. Both models provide valuable insights into intangible asset valuation (Mirjam, 2019; Ryan, 2007). While Lev's Knowledge Earnings method provides a structured approach to valuing intangible assets, the criticisms are emphasised on the reliance on accounting measures in its application and problem in extracting a pure knowledge rate (Ryan, 2007).

The Relief-From-Royalty (RFR) Payment Method, proposed by Reilly (2008 and 2022) and Hadjiloucas (2014), is another DCF-based model that operates on the principle that an intangible asset's value can be evaluated by assessing the potential income derived from licensing it. This method evaluates both inbound and outbound licenses. For inbound licensing, it considers the royalty rate that the actual owner would be willing to pay to a hypothetical owner for licensing the intangible asset. Conversely, for outbound licensing, it assesses the amount the actual asset would charge a hypothetical licensee for licensing the asset to a third party. Although the Relief-From-Royalty Payment Method presented for intangible asset valuation, it is subject to limitations and criticisms. Notably, challenges arise in determining royalty rates due to inherent subjectivity and difficulty in finding comparable rates. Additionally, legal and regulatory risks, such as changes in intellectual property laws or licensing regulations, can significantly influence valuation outcomes, introducing uncertainty into the process (Wirtz, 2012; Reilly 2022).

2.4.2.5 Summary of income approaches

The discounted dividend model is an income approach method that involves calculating the present value of an ICT company's future dividend payments. DDM method assumes that the company will continue to pay dividends and that the investor's required rate of return matches the dividend growth rate. By discounting these expected dividends, analysts can evaluate the potential value of the ICT company from the perspective of dividend income. In contrast, the DCF method determines the intrinsic value of an entire ICT business by computing the present value of all the cash flows generated by the company, including both dividends paid

to shareholders and free cash flows to the firm. These cash flows are discounted back to their present value using the investor's required rate of return or the weighted average cost of capital (WACC). Even though both methods employ future income or cash flow projections to ascertain value, the DDM focuses only on dividends, while the DCF method considers all cash flows generated by the business. Therefore, the DCF method is generally preferred for valuing a company as a whole, while the DDM is more suitable for valuing individual dividend paying stocks. Overall, while the DCF model has limitations, it remains a widely used and effective method for valuing high-tech businesses such as ICTs. It is essential to consider all parameters carefully to ensure an accurate and reliable valuation. While the DCF-based entity approach may be the most common and important method for valuing ICT businesses, it's not the only method available. Other methods, such as comparable analysis and precedent transactions analysis, also used and suggested in the literature depending on the circumstances of the business being valued.

2.4.3 Market valuation approach: Price-earning (P/E) multiple

The next valuation method that has been offered by literature and empirical studies is market approach (also called relative) assessment. The market approach is a valuation method that review the financial metrics of an ICT company and compares the metrics of an ICT asset to other similar assets based on detail financial features such as enterprise value, sales, book value, profit, or cash flow (Berk & DeMarzo, 2017; Brealey et al., 2020; Fazzini, 2018; IVS, 2020). Market approach can be used for tangible and intangible assets and can be applied in various forms, such as the comparable company analysis, the precedent transaction analysis, and the guideline public company method. The comparable transaction method is one of the methods used in the market approach and involves finding similar assets that have been valued or sold on the market to use as a benchmark for valuing the ICT asset. It's important to consider the quality of data, any biases or outliers in the analysis, and the asset's specific features and circumstances when using this approach (Mohammad, 2016; Ong & Mohd-Rashid, 2021).

The first common market approach metric used in ICT business valuation is the price-to-earnings ratio (P/E ratio) analysis. This widely employed method allows for the valuation of an ICT company and facilitates comparisons with others within the ICT industry

(Brushwood, 2015; Cooper & Cordeiro, 2008). A higher P/E ratio suggests stronger growth prospects or high investor confidence or overvalued, while a lower P/E ratio may indicate undervaluation or less confidence in future growth (Park & Lee, 2003; Patrão, 2013). However, P/E ratios should be used alongside other financial metrics to compare the ICT companies within the same industry, as different industries have different P/E ratios. It is also important to consider other factors that may affect the ratio, such as profitability, growth potential, and debt levels. The P/E ratio should not be used as the sole method of valuation and should be used in conjunction with other techniques (Eberhart, 2004; Henschke & Homburg, 2009; Pöyhönen, 2009; ZOU et al., 2015).

Even though the P/E ratio is a popular valuation method used for publicly traded companies, but it faces criticisms when applied to private ICT companies value (Milicevic, 2009; Ong et al., 2020; Young & Zeng, 2015). The reasons include a lack of earnings, volatility of earnings, lack of comparability with peers, and uncertainty of future earnings due to rapidly changing markets (Fernandez, 2001; Schreiner, 2009). There are several issues associated with using the P/E multiple in valuation. Firstly, it relies on an accounting estimate of earnings, introducing a potential problem due to the temporal matching of cash flows to specific periods. Another concern with the P/E model is that it doesn't directly address the challenge of determining the true value of a company. Instead, it shifts the responsibility of valuation to the market. Lastly, the P/E ratio assumes that the market genuinely values earnings, overlooking the possibility that other aspects of a company's financial performance, such as growth in earnings and risk profile, might be equally or more significant. So, the P/E model may not provide an independent solution to the valuation problem; rather, it relies on the market's perception and judgment to determine what constitutes an appropriate price for earnings (Ryan, 2007).

2.4.4 Market valuation approach: Enterprise value (EV) to EBITDA multiple

The Enterprise Value to EBITDA (EV/EBITDA) multiple is another financial ratio used to determine the value of a company, specifically an ICT company, by comparing its enterprise value (EV) to its earnings before interest, depreciation, and amortization (EBITDA). The enterprise value is equals to equity + debt – cash. This ratio is useful for comparing companies with different capital structures and growth prospects. However, its limitations

include not considering capital structure differences and the potential for EBITDA manipulation through accounting choices. It is suggested that analysts use other financial metrics in conjunction with EV-to-EBITDA to get a more accurate picture of an ICT company's value (Brushwood, 2015; Fernandez, 2001; Liu et al., 2002; Park & Lee, 2003; Schreiner, 2009).

2.4.5 Market valuation approach: Enterprise Value (EV) to Sales multiple

The Enterprise Value to Sales (EV/sales) valuation is another financial measure that compares a company's enterprise value to its total sales revenue and is used to analyse and evaluate ICT companies (Henschke & Homburg, 2009). It helps analysts determine whether a company is overvalued or undervalued and measure the efficiency of its operations and quality of services (Cooper & Cordeiro, 2008). A higher EV/sales ratio indicates a more valuable company, which is determined by dividing enterprise value by annual sales. This method is a helpful tool for ICT companies that still did not reach positive net earnings (Eberhart, 2004). The Enterprise Value to Sales Multiple is determined by dividing the enterprise value (equity + debt – cash) by the company's annual sales (Milicevic, 2009; Ong et al., 2020; Young & Zeng, 2015).

2.4.6 Applicability of different multiples in valuation process of ICTs

Using a market perspective and comparing ICT companies to their peers is advantageous, but can be challenging due to the difficulty in identifying an appropriate peer group (Milicevic, 2009). One critique of using multiples as indicators of potential mispricing is their failure to account for differences in expected growth. To avoid the multiple approach to fail, in ICT business assessments, various financial metrics should be used (Hoover, 2006). Scholars are currently seeking a more comprehensive approach to extrapolate the business value of ICT, as traditional analyses often overlook intangible effects (Tallon et al., 2000). Essential financial ratios and multiples, including the P/E ratio, EV/EBIT ratio, EV/EBITDA ratio, EV/Sales ratio, price-to-free cash flow ratio, price-to-operating cash flow ratio, Return on Equity (ROE), and Return on Assets (ROA), have gained widespread recognition and approval from scholars and practitioners (Fernandez, 2001; Park & Lee, 2003; Patrão, 2013; Pöyhönen, 2009; Schreiner, 2009; Young & Zeng, 2015; ZOU et al., 2015). These metrics

play a pivotal role in the valuation process when assessing the worth of a business. However, it is suggested to review a detailed financial statement analysis during the valuation to gain an in-depth understanding of the company's situation.

This study has compiled a table containing relevant multiples for the ICT business valuation process. These multiples have garnered strong support from both theoretical analysis and practical evidence (T/P), making them applicable and relevant in the valuation process. Table 2-7 details the applicable multiples for the ICT business valuation.

Table 2-7. List of potential Multiples applicable in ICT Valuation: A Theoretical and Practical Perspective (T/P)

Applicability of Multiples in valuation process of ICT evidence from theory and practice (T/P)		
price-to-earnings (P/E) ratio	(T/P)	Berk and DeMarzo (2017), Brealey et al. (2020), Ross et al. (2020), Damodaran (2016), Fernández et al. (2015), Mackevičius and Tomaševič (2010), Mellichamp (2017), Brushwood (2015), Cooper and Cordeiro (2008), Eberhart (2004), Fernandez (2001), Henschke and Homburg (2009), Liu et al. (2002), Park and Lee (2003), Patrão (2013), Pöyhönen (2009), Schreiner (2009), Young and Zeng (2015), Zou et al. (2015).
price-to-book value ratio (P/BV)	(T/P)	
price-to-sales (P/S) ratio	(T/P)	
price-to-free cash flow ratio	(T/P)	
price-to-operating cash flow ratio	(T/P)	
EV/EBITDA	(T/P)	
EV/EBIT	(T/P)	
EV/Sales	(T/P)	

The market approach valuation concept has been thoroughly explored across various industries through different research studies. In this study, the focus lies on the multiples suggested by current research for valuing ICT companies. These multiples are essential in understanding how companies with higher economic added value compare to those with similar risks but lower economic added value. Alongside the valuation multiples mentioned above, several financial metrics should be considered when conducting a valuation. This study also emphasises the importance of profitability ratios and margins for ICT businesses, as well as an analysis of liquidity and leverage ratios, efficiency and intensity ratios, and the amount invested or funded by investors. Metrics such as return on assets (ROA), return on invested capital (ROIC), and return on equity (ROE), among others, continue to hold significant importance. These economic indicators serve as valuable tools for assessing

strategic strategies rather than merely accounting actions (Fraser and Ormiston, 2023; DeStefano et al., 2018; Ryan, 2007). These economic indicators provide crucial insights into a company's overall performance and its ability to generate returns for its stakeholders, offering valuable perspectives for strategic decision-making.

2.4.6.1 Summary of market approach

This study investigated into various financial metrics and provided a detailed review of three primary suggested multiples for valuing ICT firms: P/E ratio, EV/EBITDA ratio, and EV/Sales ratio. These multiples have been carefully selected and analysed for their relevance and effectiveness in the ICT valuation process.

To summarize, while the market approach is widely used, it has received criticism. Many scholars argue that market approach reflects market perception and investor emotion, leading to undervalued and overvalued ICT businesses compared to their competitors. This approach is more tailored to analysts' requirements and requires fewer data points than discounted cash flow valuations. Market approach is based on the notion that markets are generally correct, despite individual ICT companies' errors. However, the market approach's success depends on whether the ICT industry as a whole is overvalued or undervalued, as certain assumptions about other variables are made. If these assumptions are incorrect, the market valuation may be impaired. Additional criticism is that finding similar ICT assets can be challenging due to their differences in business models.

2.4.7 Option based pricing models

Since this research is dealing with the ICT sector, where intangible assets play a more significant role than tangible ones, option pricing models have been found relevant through reviewing current studies. These models serve as an alternative for valuing ICT firms. After reviewing the possible valuation approaches for ICTs, particularly in modeling scenarios with higher uncertainties, among these approaches, Real Option Valuation (ROV) models are discussed (Marzo, 2016; Rodríguez-Castellanos et al., 2013; Ryan, 2007).

Compared to traditional Discounted Cash Flow (DCF) models, real option valuation provides a more active framework for decision-making. It helps to considers uncertainty,

identifying opportunities in business cash flows, and the impact of volatility in different options to mitigate risks (Bogdan et al., 2017; Damodaran, 2016; Ryan, 2007).

One of the challenges lies in defining an accurate discount rate for projects characterised by high uncertainties and option-like features. ROV models are rooted in option pricing theory, drawing inspiration from the Black-Scholes-Merton (BSM) model (Gilbert, 2004), which is widely regarded as an effective approach for assessing the value of intangible based assets (Ryan, 2007).

From a practical standpoint, adopting the options methodology empowers managers to navigate uncertainty more effectively (Rodríguez-Castellanos et al., 2013). However, it's essential to recognize that implementing ROV requires specialized knowledge and experience to make informed decisions. Incorrect application of ROV modeling can significantly impact investment choices (Collan et al., 2016).

The option pricing model serves as a pivotal financial tool employed in assessing the worth of assets capable of yielding future cash flows. Predominantly used in valuing intangible assets like patents, trademarks, and copyrights, which lack a physical presence but hold substantial value for businesses (Visconti, 2022; Ryan, 2007). When applying the option pricing model to evaluate intangible assets, several crucial factors must be taken into account, including anticipated cash flows, the risk-free rate, and the volatility associated with the underlying asset (Hull, 2017; Ryan, 2007). By integrating these elements, the model computes the value of the intangible asset, thereby facilitating informed decision-making processes. Notably, the option pricing model offers several advantages for valuing intangible assets. It provides a more precise valuations compared to alternative methods, particularly when the asset exhibits substantial growth potential (Hull, 2017).

The real option's flexibility accommodates the valuation of intangibles, aligning with the sector's dynamic nature made it a suitable alternative for the valuation of ICTs (Visconti, 2022). Despite its merits, some critics argue that ROV models may be less beneficial, favoring DCF-based methods instead, and presenting ROV as a complementary technique to the DCF methodology, since DCF values the underlying asset (Brealey et al., 2020; Brek & DeMarzo, 2020).

Another option-based pricing model is the Black-Scholes-Merton (BSM) model, which can help estimate the valuation of an intangible asset by accounting for price movements and the impact of project delays. The idea is that, based on the characteristics of the asset, an analyst can forecast future cash flows and estimate the net present value of the asset using a discounted cash flow model. In such cases, the analyst can then use the Black-Scholes-Merton model to compute the present value of the intangible asset as an option. However, the model has limitations in estimating the price of options and assets. One key assumption is that volatility is constant and known throughout the option's lifetime, which is not accurate in real life. A company's volatility is always fluctuating and never constant. The concept of implied volatility, which arises in options pricing, can be used to produce a surface that usually contains a so-called “volatility smile,” indicating that the distribution of options with the same time to expiration will have a smile-like shape. In most cases, the distribution is skewed. The Black-Scholes model assumes constant volatility, resulting in a flat volatility surface over time, which does not reflect real market conditions (Damodaran, 2012; Ryan, 2007).

2.4.7.1 Summary of Option-based model

The valuation of ICT firms is a complex and challenging task due to the rapidly changing nature of the industry (high volatility) and the intangible assets nature that these companies possess. One of the tools that can be used to value ICT firms is the option pricing model. This model allows analysts to account for the uncertainty and volatility inherent in the ICT sector, by treating the value of the firm as a series of options that can be exercised over time. The option pricing model is particularly useful in valuing ICT firms because it takes into consideration the uncertainties, potential for future growth and innovation in the industry, and the intangible assets nature. ICT firms often have valuable patents, technologies, and intellectual property that can lead to significant future cash flows. By using the option pricing model, analysts can capture the value of these assets by estimating the likelihood and timing of future innovations and developments and incorporating these factors into the valuation model.

Furthermore, the option pricing model can also be used to value strategic options that ICT firms may have. For example, a firm may have the option to expand into new markets,

acquire a competitor, or develop a new product and service. These strategic options have value, and the option pricing model allows analysts to quantify this value and incorporate it into the overall valuation of the firm. In conclusion, the option pricing model is a powerful tool that can provide a more accurate and comprehensive valuation of ICT firms, taking into account the unique characteristics of the industry and the strategic options available to these companies.

2.4.8 Cost/asset-based valuation approach: Replacement cost method

The cost/asset valuation approach is based on the replacement theory (Kaldor, 1966), which suggests that a careful purchaser should not pay more for an asset than the expense of acquiring an equivalent substitute asset. This methodology provides a value measurement rooted in the economic premise that a buyer will not pay more than the cost to obtain an asset of similar value, whether through purchase or construction, unless factors like excessive time, difficulty, risk, or other considerations are involved (Allee et al., 2020; Bosch & Blandón, 2009). In this method, decisions are analysed after the cost analyst has calculated the potential benefits of an ICT operation and subtracted its overall cost. Assigning value to intangible assets and establishing a project's financial viability depend on the analysis results (Boardman et al., 2017; Nas, 2016; Pearce, 2016). The approach determines value by calculating an asset's current replacement cost or the book value, which is the price paid to create an ICT asset (Brent, 2006; Collins, 2010). However, the value of a successful ICT business using replacement values is likely to be underestimated if the value of goodwill is not estimated accurately and the worth of ICT's intangible assets is not properly assessed (IVS, 2020).

The replacement method calculates the value of an ICT asset by considering the cost of a similar asset offering the same functionality, regardless of exact physical features. It accounts for physical decline and all relevant forms of depreciation. The value of the ICT asset is arrived at by computing all costs associated with replicating the asset's utility, factoring in depreciation-related or external obsolescence, and deducting total depreciation from the total costs (IVS, 2020; Kozyr, 2014; Yousefi, 2021). However, in the case of a newly established ICT firm without profit, the value of the last two components, lost benefit equivalent (LBE) and risk of profitability (RP), may be close to zero. In such instances, potential investors

might find no difference between buying the firm or starting from scratch. Replacement model considers the time required to establish the technological process and acquire the market share necessary to achieve the expected outcome or meet the required return on investment (Dedrick et al., 2003; Malkiel, 2003).

Skinner (2008) criticises studies that use cost and asset methodologies, arguing they consistently undervalue company values. Critics worry that relying on these approaches could lead to an overemphasis on weak and long-term criteria when evaluating ICT firms. Kozyr (2014) adds that the asset replacement technique can result in significant differences in firm value compared to alternative methods like DCF, particularly for ICT companies. This critique is more applicable to highly traditional and tangible-based companies. For ICT firms, analysts suggest that values should focus less on assets and more on future cash flow projections. The cost-based approach centres on the fair market value of an ICT's assets and liabilities (Schoentgen & Gille, 2017). Thus, this strategy utilises different techniques, including intangible assets, to consider the valuation of individual assets and liabilities (García-Sánchez et al., 2018).

2.4.8.1 Summary of cost/asset-based approach

The cost and asset-based valuation approach measures the value of assets based on economic rationality. In this approach, the value of an ICT asset is determined by calculating its current replacement cost or the price paid to create the asset. This approach is commonly used to assign value to intangible assets and evaluate project financial viability. However, it has a deficiency as it assumes the investor can find an available and comparable ICT asset elsewhere to replace, which may not always be the case, and it may not consider a company's current and future earning capacity. This method is suitable for capital-intensive enterprises with no current or forecasted operating income or non-operating entities, such as tangible assets, as it represents the minimum value of the company (Svoboda, 2007).

2.4.9 Venture capital valuation method

The Venture Capital (VC) strategy is a useful method for evaluating early-stage, pre-revenue enterprises, especially in the ICT industry where traditional valuation methods often fail. The VC method estimates the value of a company based on the expected return on investment that

a venture capitalist would require, expected growth rate, and exit value. To apply this method, analysts need to estimate potential future earnings, sector growth rate, the company's stage of development, market opportunity, and potential risks. The VC rate of return is higher than traditional methods to compensate for the higher risk of investing in early-stage companies (Miloud et al., 2012; Suwarni et al., 2020).

The Exit Value (EV) or terminal value is an estimated price at which an ICT company will be sold, calculated using the VC approach as a multiple of its sales in the year of sale. The use of EBIT multiples is not appropriate for early-stage start-ups as they are still generating negative cash flows. Private ICT enterprises, especially start-ups, have difficulty gathering appropriate data, and relevant data is often not shared. Predicting an exit multiple requires comparable and more mature companies' relevant data (Metrick & Yasuda, 2021).

The venture capital method of valuation has been criticised for its subjectivity, lack of transparency, inaccuracy, bias towards high-growth companies, the incentive to seek quick exits, and limited applicability to early-stage start-ups. The method relies on assumptions about future cash flows, discount rates, and exit multiples, which can lead to widely varying valuations for the same ICT company (Giardino et al., 2014). The lack of transparency can be a barrier to entry for new investors, and the method may not accurately reflect a company's true value due to the assumptions made. Additionally, the method is biased towards high-growth companies and incentivises VCs to seek quick exits rather than investing in more stable, sustainable business models. Finally, the method is most applicable to early-stage start-ups and becomes less appropriate as an ICT company grows and establishes itself (Žemaitis et al., 2020).

2.4.9.1 Summary of venture capital approach

The Venture Capital (VC) approach is used for valuing early-stage ICT businesses. This method is particularly useful for companies in the ICT sector with limited financial history but significant potential for growth. Nonetheless, the VC method has some limitations and should not be relied on exclusively to determine the valuation. It can serve as a starting point for more detailed models, and other techniques should be considered to achieve a more precise ICT valuation. Although VC may not be suitable for all ICT firms, it can still be a valuable tool for evaluating start-ups in this sector.

2.4.10 Summary of the potential valuation approach for ICT companies

The summary of potential valuation approaches provides an overview of various theories used to evaluate ICT enterprises, along with the underlying assumptions for each theory.

The first category included income approach theories, which were based on future cash flows and involve models like Dividend Discount Models (DDM). DDM calculates the present value of expected future dividends and applies discounted-based techniques while considering expected returns. The Discounted Cash Flow (DCF) involves methods like FCFF and FCFE, considering future cash flows and discounting them based on risks and expected returns.

The second category comprises market approach multiples, which include comparable analysis. The market approach involves reviewing multiples and financial metrics of ICT companies and comparing them to peer groups or similar company transactions. Key multiples considered are the detail financial statement ratio analysis as well as the valuation multiples such as Price-to-Earnings (P/E) ratio, Price-to-Cash Flow (P/CF), Price-to-Sales (P/S), Enterprise Value to EBIT, and Enterprise Value to EBITDA.

The third category is the option-based pricing model, reviewing the implementation of option pricing models in valuation theories relevant to ICTs in current literature and across various nations uncovers numerous instances where option pricing has been used in the valuation process and recommended for assessing the value of the ICT sector.

The fourth method was the cost-based approach, which evaluates the cost required to replicate the same ICT company. This approach includes the Replacement Cost Method.

The last category is for start-up valuation, the Venture Capital Method relies on assumptions about the venture rather than the company's characteristics.

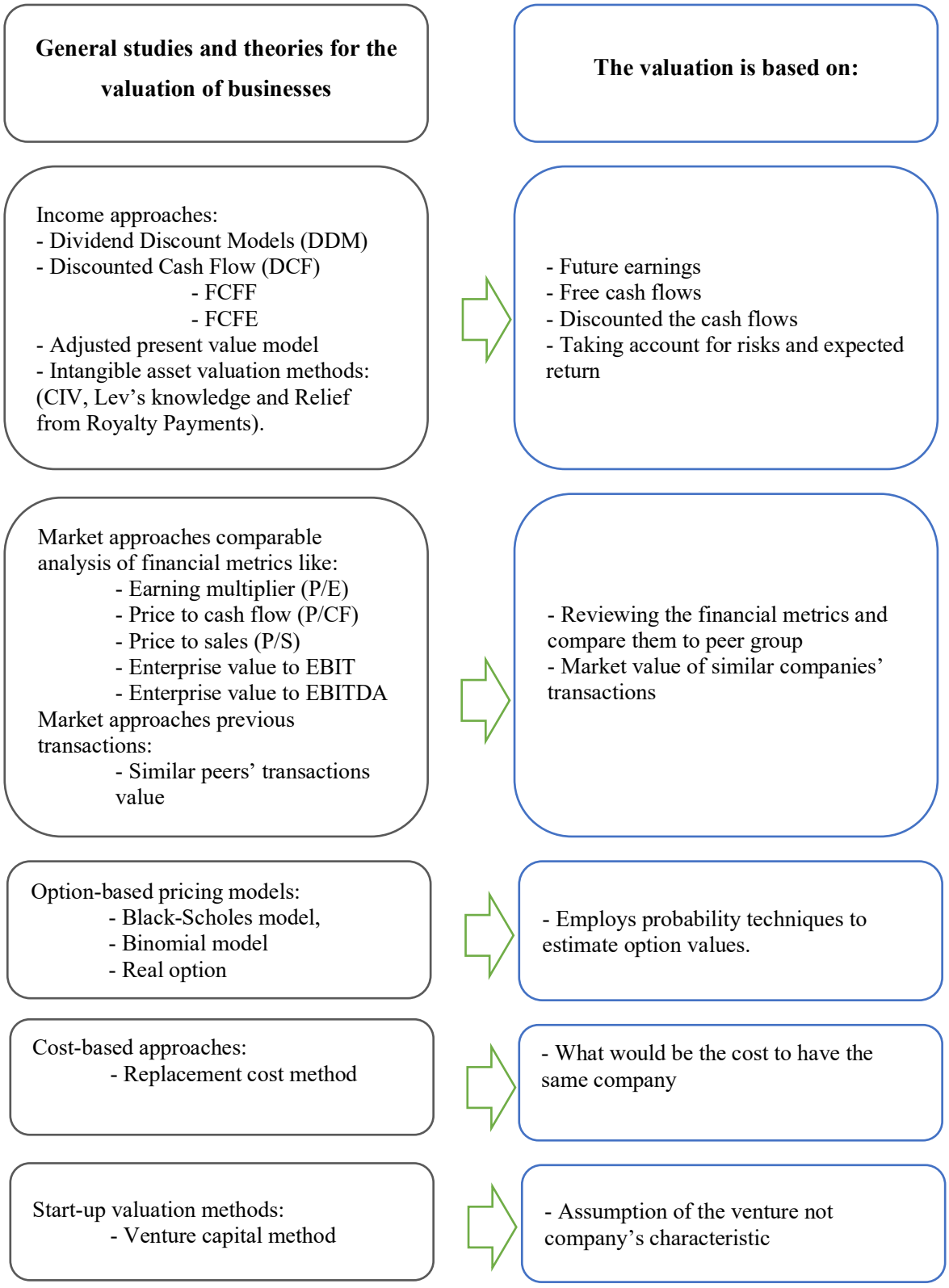
2.4.11 Final valuation conclusion

According to Business valuation standards in United State the selection and weighting of appraisal methods depend on the appraiser's informed judgment rather than a set formula (BVS, 2018). Multiple approaches may be considered, and the appraiser must decide how to weigh the indications of value obtained through various methods, either qualitatively or

mathematically, while providing a rationale for their choices. Factors like the standard of value, the valuation's purpose, the type of subject being appraised, data quality, and other relevant considerations should guide the appraiser in determining the significance of each method's results and whether a single method should take precedence in reaching the final valuation conclusion.

Drawing from an extensive review of published sources in this study, Figure 2-6 provides an overview of the classification of prevalent valuation methods employed for assessing ICT firms, based on a review of recent research studies. Since each of these methodologies has a distinct nature and relies on different assumptions, it is crucial to present the final valuation conclusion in accordance with a standardised approach. This ensures that analysts can effectively communicate their findings in a systematic manner.

Figure 2-6. The classification of valuation theories applicable for ICTs



Source: Author's illustrations data adapted from publication sources

2.5 Application of identified theories of valuation in different countries

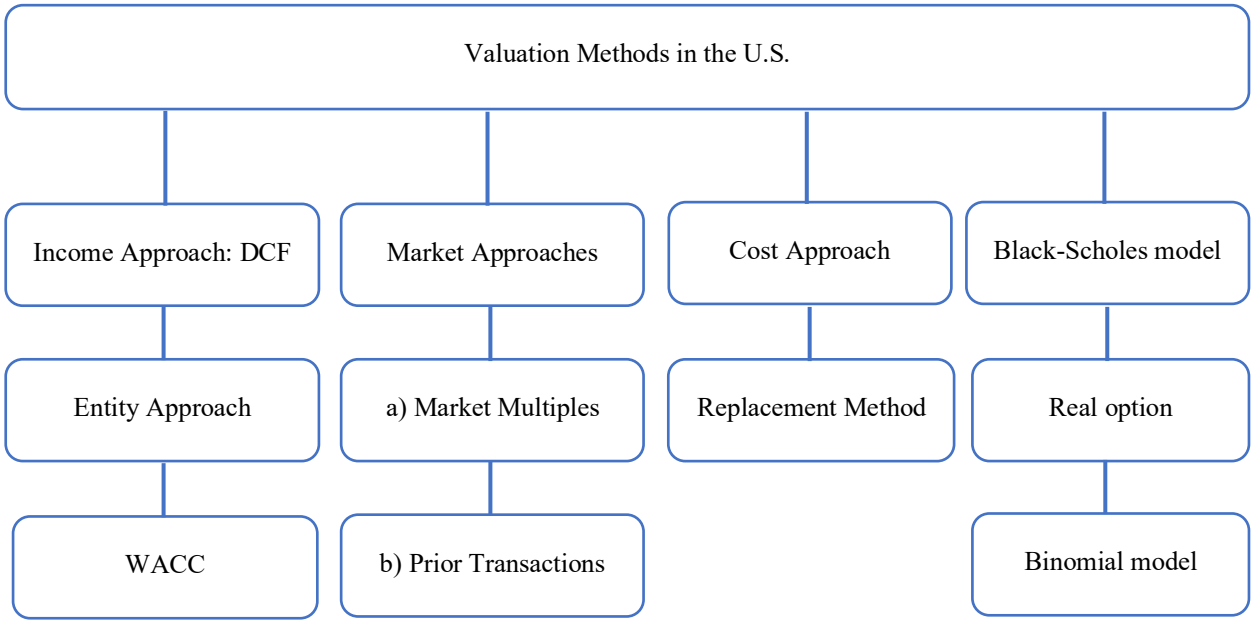
This section presents the regulatory parties and guidelines for evaluating ICT business. It also shows the diverse methodologies used in different countries and provides examples of ICT companies that are traded. The examples provided mostly focused on traded ICT companies whose information is publicly available online, making it possible to analyse their data. Nevertheless, private companies also used these valuation methods to evaluate their ICT businesses. However, due to the lack of data, this study is limited to presenting information made available through various recent sources.

2.5.1 ICT valuation examples in the United States

In the United States, the Securities and Exchange Commission (SEC) and the Internal Revenue Service (IRS) are responsible for overseeing and enforcing securities laws, as well as setting guidelines for trading and the valuation of companies (Burke, 2023; Liu et al., 2022). When determining the value of a start-up in the ICT sector in the United States, analysts consider various methods, such as discounted cash flow (DCF), multiple, and replacement valuation based on ICT industry analysis (Hoven, 2007; Vayas-Ortega et al., 2020). Valuing an ICT business is a complex process that necessitates a thorough understanding of the industry and the company's characteristics. Adhering to guidelines can assist in valuing these companies (Trugman, 2016). To value the ICT sector in the US, analysts used various methods such as replacement cost and asset-based approaches to analyse the value of tangible assets, while venture capital valuation can provide insight into the value of ICT start-ups (Colombo & Grilli, 2010; Levy, 2015). Additionally, other valuation techniques such as real option have been used in the communications industry (Trigeorgis & Ioulianou, 2013).

Based on Business Valuation Standard and IRS, when valuing ICT firms, appraisers may employ the following approaches (BVS, 2018): A) The Discounted Cash Flow (DCF) method, which entails utilizing the Free Cash Flow to the Firm (FCFF) methodology. B) The Market Approach, in which the appraiser must consider comparable ICT companies and previous transaction data. C) The Cost Approach, which requires a thorough examination of both direct and indirect costs associated with replacement.

Figure 2-7. Valuation approaches reference for appraisers in the U.S.: A review of BVS (2018) and IRS (2020)



Examples of U.S. Companies used the Discounted Cash Flow (DCF) Valuation Method

According to Vasilaki and Jr (2019), DCF is employed to evaluate corporations like Apple Inc. and investments in ICT infrastructure, such as Verizon Communications Inc. Despite criticism that DCF relies on subjective assumptions leading to substantial variations in valuation estimates, it proved effective in assessing the value of Apple, as evidenced by its example. Other companies that have been valued using this method include Microsoft, Google, and Facebook. However, the DCF model did not produce an appropriate result for Amazon and Uber in earlier years.

Amazon is one of the most successful ICT companies in the world, but DCF valuation would have failed to capture the full potential of the company's growth due to its unconventional business model, which focuses on long-term market share gains over short-term profits. In the early days of Amazon, its revenue growth was not matched by its earnings growth, making it difficult to accurately predict future cash flows. The discounted cash flow analysis of Amazon in 2014 showed how inaccurate projections for future cash flow could provide an inaccurate value for the company (Fox, 2014). Another example, Uber used ICT and disrupted the traditional taxi industry by offering convenient and affordable alternative services. However, DCF valuation would have failed to capture the full potential of the

company's growth, particularly in emerging markets where Uber is rapidly expanding. Additionally, Uber's heavy investments in research and development and expansion have resulted in significant losses in the early stages of the company's growth (Li, 2020).

Examples of U.S. Companies used the Market Approach Valuation

The utilisation of multiple approaches is a common practice in valuing ICT firms in the U.S. This method is applied by analysts in the Apple Inc. case to compare Apple's performance with the industry average multiples. In the market approach, Damodaran (2020) conducts a thorough analysis of Apple's financial statements, with a particular focus on crucial metrics like revenue growth, profit margins, and cash flow.

Pozo (2020) used the replacement method of valuation in the brand valuation case study of Apple Inc. This highlights the significance of this method in evaluating ICTs.

Examples of U.S. Companies used the Venture Capital Approach Valuation

The venture capital approach is used in estimating the value of Uber's company based on its potential for future growth and profitability. Uber's valuation was significantly higher than its revenue at the time. This suggests that investors believed in Uber's potential for future growth and profitability. However, this led to an overestimation of the company's value and resulted decreasing the value of Uber in the market.

Examples of U.S. Companies used the Option Pricing Valuation Models

According to Trigeorgis and Ioulianou (2013), which discusses the use of real options to value the growth potential of a high-tech company, using EchoStar Communications Corporation as an example. The company's growth opportunities are modelled and valued as a portfolio of options to expand its services. The article argues that an options-based estimate of the present value of growth opportunities provides a better estimate of the firm's growth prospects than the traditional terminal growth DCF assumption.

Moreover, real option model valuation emerges as a vital technique in evaluating investment opportunities within the ICT projects. For instance, Netflix, Google, and Microsoft have all leveraged real option model valuation to assess potential future value and strategically guide

investment decisions in projects like the development of Android by Google and the entry into cloud computing by Microsoft with Azure. These approaches enable effective risk management and capitalise on growth opportunities within the evolving IT landscape (Ullrich, 2013).

Another example is using the Black-Scholes-Merton Model to determine the value of Apple's AirPods patent. This patent allowed Apple to manufacture AirPods using the technology and produce similar accessories. The owner of a patent has the right to decide whether to commercialise the invention and start generating income. After investing an initial cost in developing the invention, the owner can operate the business to earn revenue. If not, the maximum loss is limited to the initial investment and the patent filing cost. This scenario is analogous to a call option, which grants the holder the right to buy shares of stock at the strike price (Nguyen-Hoang, 2020).

2.5.2 ICT valuation examples in the UK

The Valuation Office Agency (VOA) in the UK is responsible for regulating the methods for valuing businesses in England (Amin-Smith & Phillips, 2017). There are various approaches to valuing a business in the UK, including earnings multiple, discounted cash flow, and relative valuation based on analysis of the ICT industry. The earnings multiple is often used for small ICT businesses as a market comparison, in addition to DCF (Imam et al., 2008). The methods used for valuing ICT companies can differ depending on the company's stage and historical data availability, with commonly used valuation multiples including Enterprise Value to Earnings Before Interest, Taxes, Depreciation, and Amortization (EV/EBITDA) and Price to Sales (P/S) multiples (Festel & Wuermseher, 2013). When valuing private equity and venture capital investments in the ICT sector, it is suggested to follow the International Private Equity and Venture Capital Valuation (IPEV) Guidelines in the UK, which aim to ensure consistency and transparency in the valuation process (Bland, 2017).

Examples of UK Companies used the Discounted Cash Flow, Market Approaches and Option Pricing Models

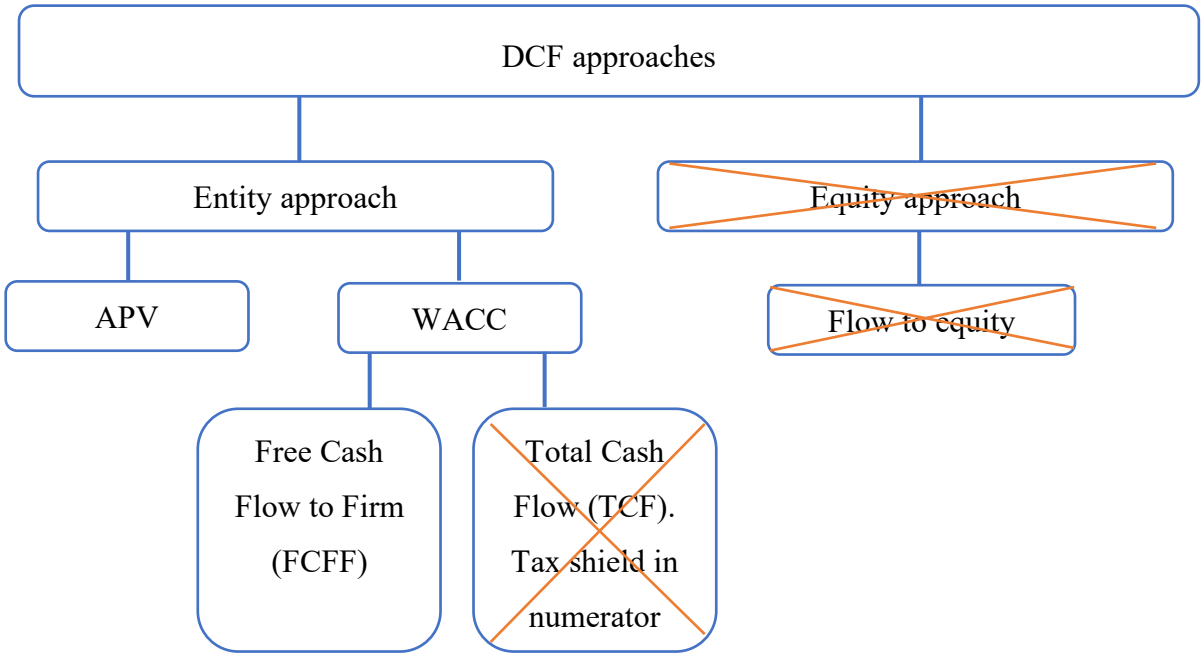
An additional instance is Vodafone Group plc, a British multinational telecommunications corporation that offers mobile, fixed-line, and internet services to consumers and businesses worldwide. The company's valuation was determined using the DCF method in 2008 (Saplitsa, 2008). Later, in 2019, analysts employed a relative valuation technique to estimate its value (Pereira, 2019). Although the DCF method has been used in Vodafone's valuation, there have been some failures in its application. In 2000, Vodafone's attempt to acquire Mannesmann, a German telecom company, using a DCF valuation method failed as the estimated value was lower than what Mannesmann believed the company was worth. Mannesmann argued that Vodafone underestimated their future growth potential in mobile phone and internet businesses. Vodafone had to increase their offer, resulting in a higher acquisition price than the DCF valuation method suggested. This case highlights the limitations of DCF valuation methods in valuing rapidly changing industries like ICT, as they may not capture the total value of a company's growth potential (Garrett, 2001).
Option pricing models are employed by UK companies for the valuation of intangible assets, including patents and intellectual properties, wherein various factors such as expected cash flows, risk, and time value of money are deliberated to ascertain fair value (Brassell and Maguire, 2017, Ryan, 2007)

For the valuation of special share classes in the UK. Andrew Strickland (BVW, 2022; IVS, 2022) discusses the prevalent use of option pricing models for gauging entity growth, yet highlights challenges in determining value, prompting exploration into models such as the Black-Scholes option pricing model (BSOPM) and other sophisticated alternatives. However, these models encounter practical obstacles, including dynamic hedging concerns and volatility assumptions, particularly in the context of privately held firms. This research underscores the necessity for refining valuation practices and fostering collaboration within the business valuation community to enhance the precision and dependability of growth share valuations in the UK.

2.5.3 ICT valuation examples in Germany

In Germany, business valuation is a highly regulated field and there are specific standards and guidelines that must be followed. The most used standard for business valuation in Germany is the IDW S1 standard, which is issued by the Institute of Public Auditors in Germany (IDW). Business valuation in Germany is based on the International Financial Reporting Standards (IFRS), which aim to achieve fair value. The two primary approaches used for business valuation in Germany are the Discounted Cash Flow (DCF) method and Multiples. The DCF method calculates the present value of future cash flows and is chosen for its ability to estimate future performance. Other methods of business valuation that are commonly used in Germany include the market multiples method. Multiples compare a company's financial metrics to those of similar businesses, making it a quick and easy method to apply. However, there is criticism of the domination of DCF methods over multiples, and some organizations call for a more balanced approach. IDW recommended using the WACC method in conjunction with FCFF to determine entity valuation (Figure 2-8) and advise not using the total cash flow. Another method that valuers can consider is the APV approach (IDW, 2009).

Figure 2-8. DCF approaches as a reference for valuers in Germany (IDW-S1)



Source: Author's illustration data adopted from IDW S1, (2017)

Total Cash Flow (TCF) offers a comprehensive perspective of a company's cash flows. The tax shield can be incorporated into the valuation model's numerator to account for tax savings resulting from debt interest payments in business valuation. However, the use of tax shield in TCF for tech business valuation is not common in German valuation guidelines. TCF can be calculated using various methods, such as the bottom-up and direct approaches. In the tax shield approach, TCF is calculated by adding operating cash flow to the tax shield resulting from the deduction of interest expenses (Ballwieser, 2020; Ballwieser & Hachmeister, 2016).

Several parties are interested in business valuation in Germany, including courts, regulators, owners, auditors, investment banks, public, and specialists. Courts and regulators such as the Federal Financial Supervisory Authority (BaFin) and courts rely on business valuation to determine compensation and assess damages in legal proceedings. Owners, including M&A parties, taxpayers, and expropriated people, use business valuation to determine the worth of their assets. Investment banks and public auditors (WP) provide advisory services to clients on business valuation matters.

Some organizations in Germany provide guidelines and suggestions on business valuation. The Institute of Public Auditors in Germany (IDW) issued Best Practice Recommendations for Corporate Valuation, including the issuance of the Principles for the Performance of Business Valuations (IDW, 2009). The Deutsche Vereinigung für Finanzanalyse and Asset Management (DVFA, 2010), also provide guidelines and recommendations on business valuation.

In Germany, when evaluating ICT companies, the DCF entity approach with WACC and FCFF is frequently employed for assessing their value. The IDW presents this method as a reference for valuers. While specialists' reports may use various approaches in addition to DCF, multiples have yet to gain acceptance in the country's highest courts, the Bundesgerichtshof and Bundesverfassungsgericht.

Examples of German Companies used the Discounted Cash Flow, Market Approaches and Option Pricing Models

Some example of German ICT companies and the way they have been valued included: SAP SE is a German multinational software company that provides enterprise software to manage business operations and customer relations. In 2007, Damodaran evaluated the value of SAP

using both the DCF and relative methods (Damodaran, 2007). Later in 2020, Nelson conducted an analysis of SAP by using Discounted Cash Flow, Scenario and Uncertainty Analysis to factor in the risks, followed by a Comparable Company Analysis to establish a justifiable valuation for the company (Nelson, 2020).

The experience of Infineon Technologies AG illustrates the complexity involved in forecasting a company's future performance and value. In the early 2000s, Infineon was a leading semiconductor and electronic component manufacturer within the ICT sector. However, its value plummeted following the dot-com bubble burst in 2001. Despite having solid financials and growth potential, the valuation methods like DCF and relative valuation failed to predict the decline in Infineon's value. This failure can be attributed to the challenge of accurately predicting ICT competition and customer preferences changes (Andrews, 2001). DCF relied on assumptions about future cash flows that did not fully consider these shifts, leading to its inability to predict the company's decline. This emphasizes the need for a holistic approach when evaluating a company's future performance beyond just financial metrics and projections.

Examples in Germany where option-based pricing models have been used include the purchase of enterprise resource planning software, where the type of real option was a growth option. The underlying of this real option involved extending the system with additional standard functionalities (Ekström and Björnsson, 2005; Ullrich, 2013). Another project utilizing a real option model was SAP's switch from SAP R/2 to SAP R/3. In this case, the type of real option was also a growth option, with the underlying being the implementation of web-based standard functionalities (Taudes, 1998; Taudes et al., 2000, Ullrich, 2013).

2.5.4 ICT valuation examples in France

Different regulatory bodies in France are responsible for enforcing regulations and laws and setting guidelines for company valuation. The Autorité de Contrôle Prudentiel et de Résolution (ACPR) oversees the financial institutions and banking sector, while the French Data Protection Authority (CNIL) is responsible for data protection regulations (ACPR, 2023; CNIL, 2023).

Examples of French Companies used the Discounted Cash Flow, Market Approaches and Option Pricing Models

Various methods have been used to value ICT companies in France. In 2014, Dassault Systèmes, a software company, acquired Accelrys, a scientific software company, using the market approach valuation method (Woodford, 2020). Similarly, in 2018, French media conglomerate Vivendi used the DCF valuation method to value its acquisition of Havas, a global advertising company (Techbehemoths, 2023). In 2019, Thales, a multinational electronics company, also used the DCF valuation method to acquire Gemalto, a digital security company (Thales, 2020).

For Orange S.A., an ICT corporation in France, analysts employ various valuation techniques to determine the value of the company, including the discounted cash flow (DCF) method and real option analysis for risk profile. The company's valuation was also assessed through comparable and historical five-year averages, to get the indication of its past and peer average. Additionally, the replacement valuation method was applied to the plausibility of Orange's valuation (Analytics, 2021; Macroaxis, 2022).

Additionally, research by Maklan et al. (2005) investigated into the evaluation of CRM software investments using real options theory, highlighting its efficacy in assessing software investment value amid uncertainties. Similarly, Harmantzis and Tanguturi (2007) presented real options techniques to evaluate investment decisions for telecommunications service providers, showcasing its applicability in strategic planning under uncertainty. Furthermore, Dolci et al. (2010) concentrates on optimising product delivery management and explore investments in software solutions using real option valuation, particularly employing the Growth Option framework, to assess investment value, emphasising its practical relevance in enhancing business operations and decision-making.

2.5.5 Summary of case studies in different countries

Valuation theories are critical tools for determining the value of a company. In the case of ICT firms in Western countries, several valuation theories have been used to determine ICTs value including DCF, market approach, replacement approach, option-based pricing models and venture capital for ICT companies and start-ups. While developed countries have established guidelines and standard concepts for assessing ICT companies (Enholm et al.,

2021), certain methods still fall short in accurately forecasting the future value of these companies. The absence of standards is even more conspicuous when examining emerging and developing countries. Therefore, scholars and practitioners should focus on creating a set of outlooks based on thorough investigation and a library of valuation theories to address this issue in developing countries. Valuing ICT companies requires greater attention due to their business plan nature which changes frequently, high competition, uncertainty, and recent attention from Covid-19 (Bauer & Friesl, 2022). The limitation is particularly noticeable in specific economies like Iran.

2.6 Iran – as a country

Iran is the seventeenth-biggest state in the world and the second largest country in the middle east with a rich history and diverse culture. Iran ranks number 18 in the list of countries (and dependencies) by population. The population density in Iran is 52 per Km^2. The median age in Iran is 32.0 years (worldometers, 2023). However, in recent decades it has been faced with various political, social, and economic challenges. Iran has been in conflict in global communication and has been subject to sanctions and export controls. The country has also faced ongoing concerns over the possible military dimensions of its nuclear program (Cia.gov, 2023).

In terms of its economy, Iran is characterised by its hydrocarbon, agricultural, and service sectors, as well as a noticeable state presence in the manufacturing and financial services. The country ranks second in the world for natural gas reserves and fourth for proven crude oil reserves (Khalil, 2023). However, Iran's economy has faced difficulties in recent years, with negative growth rates in 2018 and 2019 (Ziya, 2021). The Covid-19 pandemic also had a significant impact on the country's economy, with only a third of the pandemic-period job losses recovered so far (Khalil, 2023). Iranians have participated in numerous protests across the country amid deteriorating economic conditions and perceptions of systematic government corruption (hrw.org 2019, and State.gov 2022).

Iran's political system is an Islamic republic, and the economy is divided into three sectors: public, cooperative, and private (Afary, 2023). The public sector includes major industries, banks, insurance companies, utilities, communications, foreign trade, and mass transportation, while the cooperative sector includes production and distribution of goods and

services. The private sector consists of all activities that supplement the other two sectors (Afary, 2023).

Inflation indicates how much a collection of products and services has gotten more costly over a specific time period, typically a year (IMF, 2022). The inflation rates in Iran have been consistently high and have worsened over time, with the annual inflation rate reaching 54.0% in July 2022, the highest level since June 1995. According to the Statistical Centre of Iran, in August 2022, the annual inflation rate in Iran was 52.2% (SCI, 2022). The IMF predicts that the global inflation rate for 2023 will be 6.6%, with Iran's inflation rate at 53.4% as of February 2023 (IMF, 2022).

2.6.1 Iran's economy and contextual background

Iran's economy is diverse, with a significant presence of the state in manufacturing and financial services, as well as petroleum, agricultural, and service industries. Iran ranks second for natural gas reserves and fourth for proven crude oil reserves globally, but the government still heavily relies on oil sales for revenue, making the economy and government finances volatile. The previous plan for development focused on science and technology, but external shocks like sanctions and commodity price volatility caused a decline in oil exports, strain on government finances, and high inflation for four consecutive years (IMF, 2022; WorldBank, 2021b).

According to the World Bank (2023), as of the end of 2022, Iran's GDP was $388.54 billion and the country's compound annual growth rate during the previous ten years was -0.46%. In comparison, Germany's GDP was $4.07 trillion, and the country's compound annual growth rate during the previous ten years was 1.0%.

Iran is one of the largest emerging and developing countries in the Middle East, with a population of approximately 86 million people. Internet use has grown significantly in recent years, with 84.1% of the population using the internet in 2022 (WorldBank, 2023). The ICT sector has experienced rapid growth, leading to widespread nationwide usage, and changing how people communicate and conduct business in Iran. The number of people using the internet in Iran is growing, and the ICT development index is increasing (WorldBank, 2021a). The online business and digital trade sectors have drawn national attention to this significant sector in Iran, with online start-up platforms developed for mobile applications

such as games, sports, entertainment, health, ethics, science, economics, social media, and more. The information and communication technology market size in Iran has expanded over the previous decade, with an average growth rate of roughly 9%, indicating the importance of the sector and government and company investment in this area (Fayyaz, 2018).

2.6.2 ICT sector in Iran: Contributions and challenges

The Iranian government has designated the Information Technology Organization (ITO) as the lead agency responsible for overseeing the development of Information and Communication Technology (ICT) in the country. Established in 2003 under the Ministry of Information and Communications Technology, the ITO plays a crucial role in planning, supervising, and coordinating ICT initiatives in Iran. The overarching aim is to advance ICT by conducting research, facilitating technology transfer, supporting human resources development, enhancing ICT infrastructure, and promoting e-government initiatives (Techrasa, 2017).

As of the Sixth Five-Year Development Plan (2017-2022), the ICT sector was anticipated to contribute 8% to Iran's GDP, a significant increase from 2.1%. Over the past three years, approximately $3.7 billion has been invested in ICT infrastructure, with $2.5 billion from the private sector and $1.2 billion from the government (Emami, 2018; Karbalaii, 2017). Notably, the ICT sector contributed about 7% to Iran's GDP in 2017, according to the National Statistical Centre of Iran (Mozayani & Moradhassel, 2020).

Despite challenges outlined in reports by Asemi (2006) and UNCTAD (2016), Iran has made strides in ICT development, as reflected in its ICT Development Index (IDI) of 4.99 in 2016, surpassing the average for developing economies 4.07. Recognising the strategic importance of technological development, the Iranian government has allocated increased budgets for research and development, anticipating a 400% increase by 2030 (Weforum, 2015). This aligns with a global trend where ICT is viewed as a catalyst for progress in employment, education, health, and business (Mozayani & Moradhassel, 2020).

Several prominent ICT companies operate in Iran, contributing significantly to the country's economy and job market. Major players include Mokhaberat and Irancell, while private firms like TechBehemoths, Glassdoor, Irantalent, and Rocketreach.co offer diverse ICT services. Notable companies in this sector also include Digikala and IDRO (Heritage, 2023).

2.6.3 Importance of studying Iran's ICT sector valuation

The scarcity of studies on ICT valuation in Iran, as revealed by Ragupathy (2011), highlights a gap in academic coverage, necessitating a focused empirical investigation. Iran's emergence as an "emerging country" in studies by Niebel (2018) emphasises the significance of understanding its ICT sector's growth and productivity. Existing research, as suggested by Xiao et al. (2013), emphasises the need for additional studies to comprehensively assess ICT in emerging economies, including Iran.

The ICT industry's transformative shift from manufacturing to service sectors, especially in developing countries, underscores the importance of more frequent measurement and evaluation (Toader et al., 2018; ITU, 2020). The rapid development of digital software and platforms in Iran, accelerated by the Covid-19 crisis, further emphasises the urgency for valuation methodologies (Barrutia & Echebarria, 2021; Heidari et al., 2022; Klein & Todesco, 2021). Valuation of ICTs holds critical importance, as highlighted by Bancel & Mittoo (2014) and Goedhart (2016). This study aims to contribute significantly to existing literature by conducting the first comprehensive investigation into ICT valuation in Iran, addressing the identified gaps and deficiencies (Mazzariol & Thomas, 2016; Bylund, 2019; Miciuła et al., 2020; Shen & Stark, 2013).

2.6.4 Iran’s financial markets and structure

Iran's financial markets predominantly rely on banks, experiencing substantial growth in recent years (Moayedi & Aminfard, 2012). The government, particularly through the Islamic Bank of Iran, provides loans for various projects. All private banks and insurance companies were nationalised in 1979, and the ten existing banks are categorised as commercial, industrial, and agricultural. Despite these classifications, they adhere to the same regulations (Nejad & Ferdowsi, 2018). Complying with Islamic law, which prohibits usury, banks charge service fees or commissions instead of interest on loans. The Central Bank of Iran issues the national currency, the rial, and the money market operates as a crucial source of working capital, with operations ranging from one day to a year (Abadi, 2019; Rosen, 2023).

Iran has listed state-owned companies for sale, anticipating substantial contributions to fiscal revenue through privatisation efforts (EIU, 2023). Corporate capital structure in Iran is

influenced by factors such as firm size, financial flexibility, asset structure, profitability, liquidity, growth, risk, and state ownership, with short-term debt being a significant financing source (Alipour & Mohammadi, 2015). Privatisation has increased, accompanied by rising capitalisation, Foreign Direct Investment (FDI), and equity prices, although concerns of a forming bubble persist (Ezzati, 2013). The widely accepted Salam Sukuk serves as an instrument for managing financing needs and determining future commodity prices in Iran (Salmani & Yavari, 2018). Salam Sukuk is a type of Islamic securities based on the Salam contract in Shariah that is used for fundraising by companies in Iran. Salam Sukuk is used to support a company's short-term liquidity requirements and ensure that goods are obtained when needed at an appropriate price (Issawi & Ghelich, 2015). The country has a relatively small and underdeveloped stock market with limited foreign investment, and the Tehran Stock Exchange (TSE) is the main exchange. Its market capitalisation was estimated to be around USD 100 billion in 2020, subject to fluctuations reflecting wider economic and political challenges in the country (Khalil, 2023).

2.6.5 Corporate finance structure in Iran

Iran's financial sector is primarily bank-based, dominated by commercial and expertise banks, with contractual financial institutions including commercial insurance and pension funds (Erdogan et al., 2020). After the Islamic revolution, non-Islamic monetary institutions were replaced with Participation Certificates. However, there are significant issues facing the financial sector, including regulating the capital market, reducing government involvement, and enhancing competition. To develop a stronger financial structure in Iran and minimise government influence, additional research needs to be conducted (Mirjalili, 2008; Najafi et al., 2021). Table 2-8 presents the structure of the financial sector in Iran.

Table 2-8. Structure of financial sector in Iran

Financial Institutions	**- Depository**	- Commercial banks
		- Expertise
		- Private banks
		- Non-banking financial institutions
		- Credit units
		- Gharz-Ul-Hasanah funds
	- Contractual	- Commercial insurances
		- Social insurances
		- Pension funds
	- Investment	- Investment companies listed in the Tehran Stock Exchange
		- Over the counter investment companies
Financial Market	**- Money market**	- There is no organised money market in Iran
	- Capital market	- Tehran Stock Exchange - Tehran Commodity Exchange
Financial Instruments	**- Instruments**	- Stocks
		- Participation certificates
		- Deposit certificates
Policy making organisations within the financial sector	**- Central Bank** **- Ministry of finance and economic affairs**	- Money and credit council - Supreme council of the Exchange

Source: Adopted from Najafi, Madanchi, Fallahshams, and Saeedi, (2021) and Mirjalili (2008)

Depository financial institutions include the government, private banks, non-banking financial institutions, credit cooperatives, and Gharz-ul-Hasanah funds. Contractual financial intermediaries encompass commercial and social insurance companies and pension funds.

Money market participants in Iran are individuals or organisations with excess finances that invest their capital for a short period. The capital market is a market for long-term financing of money that comprises both debt and equity instruments. The Tehran Stock Exchange is Iran's most significant capital market institution. The Ministry of Finance and Economic Affairs and the Supreme Council of the Exchange are the regulators and policymakers of the market (Mashayekhi & Mashayekh, 2008; Mirjalili, 2008; Najafi et al., 2021; Namakavarani et al., 2021).

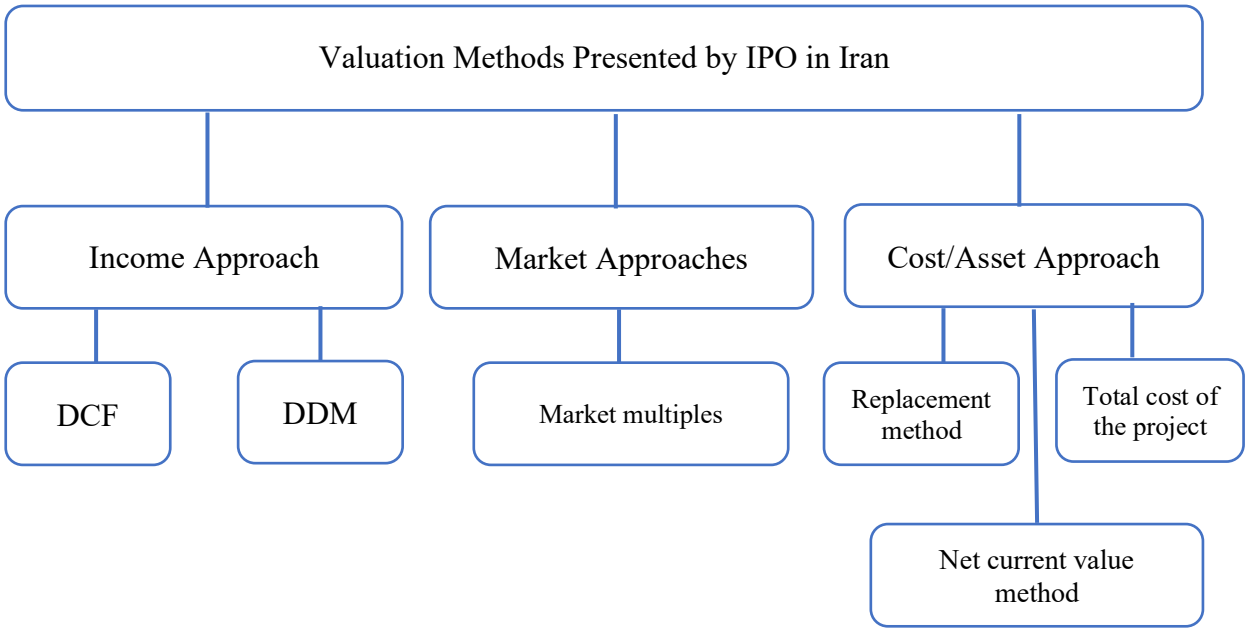
Financial instruments in Iran include stocks, participation certificates, bonds and treasury bills, and bank deposits. Stocks are a direct financing financial instrument traded on the stock exchange. Participation Certificates have emerged as a replacement for bonds as a tool for funding projects. Bonds and Treasury Bills were produced for the first time in accordance with Article 2 of the 1941 Budget Law revision. Bank Deposits take the form of one-year, two-year, three-year, and five-year deposits and are utilised by banks. It is important to compare and contrast these financial instruments with those in developed nations (Mirjalili, 2008; Najafi et al., 2021; Sarker, 2016).

2.6.6 Valuation guidelines in Iran

This study searched the Iranian database for valuation guidelines and found none that specifically provided guidance for ICT valuation in Iran. Although the Securities and Exchange Organization (SEO) has published regulations and guidelines related to various aspects of the capital market, a specific search for "valuation guidelines for specialists" did not yield any relevant results.

The Iranian Privatisation Organisation (IPO) is the only official source that provided methods for determining share prices in different scenarios. The IPO presented general and executive regulations for companies, which include valuation methods such as the market approach, replacement value, net recoverable value, the net present value of future cash flows resulting from the implementation of the plan (DCF-based method), the total cost of the project determined according to accounting standards, and the net current value method of the company's assets (Hosseini, 2018).

Figure 2-9. Valuation approaches reference for appraisers in Iran: A review of IPO (2018)



Source: Author's illustration

The valuation of companies in Iran is done by financial institutions such as banks and investment firms and they play a significant role in this process. Access to finance is crucial for Iran's economic development, but the country's financial markets are still ill-equipped to accept new foreign capital, and new securities need to be created to attract investors with a better risk/reward profile (Araghchi, 2015; Pasha & Khansari, 2021). These financial institutions are doing the process of selecting the appropriate valuation method and determining the level of detail for their valuation process. In line with the requirements set by the Iranian Privatisation Organisation (IPO), practitioners conducting the valuation for a company undergoing an IPO process which typically choose a minimum of three valuation methods (DCF-based, market approach and replacement value) to ensure comprehensive analysis.

The value of high-tech companies, specifically ICTs, in Iran has become challenging to determine due to the country's economic situation and inflation (Kelishomi & Nisticò, 2022). This study aims to explore how ICT valuation works in Iran and what factors should be considered when assessing an ICT company's value. Inflation and economic growth rates are important factors in the valuation process, but Iran's high inflation and volatility over the past decade have increased the overall risk and uncertainty of future forecasts.

2.6.7 Exploring evaluation approaches with ICT company examples in Iran

Despite having conducted searches in multiple Iranian databases, no relevant information was found. It was found that there is a lack of research available on the different valuation methods applied to ICT companies in Iran. However, a few examples are provided here to shed some light on this matter.

One of the unsuccessful examples include Lorestan Mokhaberat, when the first provincial telecommunication company was privatised in 2006, analysts used an asset-based method to determine its value, considering both tangible and intangible assets. However, this approach resulted in an inaccurate valuation and caused the company to miss out on the potential international buyers. Critics was more the problem in coming to a reasonable value for the intangible assets of the company. In this regards analyst such as Natghian and Pourkhasalian (2006), called for a change in valuation attitudes towards such companies, particularly in the valuation methods. This shift required a fundamental re-evaluation of traditional to more modern valuation models and the inclusion of the intangible assets value of modern technology-based companies. The other researchers suggested that successful ICT implementation and valuation in Iran could have a positive impact on trade exchange volume and increase the Tehran Stock Exchange index (Ghazinoory & Khorasani, 2016).

In regard to ICT valuation another published article (Ahangari, 2017) discussed the gap in valuation methods for high technology and technology-based companies in Iran. The article also suggested practitioners to use updated resources to develop valuation methods for these companies. Additionally, the article reviews the challenges of valuing newly established technology-based companies, which pose significant challenges for investors and entrepreneurs due to the risky nature of financing through venture capital. The article highlights the existing challenges in this area and needs of strategic solution to bridge the gap in valuation approaches for such companies in Iran.

In another article, the authors present an evaluation of the valuation methods used by new technology-based firms in Iran. Research emphasised the significance of accurate valuation for these firms to acquire financial resources and draw investors. The authors reviewed existing valuation methods and analysed the valuation relevance for Iranian entrepreneurs

and investors in the ICT sector. Based on the research findings with highlighting the need for further studies aimed at enhancing these existing valuation methods (Dastkhan, 2022).

Other study examines the performance, and selection of high-tech IPO valuations methods in Iran. The authors analysed a sample of 83 IPOs from January 2017 to March 2021 using pre-IPO data and various statistical methods. The findings indicate that the dividend discount model (DDM) is the most used valuation method in Iran when it comes to pre-IPO price estimations. The study also found that firm characteristics such as age, size, and profitability affect the selection of valuation methods. Eventually, the study reported of pre-IPO valuations at 61%, with Dividend Discounted Model (Hekmat et al., 2023). Various research has highlighted the constraints and disadvantages of using the dividend discount model (DDM) in valuation due to its consistent assumptions, inputs, sensitivity to errors, and limitations. The DDM valuation measure is particularly sensitive to dividends, however, the primary objective of valuation analysis is to estimate a reasonable value for ICTs that also do not pay dividend (Payne & Finch, 1999). In a separate investigations in 2008 and 2013, it was found that UK analysts favour the DCF model over the DDM as the more precise valuation approach for ICT firms (Imam et al., 2008; Imam et al., 2013).

Zarei et al. (2020), conducted a study to examine the valuers' decisions to issue qualified valuation reports for Iranian tech firms. Their research involved analysing data from these firms over a period of five years, using multiple approach of financial and non-financial ratios. The results indicated that financial ratios and the type of valuation firms were significant factors in explaining the valuation reports.

The lack of literature on Iranian ICT valuation emphasises the need for further research, especially with the increasing significance of appropriate assessment methods due to the Covid-19 pandemic (Coombs, 2020; Griffith et al., 2020; Rahiem, 2020; Thornton, 2020; Yang et al., 2020). This study aims to investigate these issues in Iranian literature and practice and suggest ways to close the gap between Iran's current ICT valuation and advanced nations. The researcher conducted an empirical analysis of ICT valuation practices in Germany to gain a deeper understanding of the process while interviewing Iranian valuation practitioners. The reason for selecting Germany was its position as the top ICT sector in Europe, with significant investments in technology, software, and media (Berger, 2021). Valuing ICT assets holds significant importance in the context of investment decisions, equitable transactions, and the evaluation of a company's financial health. However, it is

noteworthy that existing publications in Iran predominantly concentrate on traditional business valuation methods, rather than exploring contemporary or more current theoretical approaches. Valuation methodologies need to consider the unique characteristics of ICT firms, such as intangible assets and technological change, as well as government policies' impact on ICT companies. Risk assessment at a deeper level is also necessary due to high inflation and economic instability in Iran. Effective ICT valuation processes require a better understanding of making more accurate growth strategies (Mozayani & Moradhassel, 2020).

The ICT sector's dynamic and innovative nature creates unique opportunities and challenges for valuation, and some widely accepted methodologies may require adjustments to reflect the sector's specific characteristics (ArabSalehi & Mahmoodi, 2011). Political, economic, cultural, and legal differences in certain economies or regions, such as Iran, can affect the reliability of valuation methodologies, necessitating the adjustment or development of methods to better suit the context (Verhoef et al., 2021). To go deeper into the first research objective, the researcher conducted a review of the valuation approaches employed by Iranian practitioners. This analysis aimed to identify the effectiveness of theoretical models in practical application within Iran and shed light on their limitations. Additionally, this study aimed to bridge the existing gap highlighted by previous researchers, who have suggested further research on ICT valuation and the examination of Iran's high-tech valuation process (Aghaei & Sahebi, 2021; Mousavi et al., 2019).

The investigation of valuation of ICTs in Iran indicates that companies in Iran are notably smaller compared to the reviewed examples from different countries, with Iranian ICTs classified as Small Medium Enterprises (SMEs) within the ICT sector.

2.6.8 Summary of ICT evaluation in Iran

The importance of researching the valuation of ICT companies in Iran is emphasised by the growing sector and calls from previous researchers. High inflation and the current situation in Iran have increased uncertainty in predicting the future cash flows of ICT companies. Even though different practitioners in Iran have applied various valuation methods such as DDM, DCF, market approach, and replacement methods. To address the gaps in this area, the researcher investigated further and analysed criticisms of valuing ICT firms in Iran through interviews with participants. Understanding the valuation of ICT firms in Iran can enhance

investors' decision-making abilities and aid policymakers and regulators in promoting innovation and growth within the industry (Bancel & Mittoo, 2014). Although the researcher identified the valuation methods used for ICT firms in Iran in current literature, the available valuation tools have not been adequately instructed by regulators to provide proper guidelines for valuers on how to value ICTs. This research also found that there is a lack of literature specifically addressing the value of investments in the ICT industry in Iran, and that available valuation tools have not yet been applied to this industry in Iran. This is a significant gap in the literature, particularly given the importance of the ICT sector. Valuing high-tech companies is a known challenge, and there is a need for more studies focusing on the valuation of high-tech companies in emerging countries in general (Chindris, 2020; Durand & Fry, 2014; Oh, 2018) and Iranian ICT companies in particular. This study should develop updated approaches that consider the uncertainties and flexibilities inherent in these types of firms.

After reviewing the Iranian literature, it becomes apparent that there is a notable absence of option pricing models, which have been widely adopted and suggested by many developed countries, including the US, UK, and France. These models are particularly valuable for valuing ICT companies, which often have business models heavily reliant on intangible assets. The lack of such advanced valuation methods in Iran may hinder accurate assessments of these companies' true worth.

2.7 Chapter summary

This chapter focuses on the first research objective, which was to identify and critically evaluate the main theoretical valuation models used to value ICT firms in other countries and specifically in Iran. The chapter provided an overview of the central themes in the theoretical debate surrounding the valuation methods employed for ICT companies in Western literature. Additionally, it offered practical examples from various countries that have applied these models to value the ICT firms. Furthermore, the chapter conducted a comprehensive review of existing studies about Iran as a country and critically evaluated the valuation of Iranian ICTs. By identifying gaps in the existing body of ICT valuation studies in Iran, this review establishes a groundwork for subsequent empirical research. The aim is to address deeper into the details outlined in the research objectives.

In summary, the chapter explored the application of various valuation methods, such as DCF, multiples, option-based pricing models and replacement, in valuing ICT firms in different developed countries, along with the venture capital approach for ICT start-ups. However, in Iran, the methods for valuation were DDM, DCF, multiples and replacement. DDM is criticised for its outdated nature and limitations compared to DCF, which is commonly used in developed countries. This disparity represents a significant gap in the valuation of ICT firms in Iran that requires attention. The importance of investigating the valuation of the ICT sector in Iran is underscored by previous researchers.

The chapter also reviewed different risk analysis techniques applicable to the valuation process of ICT companies. Risk assessment tools like scenario analysis, sensitivity analysis, and Monte Carlo simulations are amount the employed tools in developed countries for ICT valuation. Regarding the discount rate in the DCF method, Western countries employed various discount rate approaches, such as the WACC, CAPM, and peer group methods. These approaches are used to determine an appropriate discount rate for valuing ICT companies in the DCF framework.

Table 2-9 displays the notable models and their corresponding components, derived from a literature review and empirical insights provided by practitioners. The table outlines the methods proposed in academic literature and used in practical settings for valuing ICT firms. These methods are categorised based on their theoretical recommendations (T) and practiced among professionals (P).

Table 2-9. Applicability of valuation methods for ICTs evidence in theory and practice

Valuation Methods	Applicability for ICT valuation – Theory / Practice (T/P)		
Income approach	Discounted cash flow Dividend discounted model	(T/P) (T/P)	Feste (2013), Givoly et al. (2009), Truong et al. (2008), Arshad, (2012), Ryan (2007), Fernández et al. (2015), Mellichamp (2017), Arshad (2012), Damodaran (2016), Brealey et al. (2020), Berk and DeMarzo (2020), Octav (2020), Ross (2020).
Market approach	Price to earnings, Price to book value, Price to cash flow, Price to sales, Enterprise value to EBITDA, Enterprise value to EBIT, Enterprise value to sales	(T/P) (T/P) (T/P) (T/P) (T/P) (T/P)	Berk and DeMarzo (2020), Brealey et al. (2020), Ross (2020), Fernández et al. (2015), Mackevičius (2010), Mellichamp (2017), Ryan (2007), IVS (2020), Mohammad (2016), Fazzini (2018), Hoover (2006), Collins (2010).
Risk analysis	Scenario analysis Sensitivity analysis Monte Carlo analysis Risk-adjusted analysis	(T/P) (T/P) (T/P) (T/P)	Elgembri and Altamimi (2011), Gao and Li (2003), Xia and Yu (2013), Bhargava et al. (2013), Priyam et al. (2013), Reyck et al. (2008), Berk and DeMarzo (2017), Brealey et al. (2020).
Option based method	Black-Scholes option pricing Binomial option pricing Real option	(T/P) (T/P) (T/P)	Hull (2017), Ryan (2007), Brassell, and Maguire (2017), Hsu (2010), Marzo (2016), Adner and Levinthal (2004), Maklan et al., (2005) Dolci et al., (2010), Csapi (2019), Ullrich (2013).
Cost/asset-based approach	Replacement cost method	(T/P)	DeStefano et al. (2018), IVS (2020), Kozyr (2014), Yousefi (2021), Skinner (2008), Dedrick et al. (2003), Malkiel (2003).
ICT Start-up valuation method	Venture capital valuation	(T/P)	Gilson (2002), Köhn (2018), Giardino et al. (2014), Ngassam (2020), Metrick (2021), Miloud et al. (2012), Suwarni et al. (2020).

Source: illustrated by author

The review of current studies reveals a significant gap in the research and lack of standardised valuation methods for ICTs in Iran and neighbouring countries. The absence of valuation standards in developing countries poses increased risks for business transactions. Standardised criteria for valuation are essential to accurately determine the true value of a company and facilitate comparisons with others within the same industry. Without these criteria, investors may encounter scenarios of overpaying for a company or making uninformed investment decisions, potentially resulting in financial losses. To address this issue, it is crucial to establish a robust and reliable procedure accompanied by complementary rules for ICT valuation. The implementation of standard guidelines or procedures can assist companies in accurately valuing their assets and enable investors to make well-informed decisions, thereby mitigating risks associated with investing in these companies.

Western countries have already established valuation standards and criteria for ICTs, which can serve as valuable reference points for developing countries to compare and create their own standards. To this end, this study initially reviewed relevant research conducted in Western countries and examined empirical studies involving German practitioners to gain insights into the standards and processes of valuation methods for ICT companies. Consequently, this study covered four valuation methods and risk assessment methodologies, which serve as crucial building blocks for addressing the research objectives. By completing this study, emerging countries like Iran can identify and develop standardisation practices to facilitate the implementation of these methods for future ICT valuation.

2.8 Conceptual framework

To provide a comprehensive overview of the literature, a conceptual framework was developed to contextualise the emergent themes and identified gaps in the existing research. This section presents a conceptual framework that incorporates findings from the current literature and relevant theories, illustrating the interrelationships between valuation methods and the process of valuing an ICT firm. While conceptual frameworks derived from theory may not fully address all aspects of the phenomena under study, they serve as a guiding framework that highlights the need for further investigation (Green, 2014; Varpio et al., 2020). The conceptual framework presented in this study offers a broad understanding of the existing knowledge base through the literature review, while also identifying areas where additional research is required to address specific aspects or gaps. As discussed by Leshem and Trafford (2007), literature studies based on tested models in the field contribute to the exploration and development of the conceptual framework, ultimately helping to identify research gaps and inform future studies.

The model presented depicts the interconnected essence of the emerging themes encompassing the ICT valuation process, alongside a subcategory dedicated to risk assessment, and the final valuation conclusion. Through a comprehensive review of theoretical and empirical publications on the valuation of ICTs reveals that analysts may use income approaches, market approaches, option-based models, cost-based approaches, and venture capital valuation method. The researcher effectively explored into the three research objectives designed to investigate this study by methodically considering the relevant studies and using the developed framework. According to the current literature, a thorough analysis

of the risk profile is crucial for an effective valuation process, and various tools such as scenario analysis, sensitivity analysis, and Monte Carlo simulation are employed for this purpose. Additionally, the presentation of final valuation conclusion derived from different valuation methods is another important consideration, as it was identified as a gap in reviewing the Iranian theoretical studies. To address the identified gaps, a conceptual model (Figure 2-10) was formulated to fulfil the research objectives. This model is designed to examine the debate through an ICT valuation lens and establish a conceptual framework for ICT valuation in Iran, drawing insights from a comprehensive study of current literature.

The aim of the study was to critically evaluate the models and valuation strategies used in Iran to value Iranian-based ICT companies and to contrast these with approaches used in other countries. Since there was a minimal study for Iranian ICT valuation available, the gaps that needed to be filled were recognised; an empirical study was needed to determine such companies' valuation processes in Iran to address these gaps. The study looked at the valuation process from the point of view of Iranian valuation to fill this gap. So, within the income approach, studies suggested the applicability of the DCF model and deep analysis process, which is considered the first gap of the study. The academic literature and empirical studies indicate that employing complementary tools such as sensitivity analysis, scenario analysis, and Monte Carlo simulations are crucial for enhancing the relevance and effectiveness of determining cash flow projections, growth rate assessments, and discount rate considerations. This aspect represents the second gap in research analysis. Another critical area requiring attention is the incorporation of qualitative risk analysis into the valuation process, constituting the third gap.

Option pricing models were frequently discussed in various studies reviewed in the literature, but they were notably absent in the Iranian literature, indicating a gap that needs to be addressed in this study. Lastly, the researcher must address the presentation of calculated values, as there is a lack of specific guidelines in this regard in Iran. After filling this study's gaps, this research provides academic insight into how Iranian practitioners assess the value of ICT companies and what theoretical models they use.

To start a financial model in the valuation process, several steps are necessary. First, there are ***pre-modelling*** activities, which include developing business acumen: understanding the overall ICT market in which the business operates, analysing industry competitors and their

market positions, grasping the fundamental business model and value proposition, and identifying and understanding the sales channels used.

Next, the appraiser must ***collect and analyse*** relevant information. This involves gathering data from various departments, using market research and industry data to inform assumptions, and collecting historical sales and margin data. Leveraging ERP and CRM systems provides detailed operational information about the business, its ownership, future outlook, industry conditions, economic factors, and previous transactions.

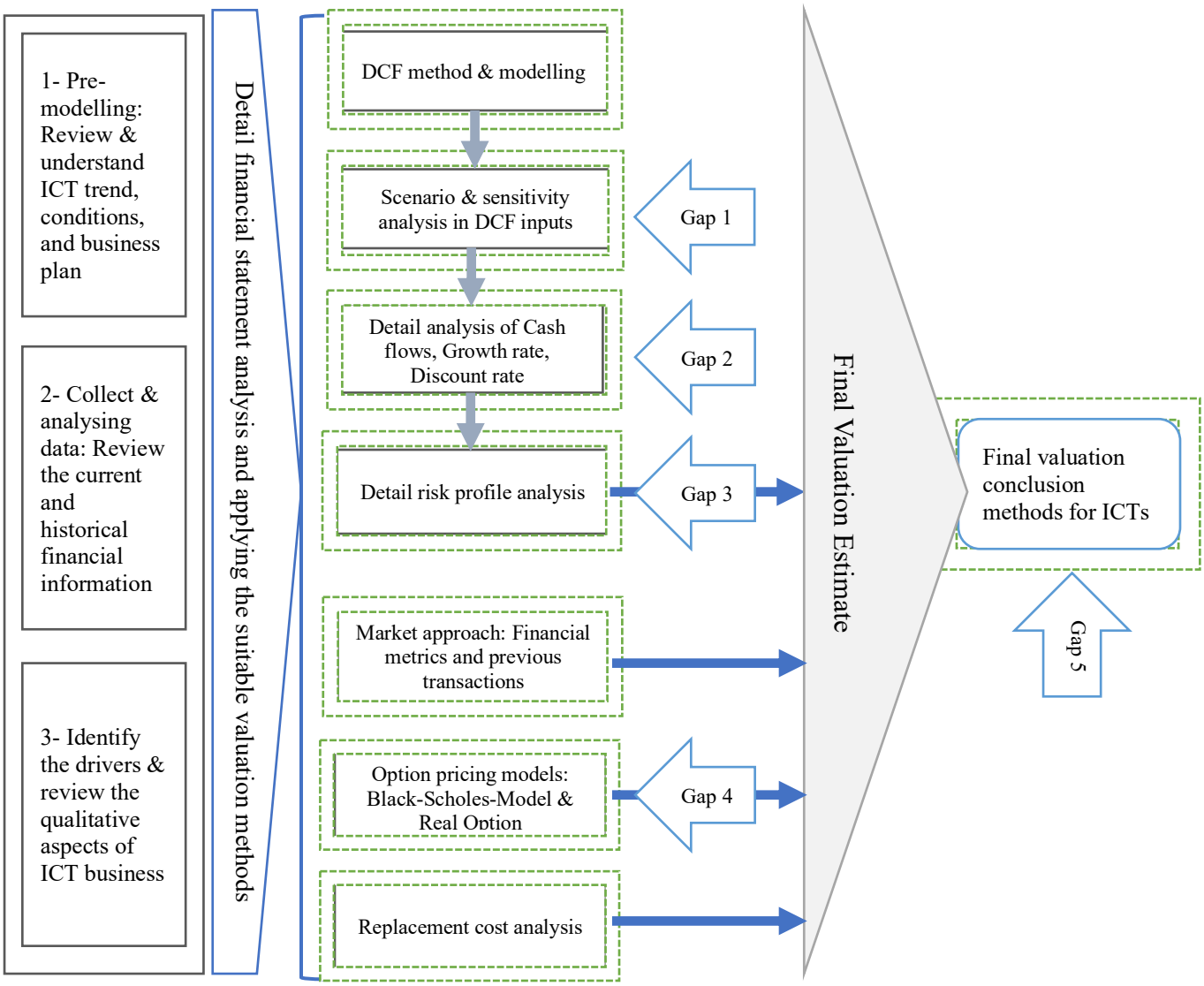
The second step involves making ***assumptions*** and identifying ***drivers***. This includes estimating future revenue growth rate potential, projecting the cash flow growth rate for a stable period, determining appropriate potential premiums and discount rates, and assessing expenses growth rate and capital expenditures.

Following the review of these assumptions, the detailed ***financial statement analysis*** begins. This includes reviewing and using advanced tools such as scenario, sensitivity and Monte Carlo analysis in the *income statement* to analyse sales, gross and operating margins, and variable and fixed expenses; the *balance sheet* to analyse current and non-current assets, liabilities, and owner's equity; and the *cash flow statement* to analyse operating, investing, and financing activities. This assists the analyst in projecting future estimations based on historical and potential growth that the ICT company can achieve in the market.

The next step is the ***valuation*** itself. The appraiser must choose and apply suitable valuation methods to calculate the estimated value of the ICT firm. These methods can include discounted cash flow (DCF), market approach, option pricing models, and replacement cost method.

Analysts must also thoroughly document and retain all relevant information and work used in the valuation process. Ultimately, the appraiser must provide a written and oral report of the ***valuation conclusions*** to the client. The conceptual framework developed by the researcher in this study for ICT firm valuation, based on a review of the literature and existing knowledge, is shown in Figure 2-10.

Figure 2-10. Conceptual framework from the literature review



Source: Author's illustration

Note:

Basic inputs

Influence on valuation estimates

The final valuation estimation from each method

The main area of this research

Presenting the result

Gaps to be filled

Since the primary objective of this study was to conduct a critical evaluation of the models and valuation strategies used in Iran for valuing ICT companies, the study contrasted these approaches with those employed in other countries. Given the limited availability of studies on ICT valuation in Iran, it was crucial to identify and address the existing gaps in knowledge. To bridge these gaps, an empirical study was conducted to investigate the valuation processes employed by Iranian companies.
The conceptual model developed in this literature review highlights the researcher's objectives and desired learning outcomes from the research. This model identifies the relevant themes for the study and illustrates their potential interrelationships.

Through a comprehensive review of theoretical and empirical concepts related to valuation, the researcher was able to identify gaps in knowledge and determine the necessary steps to address them. However, it is important to note that the limitations of secondary data, mainly relying on historical information, hindered the ability to answer the research objectives. To gain a deeper understanding of ICT valuation analysis and the applied theories, more detailed information was required.

To deeper understand into this topic, the findings chapter presents primary data obtained from senior valuation practitioners in both Germany and Iran. These insights help shed light on the methodologies applied and contribute to a better understanding of the subject matter.

Chapter Three
Methodology

3.1 Introduction

To conduct research, the researcher must identify the strategy, adopt the philosophical perspective, and choose the suitable method for investigation and exploration. The researcher must comprehend the logic behind these decisions and the possible boundaries of the study. Blaikie (2009) contends that selecting a suitable research methodology might be a challenge for researchers. The methodology is the philosophical framework or basis upon which research is conducted or constructed (Brown, 2006). O'leary (2004) defines methodology as the research framework connected with a specific set of paradigmatic assumptions. The researcher therefore understands the ontological and epistemological concerns associated with the research project. To do research, it is necessary to identify the appropriate methodology when collecting the data.

The methodology section of the study aims to critically review different research methods to understand which ones are a better fit for this study.

The section starts by discussing the different research philosophies (positivism, interpretivism, and pragmatism) and the relation of each philosophy to the research objectives for this study.

Then discusses the methodological approach and explains its application, advantages, and disadvantages of different research designs to the current topic proposal.

The chapter reviews sampling methodologies by discussing the sampling frame, drawing the sample population, and sampling method and explaining how the sample is approached and the argument of potential biases or limitations of the sample.

The methodology chapter continues with the techniques used to conduct and examine the fieldwork, the data collection tools used and how the pilot and main studies were developed and selected. Discuss the data analysis techniques used in fieldwork and how they were chosen.

The chapter ends with an ethical review, the study's reliability, and authenticity, discuss of the limitations of this study, and a chapter summary.

3.2 Research philosophy

To conduct the research, the researcher must first decide on the appropriate research philosophy to employ in the study. This involves a thorough examination of various methodologies to identify the most suitable one for the current topic. The most common research philosophies, interpretivism, positivism or realism, and interventionism (Bryman, 2016), have been examined for this study. Understanding the philosophical assumptions that support qualitative research begins with establishing where it fits within the overall research process, recognising its significance as a component of research, and analysing how to actively design interest-grabbing questions (Zhang & Creswell, 2013). Research philosophy is a set of attitudes and beliefs concerning the acquisition of knowledge (Saunders et al., 2009). In business and economics studies, the justifications behind the study's philosophical categories should be stated as part of the research philosophy section. In addition, research philosophy has implications for research strategy in general and the selection of primary data collection techniques. The research philosophy focuses on the origins, nature, and evolution of knowledge, as well as how to gather information about a phenomenon in order to analyse and apply it (Bajpai, 2011).

The ontology and epistemology of the proposed research method affect the results, so the researcher in this study needed to understand and justify the choice of method so that readers can understand it. Ontology refers to the philosophical understanding of the nature of reality and existence, while epistemology deals with the nature of knowledge and how it is acquired. In this research, ontology shapes the researcher's viewpoint regarding the subject of ICT valuation under investigation, while epistemology guides the selection and application of methods and techniques the researcher used to gather and analyse data for this study. These considerations ensure that the study is firmly rooted in a well-defined philosophical framework and that the chosen methods align with the research objectives and questions being pursued (Collins, 2010; Crowther & Lancaster, 2012; Dudovskiy, 2018).

The following are the three research philosophy approaches and how they suit the purpose of the study: positivism, interpretivism and pragmatism. Positivism and realism are structured and quantitative in nature, relying on large sample sizes and precise measurements. Interpretivism is qualitative and focuses on in-depth understanding through interviews and small sample sizes. Pragmatism can encompass both qualitative and quantitative methods and

is often used in mixed-methods research (Saunders, 2018).

3.3 Research approach

In the context of this research, the chosen research approach includes the methodologies and procedures employed to gather data and information, as elucidated by Bryman et al. (2007). The incorporation of theoretical frameworks is a requisite aspect of the research process, and this incorporation typically receives explicit attention within the context of data presentation and the formulation of conclusions. The emphasis placed on either theory testing or theory development plays a pivotal role in shaping the overall design of the research study (Ketokivi & Mantere, 2010).

The research approach is typically illustrated by three study modes: deductive, inductive, or abductive reasoning. Deductive reasoning starts with a theory or premises and reaches a conclusion based on logical deductions. Inductive reasoning, on the other hand, starts with observations and experiences to arrive at a general conclusion. Deductive reasoning aims to prove or disprove theories while inductive reasoning aims to gain a better understanding of the issue. Abductive reasoning starts with a surprising observation and seeks to find the most likely explanation (Ketokivi & Mantere, 2010; Saunders, 2018; Thomas, 2006).

This study used an inductive research strategy to develop social scientific concepts and theories by analysing the participants' experiences and understandings. The aim was to create a research outcome that reflects the participants' perspectives for valuing the ICT firms in Iran.

3.4 Research strategy

There are two primary approaches to research analysis: qualitative and quantitative. The fundamental differences between the two primary research methods: qualitative and quantitative research have different goals, and they rely on different data collection and analysis techniques. Qualitative research seeks to understand the perspectives and experiences of participants and focuses on gaining insights into their motivations, experiences, emotions, and beliefs. On the other hand, quantitative research uses numerical data and statistical techniques to examine the relationships between variables, seeking to answer questions about quantity and frequency (Bryman et al., 2019; Creswell & Hanson,

2007; Dudovskiy, 2018; Robson, 2011). Choosing a research strategy involves making ontological and epistemological assumptions. Ontology refers to the essence of reality and the existence of entities, within this context, it pertains to the assessment of ICTs. Meanwhile, epistemology is concerned with the nature of knowledge and its acquisition, and in this study, it explores the process of evaluating ICTs. Axiology revolves around values and their impact on research, and in this particular area, the researcher seeks to understand how the practitioners used these valuation methods which influence the study's outcomes. These philosophical assumptions play a pivotal role in shaping the research design, influencing the methods employed for data collection and analysis, and ultimately shaping the research findings (Blaikie, 2009).

Therefore, understanding the differences between qualitative and quantitative research methods and the philosophical assumptions underlying research strategies can help the researcher choose the appropriate approach for the research questions and objectives. This study takes an interpretivist approach, which is an ontological stance that acknowledges the subjective nature of reality and seeks to understand it through individual experiences (Crowther & Lancaster, 2012; Packer, 2011). The epistemological view in the interpretivist approach is that knowledge is created and understood from the individual's perspective. This study focused on how individuals in Iran value ICT and what that means to them. This research used qualitative methods to determine the ICT valuation process in Iran, which involves gathering and analysing data through non-numerical means such as interviews, observations, and document analysis (Blaikie, 2009; Crotty & Crotty, 1998). This approach allows researchers to gain a deeper understanding of the meanings and interpretations that individuals give to the valuation of ICTs.

3.5 Potential research methodologies

Positivism and interpretivism are the two main research paradigms in the social sciences. Positivism is based on the idea that social phenomena can be studied objectively and quantitatively, while interpretivism argues that social phenomena are subjective and can only be understood through the interpretation and understanding of individuals' perspectives. The selection of a research methodology depends on the researcher's beliefs and values about what constitutes acceptable knowledge (Dudovskiy, 2018; Saunders, 2018).

3.5.1 Positivism approach

The positivism's philosophical approach emphasises the importance of empirical data and statistical analysis in research. It believes that knowledge comes from human experience and that the world can be understood through observable and quantifiable elements. It adopts a deductive reasoning approach and values objective research where the researcher is independent of the study (Collins, 2010; Dudovskiy, 2018). The positivist research philosophy is mainly based on objectivity and the pursuit of explanation and prediction. It holds that scientific inquiry should be guided by logic, not common sense, and that findings should be evaluated based on empirical observation and deductive reasoning. The goal is to develop hypotheses that can be tested through scientific methods and avoid biases arising from personal values or beliefs. The aim is to provide a value-free understanding of the world based purely on facts (Crowther & Lancaster, 2012). Crowther and Lancaster criticised using the positivist approach in social science research because of its limitations in capturing complex and nuanced social phenomena. Positivism emphasises deductive and value-free approach to research and fails to account for the subjective interpretations and meanings individuals attach to their experiences. This detachment from the social world and lack of theoretical framework can result in degraded and artificial research outcomes, failing to capture human experiences' richness. The researcher should adopt a research approach in social sciences that is more reflective and considers the context. This approach should acknowledge how both the researcher and social institutions influence how individuals perceive and experience things (Bryman, 2016).

In summary, the positivist approach may not be suitable for this research as it emphasises observable and measurable facts and may not account for data collection limitations due to one-way communication and limited access to practitioners. This approach may offer benefits, such as a structured and historical perspective. However, it has other challenges, such as many incomplete responses and a potential gap between the selected theory and hypothesis (Bryman et al., 2019; Crotty & Crotty, 1998; Payne & Payne, 2004).

3.5.2 Interpretivism approach

Social interpretivism is a research approach that seeks to understand individuals' subjective meanings and experiences in the world in which they live and work (Zhang & Creswell, 2013). Interpretivism focuses on how humans make sense of their social reality. Interpretivist emphasises the importance of collecting rich and meaningful data from research participants to comprehensively understand social phenomena. Unlike natural sciences, interpretivist research in the social sciences account for complexity, multiple interpretations, and meaning making. Interpretivism aims to create new, deeper understandings of social worlds and contexts (Denzin & Lincoln, 2011). An interpretivist examines people's experiences and seeks to understand the meaning behind events by collecting and analysing meaningful data from research participants. The goal is to provide multiple perspectives and understandings, recognising that different people interpret events differently (Bryman et al., 2019; Creswell & Poth, 2016).

To conclude, interpretivism as a paradigm compared to positivism. Interpretivism recognises the complexity and diversity of human behaviour and the importance of subjective meaning in social phenomena. Conversely, positivism tends to reduce social reality to quantifiable variables and statistical relationships, ignoring the diversity of perspectives and experiences. Interpretivism also acknowledges the role of the researcher in shaping and being shaped by the research process. This reflexivity allows for a deeper understanding of the social phenomena under investigation, as well as a more ethical and accountable research practice. Moreover, interpretivism often involves a more collaborative and participatory approach, where research subjects are actively involved in the research process, and their voices and perspectives are heard and valued. This can lead to a more empowering and emancipatory research practice, where research is used as a tool for social change. However, both paradigms have their strengths and limitations, and the choice of paradigm depends on the research objectives, context, and epistemological assumptions of the researcher (Bryman, 1988; Bryman, 2016; Bryman et al., 2019), which in this research appears that interpretivism is fitter to current research.

So, the research method used in this study is an interpretivist method that focuses on how the participants see things from different points of view. The researcher aims to understand the "how" and "why" of ICT valuation through in-depth interviews and observations with a sample size of highly specialist people in the valuation field. The research design is

exploration, data collection, description, and data analysis. The advantages of this approach include a deeper understanding of the context, a less structured approach, and a focus on the participants' perspectives. The disadvantages include a subjective nature, the potential for bias, and difficulties in generalising the findings.

3.6 Research method

The researcher has identified a significant gap in the existing literature, after reviewing the data derived from various databases, concerning the valuation of ICT companies in Iran. Consequently, the researcher has chosen to undertake a study with Germany serving as a foundational reference for the empirical investigation. This approach aims to gain insights into the prevailing methodologies and insights related to the valuation of ICT firms.

The choice of Germany as the basis for the empirical study on ICT valuation stems from the researcher's residence and employment in the country. Germany's robust reputation for innovation, quality, and a well-developed ICT sector further justifies this selection (World Economic Forum's Global Information Technology Report, 2016). Germany's status as a leader in the ICT industry in the EU, with companies such as SAP, Software AG, Infineon Technologies, Siemens, SoftServe, Lufthansa Systems, TeamViewer, Avira, Deutsche Telekom, and Bosch, further strengthens its suitability for the study (Laitinen et al., 2020; Week, 2005). Additionally, the country's government initiatives to support the growth of the ICT sector and its emergence as a financial powerhouse in Europe make it an ideal location to understand the ICT valuation process (europa.eu, 2020). However, it is worth noting that this is not a comparative study because of the enormous differences between the two countries of Iran and Germany. Yet, the study's results can provide a useful measure and insights into promising practices for valuing ICT companies.

The researcher chose the qualitative approach using semi-structured interviews to collect data from senior managers in the Iranian and German ICT industry. This method was chosen due to the limited number of participants and the need for in-depth explanations of valuation practices. The qualitative approach was also deemed appropriate for business and management research, focusing on people and their decision-making processes (Creswell & Hanson, 2007). Also, this method was preferred over questionnaires as it allows for

elaborating areas of curiosity and provides a deeper understanding of participants' perceptions and insights.

The researcher chose a qualitative research method with an interpretivism position for the study of ICT firm valuation because wanted to understand the perspectives of Iranian and German senior managers on ICT valuation and the reasoning behind it, as well as any adjustments made in the valuation process. The choice of the interpretivism paradigm for this study was made after a thorough evaluation of its suitability in light of the limitations associated with both the positivism and interventionism paradigms. The interpretivist position with a qualitative approach using semi-structured interviews helped to explore and analyse the methods in ICT firm valuations (Denzin & Lincoln, 2011). The aim was to understand the meanings attached to ICT valuation models in an organisation and to contribute to the current knowledge base (Saunders, 2018). Given that the interpretivist approach in finance aims to unveil the symbolic meanings embedded within discourse and written communication (Prasad & Prasad, 2002), the researcher employed semi-structured interviews to gather data and subsequently conducted an analysis. This analysis was conducted to shed light on various methodologies and viewpoints pertaining to the valuation of ICT firms.

This study conducted research into the valuation methods used for ICT companies, focusing on gathering professional perspectives from experienced individuals in the industry. Also, this study used interpretivism ontology and epistemology, as it allows for understanding social and experience-based aspects and views knowledge as being produced socially through perceptions that reflect social realities. The research design involved three phases: an initial qualitative phase from current literature and German specialists, a primary qualitative phase inquiry from interviews with Iranian specialists, and a follow up phase investigation to clarify the gathered data with some German specialists. The goal of applying different phases of the studies was to comprehensively understand the evolution of ICT valuation in Iran.

To initiate the empirical data collection process, the researcher commenced with a pilot study phase. Pilot studies hold significant importance in research, as the process enable the researcher to test and refine the methodology, making any necessary adjustments before conducting the main study (Bryman et al., 2019). For this research, two pilot studies were conducted using semi-structured interviews to explore the central themes that emerged from the literature review. The use of semi-structured interviews provided flexibility to investigate any additional topics that might emerge. The following themes became the focus points.

- Identification of relevant valuation methods
- Examining their effectiveness and reasoning
- Investigating the valuation process
- Reviewing the risk assessment
- Examining the adjustment made and areas for improvement.
- Discussing the presentation of computed results
- Suggestions for future valuation of ICTs

3.7 Pilot studies profile

After finalising the interview questions, the process of the pilot study started. The pilot study helped to evaluate whether the themes emerging from the literature review were covered. The pilot study gave the researcher valuable insight and ideas on the question formulation and interview structure. Also, it is crucial to choose a group of people to whom the study questions was relevant (Braun & Clarke, 2013; Bryman, 2016; Creswell & Hanson, 2007; Denzin & Lincoln, 2011; Kvale & Brinkmann, 2009; Lune & Berg, 2017; Shinebourne, 2011). So, two pilot interviews were conducted with German specialists who met the requirements for the study. The pilot participants were selected based on direct access and chosen from the personal contacts of colleagues and valuation practitioners. The participants were contacted directly to arrange for an interview time and location. The first pilot involved an ICT valuation specialist in Germany, with the interview lasting approximately 42 minutes. The second interview conducted with another ICT valuation specialist in Germany and had a duration of around 38 minutes. Both pilot study interviews were conducted in English because the interviewees were English-native speakers living in Germany.

The two pilot studies involved the following individuals:

WL-DE: A senior manager in the valuation associate team specialising in the buying and selling of German-based ICTs. He is originally from U.S. who has worked and resided in Germany for eight years, holding a senior valuation specialist position in one of the four major multinational accounting, auditing, and valuation firms in Germany.

RB-DE: A senior manager in the deal advisory specialising in the acquisition of German-based technology and software. He is originally from Spain and employed within one of Germany's prominent companies in the investment and valuation department.

These pilot studies were instrumental in shaping the research process and ensuring that the subsequent data collection phase would be as effective and accurate as possible.

The purpose of the pilot study was to identify any problems with the research procedure, check the appropriateness of the questions and language for participants, assess the time allowed for the proposed procedure, and evaluate the overall suitability of the procedure to generate subjective information and avoid repetition.

The pilot study yielded a positive response from participants regarding the revisions made to the interview questions, as elaborated in greater detail in section 3.8. These modifications were informed by the emerging themes identified in the literature review. The participants suggested a slight focus shift towards the discounted cash flow (DCF) valuation process instead of other components. The researcher made some minor amendments to the interview questions based on the feedback and suggestions from the pilot participants. As a result, the questions were finalised with supervisors and deemed suitable for the study. The pilot study successfully provided valuable insights into the interview structure and question formulation, which helped the researcher refine the study design and prepare for the main data collection phase.

3.8 Pilot study outcomes

Prior to initiating data collection for the investigation in both Iran and Germany, the researcher conducted a pilot study involving two ICT valuation specialists in Germany. This preliminary study was instrumental in evaluating the relevance and efficiency of information gathering while identifying the most pertinent themes within the realm of ICT evaluation procedures. Given that the study conducted in Germany serves as a model, it was imperative to ensure that the interview questions were finalised and devoid of errors, as they would play a pivotal role in acquiring the most relevant data from Iranian specialists. This emphasis on precision and thoroughness was particularly important due to the primary focus of the study on Iran, given its status as an emerging economy.

The pilot study provided valuable insights into how the interviews should be conducted and offered suggestions for improving the interview questions to yield better results. In both the pilot and main investigations, the researcher rephrased questions and reminded participants of their freedom to terminate the interview if they were unresponsive. The researcher chose to continue the interviews in English, as the participants were bilingual. Therefore, the researcher initially performed the interviews in English and maintained this approach because that was how the pilot proceeded. Since the pilot informed the main study, the researcher aimed for accuracy in replicating the pilot procedures.

The contribution of the pilot study played a crucial role in testing the interview process and ensuring the research methodology's effectiveness. The study examined and analysed emerging themes, providing empirical findings from German perspectives to validate the research strategy. The outcome successfully met the first research objective, allowing the researcher to understand how the ICT valuation procedure worked in practice.

Feedback from the pilot study participants resulted in notable changes related to the ICT valuation process:

- Based on the insights from the pilot interviews, it was suggested to place greater emphasis on open-ended questions and follow-up inquiries, particularly in the context of a detailed analysis within the discounted cash flow method. This method was highlighted as the predominant valuation approach, and there was a need to investigate deeper into how risk considerations operate within the ICT domain.
- The pilot study also informed the need for modifications to the questions, including merging, eliminating, and introducing new sub-questions. These changes aimed to enhance the integration of reasoning into the development of discounted cash flow analysis. This involved identifying which components should receive greater attention and clarifying the reasons behind these choices.
- Furthermore, the pilot study emphasised the importance of gathering additional information about the specific variables that influence risk considerations within the realm of ICTs. It was crucial to explore how these variables could be effectively integrated and mitigated in the valuation process.
- Finally, the feedback underscored the significance of including questions that address the challenges inherent in evaluating ICTs, providing valuable insights into the complexities faced during the valuation process.

These revisions were guided by the valuable feedback obtained from the pilot study participants, ensuring a more robust and comprehensive approach to the research on ICT valuation.

3.9 The primary study profile

The primary data collection took place in different phases with German and Iranian practitioners. In the first phase, the study conducted interviews with ten senior-level German practitioners in the ICT valuation field to obtain rich data and understand the German ICT valuation profile. The sample size for qualitative research is reflected from (Mason, 2010; Hennink, & Kaiser, 2022). The lengths of the interviews were between thirty-eight minutes to one hour and five minutes. Furthermore, the interview duration was related to the underlying asking and answering questions in interviews (Loosveldt & Beullens, 2013). However, it was suggested to remain flexible, if possible, for both types of information, 'recording and notes' used in data collection (David & Sutton, 2004). The interview duration for this study varied because some practitioners were more communicative and willing to elaborate on the themes. The follow-up questions also led to a longer interview duration and opened more room for conversation on less relevant issues. In contrast, other participants were more to the point and responded directly to postured questions. As a result, the sample of responders consisted of highly qualified practising financial professionals in ICT valuation. German participants came from German-based local and multinational advisory businesses specialised in ICT company valuation. The interviews with German professionals were conducted in English. This decision was based on the fact that the pilot studies were conducted in English, and when the researcher asked participants for their preferences, they indicated that they were comfortable with English and had no communication issues.

Before beginning data collection during the interview phase, the researcher completed a few tasks. Initially, the researcher clarified the interview's objective through the distribution of an informational leaflet or GDPR statement (elaborated in section 8.3.1), which was send to the participants two weeks prior to the scheduled interview. Subsequently, the researcher confirmed that the session would be recorded and demonstrated the interview's format and projected duration. At the closing of the interview, the researcher requested permission to contact the participants if there was anything to add or clarify. After conducting interviews with German practitioners, the collected data was transcribed. Subsequently, the researcher

meticulously reviewed the transcripts and categorised the information using thematic analysis, identifying key themes in the process.

The second phase of interviews started where minor edits were made to the interview questions based on the Iranian valuation literature before they were circulated to a close Iranian circle network. Furthermore, the researcher applied ten semi-structured interviews with Iranian participants. The sample size was limited in Iran due to the very special topic of the study; however, it provided a rich view of Iran's ICTs valuation. The lengths of interviews were between forty minutes to one hour and eight minutes. Iranian participants were from local advisory valuations involved in several ICT firms' valuations. The interviews with Iranian specialists were conducted in Persian, and subsequently transcribed in the same language. The participants' names and personal information were removed due to ethical concerns and then translated data by hiring a highly trusted translation service in Iran. The original and translated data were then reviewed with an Iranian valuation professor to ensure the translation accurately conveyed the debate's content. Reviewing the data helped to avoid any errors in the interpretation of the collected data. The data were then analysed using the thematic method, and NVivo was utilised to code the themes.

The last phase of the research project entailed conducting follow-up interviews with three German specialists from initial phase and five new German participants. These interviews were conducted to gain further insights and to review the data collected in the earlier phases of the research. The specialists were asked to clarify more about the challenges of the valuation process and recheck the emerging themes and findings from the earlier phases of this study to ensure that the data was accurate and reliable.

The collected data from interviews with professionals helped the researchers to find answers to the research questions, which were focused on the effectiveness of various valuation methods for valuing ICTs in the Iranian context. The DCF and market valuation methods were among the most dominant methods in the study. The researcher aimed to better understand how these methods are used and perceived by professionals working in the field.

3.10 Sampling selection and access to the samples

The sampling methodology used in this study involves a combination of purposive and snowball sampling. Purposive sampling is a technique that involves selecting participants

based on a researcher's judgment and criteria, while snowball sampling involves asking participants to refer additional participants who meet the study's criteria (Bryman et al., 2019; Dudovskiy, 2018). The researcher began by purposively selecting key people who met the study's criteria and then asked them to refer additional participants using the snowball sampling technique. This process was repeated until data saturation occurred, meaning that the researcher had collected enough data about the ICT valuation methods to answer the research questions, and further data collection did not add any new information (Kvale & Brinkmann, 2009).

The use of purposive and snowball sampling has advantages and disadvantages. Purposive sampling allows the researcher to select participants who have the knowledge and experience relevant to the research questions. However, it may introduce bias into the sample if the researcher's judgment is influenced by their preconceptions or assumptions. Snowball sampling, on the other hand, allows the researcher to access hard-to-reach populations and can generate a diverse sample. However, it may also introduce bias if the initial participants refer others who share their views or characteristics (Krippendorff, 2018).

The researcher was aware of likely biases and took steps to minimise potential biases and used multiple sources of information to triangulate the data with academic literature. This approach helped improve the validity and reliability of the research findings as well (Adams et al., 2007; Blaikie, 2009).

Saturation and Scope of Research Questions

While this study suggests that data saturation was achieved in conducting the interviews, it is important to evaluate whether the limited number of interviews undertaken, adequately addressed the scope of the research questions. For the German sample, the initial phase of the study focused on understanding valuation processes in a developed economy like Germany. This phase began with two pilot interviews with German valuation practitioners, which helped refine the research approach and provided insights into valuation methodologies used. Following the pilot phase, 14 additional interviews were conducted with German practitioners. After 12 interviews had been conducted no new information relevant to the research questions was emerging and it appeared that data saturation had been reached. However, as a precaution, two additional interviews were conducted to confirm that saturation had been reached.

For the Iranian sample, the researcher applied the same criteria for selecting practitioners after a thorough review of Iranian valuation literature. Almost identical interview questions were used to ensure consistency across both contexts. In the second phase of data collection, ten interviews were conducted with Iranian practitioners. Data saturation occurred after eight interviews when the responses became repetitive, and no new knowledge was produced. Nevertheless, two additional interviews were conducted to ensure that saturation was fully met.

Although this study does not aim to be a comparative analysis due to significant contextual differences between the two nations, the phased approach ensured that the research questions were comprehensively addressed within each context. By achieving saturation in both the German and Iranian samples, the study confirms that the data collection process was thorough and sufficient to answer the research questions.

Depth and Quality of Data Collection

This study achieved data saturation with a relatively small sample size due to the in-depth nature of the interview questions. The interviews were sufficiently detailed to comprehensively address the research questions focused on specific ICT valuation practices. The emphasis on interview quality, including length and depth, ensured the collected data was robust and provided rich insights.

To select the relevant target participants, a set of criteria and a procedure were developed as described in Table 3-1. If the participant fit the requirements, they were added as a potential interviewee; if they did not, they were discarded.

Table 3-1. Participant's quality assessment criteria

Search	**Assessment criteria**
Geographical filtering of companies	- All the searched individuals and companies should be located in major cities Germany and in Iran - They must be in consulting and advisory companies dealing with valuation
Specialist filtering	- Experienced specialists that are involved in valuation process have been chosen. - The specialists should have experience in ICT valuations.
Contact filtering	- All the selected potential participants with some contact information filtered and have been contacted them through their profile contact information such as email, message (social media), and call. Moreover, if they did not reply after few times trying, then eliminated.
Voluntary filtering	- The specialists should be voluntary willing to do the interview.

This study's sampling method was a combination of purposive and snowball sampling. In purposive sampling, participants are selected based on explained criteria, whereas in snowball sampling, participants are selected through referrals from other specialists. The researcher used these methods to select participants from different sources, such as valuation clubs, events, social media networks, and colleagues, and then used referrals to select additional participants.

The list of potential participants was drafted through the following access points:

- Friends
- Previous and current colleagues
- Valuation specialists known through work
- Specialists known from different finance conferences and events
- And social networks (e.g., LinkedIn, Xing, Clubhouse and Indeed)

The researcher compiled a list of potential interviewees from personal contacts, attending finance conferences, and becoming premium members of various social media platforms. The researcher contacted these valuation specialists through emails, text messages, and phone calls to explain the research's aim and themes. Participants were initially contacted and asked about their willingness to participate and whether they could refer others. All of participants must meet the criteria. Some referrals were eliminated if they refused to be in the study. Two weeks before the interview, the questions, and an informational leaflet (GDPR statement) were provided to the participants who would be interviewed. A maximum of two interviews per day were scheduled to meet the interview's quality.

In this research study, getting in touch with unknown sources was important to avoid a conflict of interest. This made it challenging to find participants to investigate. Tables 3-2 and 3-3 show attempts to contact unsuccessful and successful sources through companies and social media.

Table 3-2. Contacted candidates with unsuccessful response

Target participants	**How selected: search option**	**Form of contact**	**Number of contacts**	**Outcome**
Advisors working in Multinational, Local big size, and Local mid and small size	- Website - LinkedIn - Indeed - Xing - Finance events - Clubhouse - Instagram & Facebook - Friends, colleagues	Email Call Message	- 1email + reminder after 2 weeks if no response. - Called minimum 4 times different days and times. - Sent message through (mobile, and social medias).	- Not response at all (no answer or reply) - Not related - Not in ICT valuation - Not interested - No capacity - Little experience - Indicated a tentative interest, scheduled a date and time, but subsequently cancelled; despite several follow-up attempts, no further responses were received.

Source: Author's illustration

Table 3-2 provides a clear and organised overview of the process of contacting candidates for interviews, including the methods of selection, forms of contact, and potential outcomes of the contact attempts.

For the purpose of collecting data for this study, Table 3-3 correspond with the target studies and candidates who successfully gave a response.

Table 3-3. Contacted candidates with successful response

Target participants	**How selected: search option**	**Form of contact**	**Number of contacts**	**Outcome**
Advisors working in Multinational, Local big size, and Local mid and small size	- Website - LinkedIn - Indeed - Xing - Finance events - Clubhouse - Instagram and Facebook - Friends, colleagues	Email Call Message	- 1email + reminder after 2 weeks if no response. - Called minimum 4 times different days and times. - Sent message through (mobile, and social medias).	- Answered and related then arranged the meeting - Answered not related but asked for suggesting related contact if they know any in ICT valuation - Interested but busy set date and time for eight six months later, could finally manage to do the interviews - Interviews started in June 2021 until Sep 2022, conducted in total 10 German, 10 Iranian and 8 follow up interviews.

Source: Author's illustration

Data for this research study was collected via online video communication tools in response to the challenges posed by the Covid-19 pandemic. The data collection phase extended over a period of 13 months, beginning in June 2021 and concluding in September 2022. All participants, from both Iran and Germany, were *external* financial professionals with specialists in valuation. In Iran, interviews were conducted with ten participants holding managerial positions advisors in valuation, each possessing between 8 to 25 years of valuation experience. In Germany, interviews were conducted with a total of sixteen participants, all of whom held management or senior positions at global and local advisory firms specialising in the evaluation of ICT companies, and German participants had between 8 to 24 years of valuation experience. Iranian counterparts had an average of fifteen years and seven months of experience, and the German participants had an average of fifteen years and three months of experience. It is important to note that both groups had prior experience in ICT project valuations.

Table 3-4 lists the profiles of the Iranian participants, including their positions and experience. The first part of each abbreviation represents the participant's name, and the second part represents the country (IR for Iran and DE for Deutschland or Germany).

Table 3-4. The Iranian participants' profiles and abbreviations

Iranian participants:			
Participants' abbreviations	**Position**	**Experience & Service to Clients**	**Citing the participant's quotation in the findings and results:**
MS-IR	M&A advisory specialist	24 years Buying & selling Iranian ICTs	(Participant-MS-IR, M&A advisory specialist, Buying and Selling).
HK-IR	Senior investment manager deals advisory valuation	17 years Buying & selling Iranian ICTs	(Participant-HK-IR, senior deal advisory valuation, buying and selling).
MM-IR	Senior manager portfolio management and valuation specialist	16 years Buying & selling Iranian ICTs	(Participant-MM-IR, senior valuation specialist, buying and selling).
MP-IR	Senior manager, deal advisory valuation	17 years Buying & selling Iranian ICTs	(Participant-MP-IR, senior deal advisory valuation, buying and selling).
MH-IR	Deal advisory valuation	11 years Buying & selling Iranian ICTs	(Participant-MH-IR, deal advisory valuation, buying and selling).
HS-IR	Brokerage, deal advisory valuation	20 years Buying & selling Iranian ICTs	(Participant-HS-IR, brokerage deal advisory valuation, buying and selling).
MHB-IR	Senior manager, deal advisory valuation	17 years Buying & selling Iranian ICTs	(Participant-MHB-IR, deal advisory valuation, buying and selling).
MB-IR	Senior asset management and deal advisory valuation	16 years Buying & selling Iranian ICTs	(Participant-MB-IR, deal advisory valuation, buying and selling).
HM-IR	Valuation specialist	10 years Buying & selling Iranian ICTs	(Participant-HM-IR, valuation specialist, buying and selling).
MA-IR	Deal advisory valuation specialist	11 years Buying & selling Iranian ICTs	(Participant-MA-IR, valuation specialist, buying and selling).

Table 3-5 provides the abbreviations of the German participants' profiles regarding their positions and experience:

Table 3-5. The German participants' profiles and abbreviations

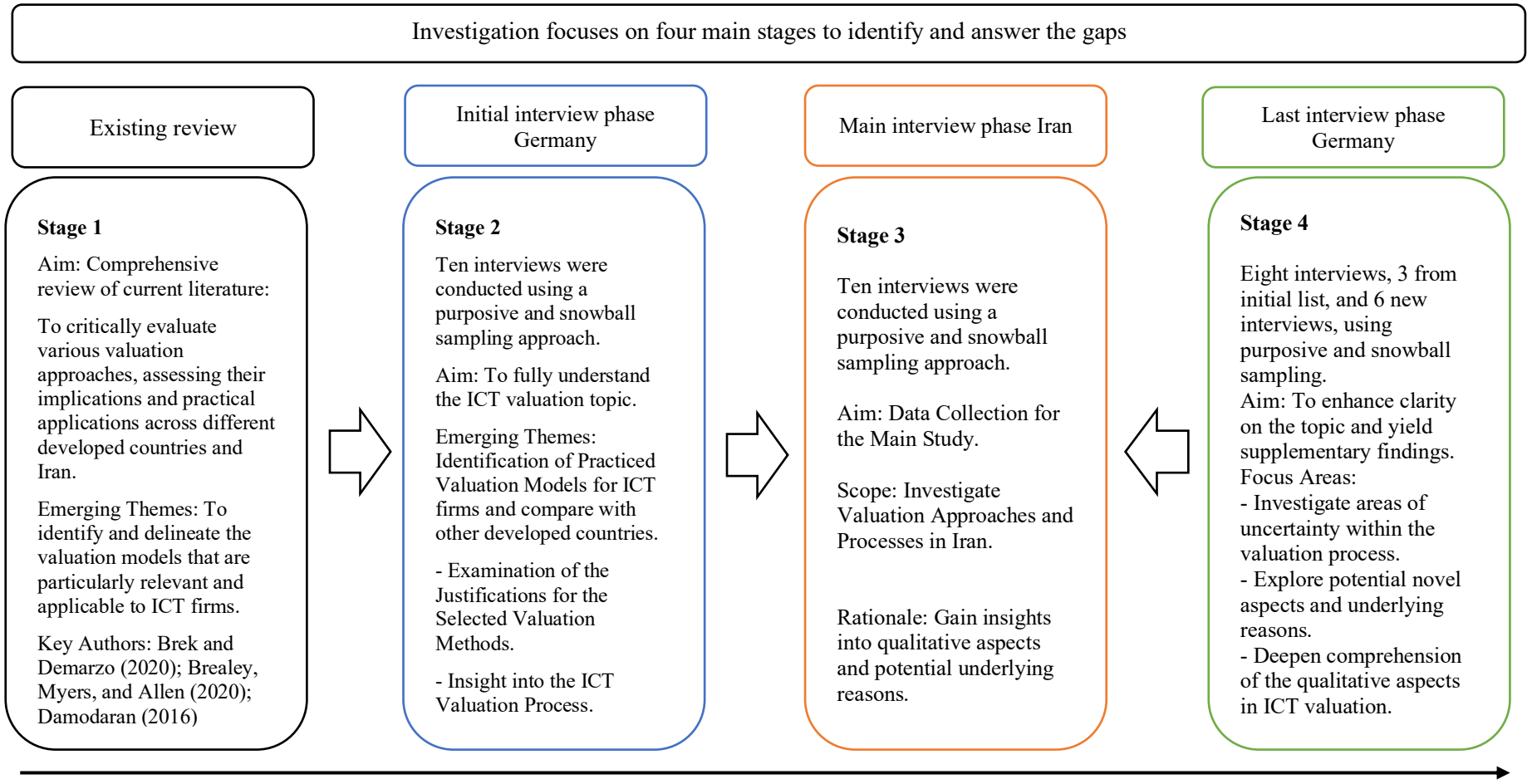
German participants:			
Participants' abbreviations	**Position**	**Experience & Service to Clients**	**Citing the participant's quotation in the findings and results:**
WL-DE	Director in the valuation associate team	17 years Buying & selling German-based ICTs	(Participant-WL-DE, senior associate valuation advisory, buying and selling).
RB-DE	Senior manager in the deal advisory valuation	20 years Buying German-based software	(Participant-RB-DE, deal advisory valuation, buying).
RH-DE	CEO and partner in an M&A brokerage	25 years Selling German-based tech & software	(Participant-RH-DE, M&A advisory, selling).
DJ-DE	Senior manager in the deal advisory valuation	16 years Buying & selling German-based ICTs	(Participant-DJ-DE, deal advisory valuation, buying and selling).
AE-DE	Senior manager in the deal advisory valuation	25 years Buying & selling German-based ICTs	(Participant-AE-DE, deal advisory valuation, buying and selling).
MH-DE	Partner in the deal advisory valuation	13 years Buying & selling German-based ICTs	(Participant-MH-DE, deal advisory valuation, buying and selling).
KB-DE	Managing director and M&A specialist	15 years Buying & selling German-based tech & software	(Participant-KB-DE, M&A specialist, buying and selling).
PK-DE	Director in the deal advisory valuation	14 years Buying & selling German-based tech & software	(Participant-PK-DE, deal advisory valuation, buying and selling).
GU-DE	Director in the deal advisory valuation	23 years Buying & selling German-based ICTs	(Participant-GU-DE, deal advisory valuation, buying and selling).
SE-DE	Managing director in the deal advisory valuation	22 years Buying & selling German-based ICTs	(Participant-SE-DE, deal advisory valuation, buying and selling).
MT-DE	CFO in the deal advisory valuation of software and tech start-ups	16 years Buying German-based tech start-ups & software	(Participant-MT-DE, deal advisory valuation, buying and selling).
NK-DE	Senior manager and valuation analyst	10 years Buying & selling German-based ICTs	(Participant-NK-DE, valuation analyst, buying and selling).
TM-DE	Managing director of investment and M&A advisory	13 years Buying & selling German-based ICTs	(Participant-TM-DE, M&A advisory, buying and selling).
LK-DE	Senior associate valuation advisory	15 years Buying German-based software	(Participant-LK-DE, senior associate valuation advisory, buying and selling).
CH-DE	Senior manager in deal advisory valuation	16 years Buying & selling German-based ICTs	(Participant-CH-DE, deal advisory valuation, buying and selling).
RF-DE	Senior associate valuation advisory	9 years Buying & selling German-based ICTs	(Participant-RF-DE, M&A associate, valuation, buying and selling).

3.11 The fieldwork

The investigation in this study covered a sequence of four distinct stages. It commenced with the systematic implementation of a data collection strategy, with each successive stage building upon the previous one. This approach helped in assuring the quality and reliability of the collected data and facilitated a thorough analysis of the ICT valuation process in Iran. The first stage was examining the ICT valuation process from different Western literature to map out the central themes from the literature review and create the conceptual framework. The other three stages of data collection were through interviews, which followed the same methodology but had different objectives.

The second stage involved pilot studies and interviews with German specialists to refine the interview protocol. This stage aimed to gain comprehensive insight and further explore emerging responses and themes in the ICT valuation process with German specialists. The third stage aimed to collect primary data and analyse the ICT valuation process with Iranian specialists. The final stage was the follow up interviews to clarify the examined topic and improve the study with additional data collected using the same methodology. The collected data were transcribed and analysed after each stage. The researcher created a diagram (Figure 3-1) to explain the sequence of data collection and the different stages of conducted interviews.

Figure 3-1. The sequence of the qualitative data collection design



Source: Author illustration

This study aims to contribute to the understanding of Iran's Information and Communications Technology (ICT) valuation process by examining the process from the perspectives of both current literature and German specialists. While the aim was not to compare the two countries, the inclusion of an advanced economy like Germany in the analysis provides a measure against which the ICT valuation process in Iran can be evaluated. This study aimed to address a substantial knowledge gap concerning the ICT valuation process in an emerging economy like Iran by initially identifying themes from a developed nation (Germany) as well as current literature and subsequently constructing a conceptual framework tailored to the Iranian context. Ultimately, the findings of this study may have implications for policymaking and investment decisions related to ICT in Iran.

3.11.1 Stage 1: the literature review of the study

The literature review helped identify the emerging themes and existing gap: the lack of research on the valuation of ICTs in Iran. It also directs to developing the research aim and objectives. Furthermore, to construct interview questions and build the core themes for the empirical phases. The following aspects have been investigated in the literature:

Identifying the theories of valuation and analysing the valuation procedure critically.

Reviewed the application of these valuation theories in other countries, including using possible reasons for certain approaches.

Reviewed the scholarly literature to illustrate the variety of potential theoretical methodologies for ICT risk assessment.

Review of Iran's economy and financial issues, ICT sector, and ICT evaluation approaches. In this review, the researcher explored into the key aspects of Iran's economy with a focus on its ICT sector. Firstly, explored the background information of the country, shedding light on its economic landscape and relevant contextual factors. Additionally, addressed the financial structures and issues that have influenced the development of ICT companies within Iran and their significance to the overall economy. Subsequently, shifted attention to the existing literature on ICT evaluation approaches in Iran. This section provided an overview of the various methods and models used to assess the ICTs within Iran. By exploring these evaluation approaches, the researcher aimed to gain valuable insights into the strengths and weaknesses of

current ICT strategies, and the potential for further understanding and developing the research objective questions to gather the primary data in main study interviews.

3.11.2 Stage 2: the first phase of interviews with German specialists

In the second stage of this research, a total of ten interviews were conducted with a select group of German specialists from major cities in Germany using a purposive and snowball sampling approach. This phase enabled the researcher to gain a comprehensive understanding of the intricate field of ICT valuation within the context of Germany. Through these interviews, the researcher examined deeper into the nuances of ICT valuation and uncovered the key factors that influence the valuation practices adopted by ICT firms in the German landscape.

During these interviews, several details regarding the emerging themes came to the forefront, shedding light on the details of ICT valuation in Germany. First and foremost, participants provided valuable insights into the identification of practiced valuation models that are particularly suitable for ICT firms operating in the country. Additionally, the interviews explored the justifications behind the selection of specific valuation methods by these firms, offering a glimpse into the rationale that guides their decision-making processes. Furthermore, the interviews provided a comprehensive view of the overall valuation process, unravelling the step-by-step procedures and considerations that are integral to valuing ICT assets in the German market. These emerging themes serve as critical building blocks in the researcher's quest to enhance the researcher’s understanding of ICT valuation practices in Germany before applying the main study in Iran.

3.11.3 Stage 3: the main study phase of interviews

It is important to note that interviews conducted in Iran were a relatively small sample due to the small pool of specialists on this topic. However, the finalised themes that emerged from the literature and pilot studies assisted in collecting rich data in Iran. The pilot interviews ensured which of the theoretical approaches is applicable in practice and confirmed the removal of the option method offered by some authors such as Herbst et al. (2006) and Penman (2016) in the literature review. Interviewees stressed the fundamentals of the ICT valuation process. Furthermore, the study generated detailed areas of risk assessment of such companies in

practice. These themes included different steps that need to be taken in the ICT valuation process, along with the factors that exert influence.

In the main stages of the study, participants with 8 to 25 years of valuation experience, including M&A Advisory Specialists, Senior Investment Managers in Deals Advisory Valuation, Portfolio Management and Valuation Specialists, Deal Advisory Valuation Specialists in Brokerage, and Senior Asset Managers in Deal Advisory Valuation, were engaged in comprehensive interviews. These interviews covered a spectrum of critical aspects related to ICT valuation. The questions posed included inquiries about participants' past involvement in ICT transactions, the methods employed for valuing ICT firms, techniques for estimating the cost of capital and discount rates, areas for improvement in valuation processes, modifications to models or techniques, considerations of systematic and unsystematic risks, determination of growth rates, assessment of different risk profiles and mitigations in ICT valuation, preparation of data and financial information for investment decisions, exploration of challenges faced in the valuation process and how they were addressed, the approaches for final valuation conclusion, suggestions for future valuation of ICTs, and other additional information. Gratitude was expressed, and participants were invited for further discussions if needed. Appendices 8.3 provide additional details on the information leaflet, interview guide, and the questions posed to participants. Furthermore, a sample of the initial contact process with interviewees is provided.

3.11.4 Stage 4: the last interview phase of the study

In this stage of the research, the goal was to validate emerging themes from the ICT valuation process and obtain specialist opinions, with a specific focus on the German context. The follow-up interviews were instrumental, not only in providing critical insights to further refine and clarify themes identified in earlier phases but also in ensuring the accuracy and completeness of the information gathered. Notably, this stage encompassed three participants from the initial phase in Germany, facilitating a continuity of insights from the preliminary interviews. Additionally, six new participants from Germany were included, offering fresh perspectives. The researcher specifically directed the discussions towards a more in-depth exploration of risk profile analysis, option-based pricing models and consideration of challenges in the valuation. This thoughtful emphasis aimed to elicit comprehensive insights into the details of ICT valuation in the German landscape. The study's results, synthesised from these diverse interviews, served to light disparities in the valuation of ICT between the two countries. This

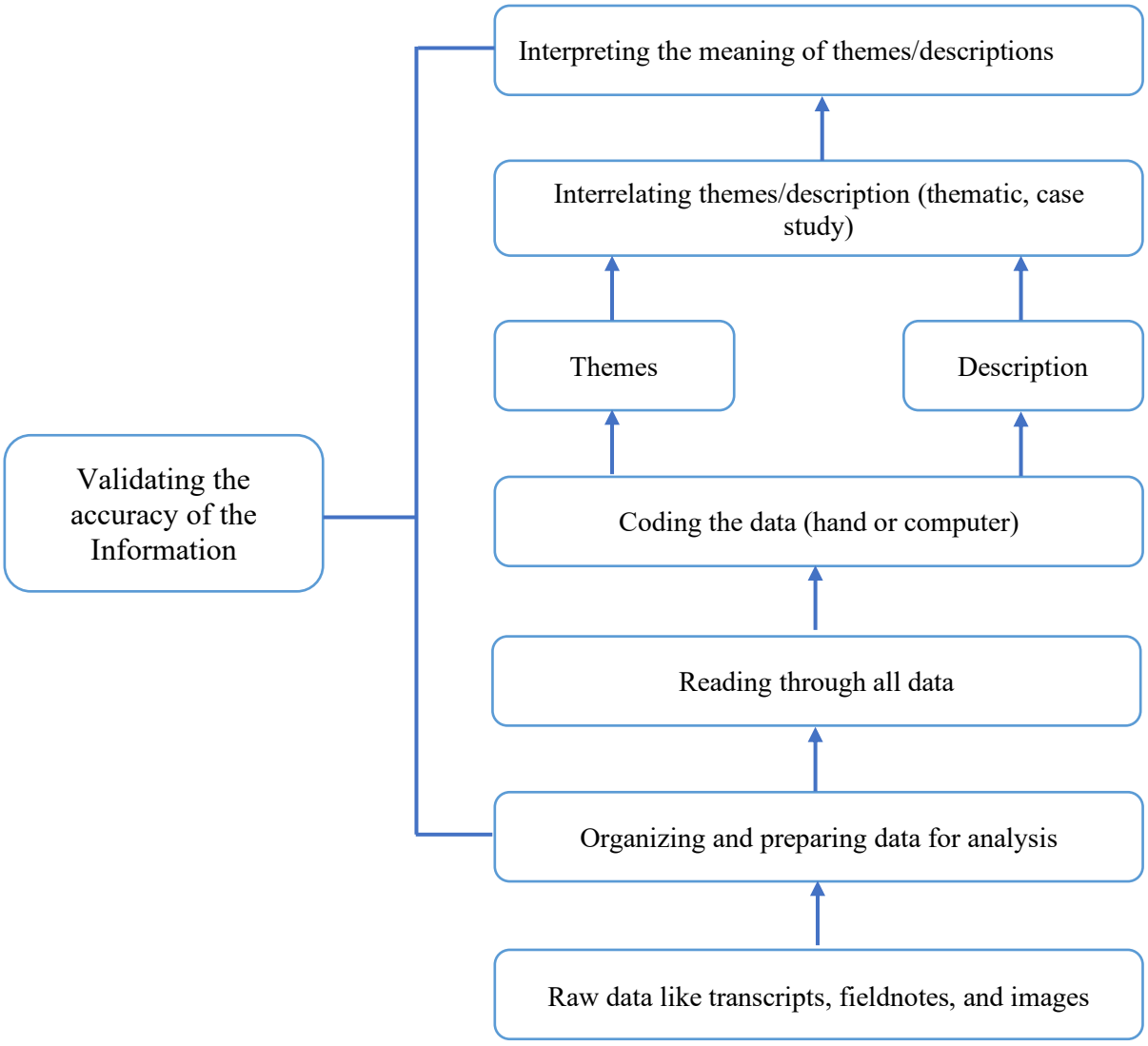
provided nuanced and valuable insights into the contextual factors influencing ICT valuation practices. Additionally, these findings played a crucial role in aiding the researcher in the triangulation analysis between Iranian practices, theoretical suggestions, and the German valuation context. This analysis aimed to discern how Iranian practices align or diverge in different parts of the valuation process.

3.12 Analysing and coding the interview data

This section outlined the data analysis method applied to the current topic. Data analysis in qualitative research, according to (Creswell & Poth, 2016), includes how findings were checked for the accuracy of the information. The researcher adopted the measures according to the Creswell model and the coding created in same structure for German and Iranian collected data. The recorded interviews were transcribed, analysed, and then coded manually and with computer software (NVivo 12). The interview findings were categorised based on the relevancy of the themes to the research. According to Braun and Clarke (2006), the thematic content analysis and coding technique are not tied to a particular methodology but give the researcher more freedom. Categorisation and coding enable the prioritisation of significant themes and facilitate the organisation of new concepts. Adopting the qualitative thematic analysis method allowed flexibility for the researcher in analysing the interview transcripts. This method provides insight into the study by analysing the content.

According to Creswell and Poth (2016), in thematic data analysis, the researcher should read the interviews multiple times to become familiar with the acquired data after the transcribed interviews. After the researcher is familiar with the data, coding can be completed by hand and computer software (NVivo 12). The researcher read over all the obtained data several times, then organised the data based on the themes into different codes and prepared it for analysis. Next was to identify the relevant topics and their relationships, through qualitative thematic analysis approach to link the themes to achieve the study objectives. Ultimately, the relevant details of each theme were given in the results chapter, and the researcher explained what each theme meant. The Creswell and Poth (2016) approach for analysing qualitative data is represented in Figure 3-2.

Figure 3-2. Data analysis in qualitative research



Source: Adopted from Creswell and Poth, (2016)

3.12.1 Coding the data

Coding is an important part of qualitative research and a vital component of content analysis, and it comes after data collection (Braun & Clarke, 2013; Clarke et al., 2015; David & Sutton, 2004). The researcher used coding to find similarities and differences between and within transcribed interviews. Since coding is a data reduction technique helped the researcher in this study to be more focused on relevant themes and take the attention away from the entire text to the parts of curiosity and applicability (David & Sutton, 2004; Robson & McCartan, 2016). To

avoid losing the original meaning, the researcher avoided isolating the coded parts from the context.

To be able to analyse the collected data from interviews, the researcher used the qualitative thematic analysis method to consider the coding process. Coding helped to categorising, analysing, and interpreting collected data to identify which valuation methods were applied by participants, explain how the process of valuation was, where the adjustment has been made, as well as how the participants mitigated the risk profile, and present the evaluation results (Castleberry & Nolen, 2018). Since this study adopted qualitative thematic analysis to analyse the interview transcripts, it helped to break down the data into smaller segments and categorise them based on emerging recurring themes (Nowell et al., 2017). As a process, Braun and Clarke (2006) offer guidelines for researchers to begin the research analysis thematically in different stages. For this reason, the researcher set out a series of steps accordingly, which began with the preparation process step of the collected data. In this step, the interviews were carefully transcribed, and the researcher read through them several times to be familiarised with the data. The researcher transcribed the participant interviews' recordings, entirely identical to the recordings. The data were transcribed in text format using f4x.audiotranskription software and by hand, since the gathered data were in audio format, then documented (Galletta, 2013; Kvale & Brinkmann, 2009).

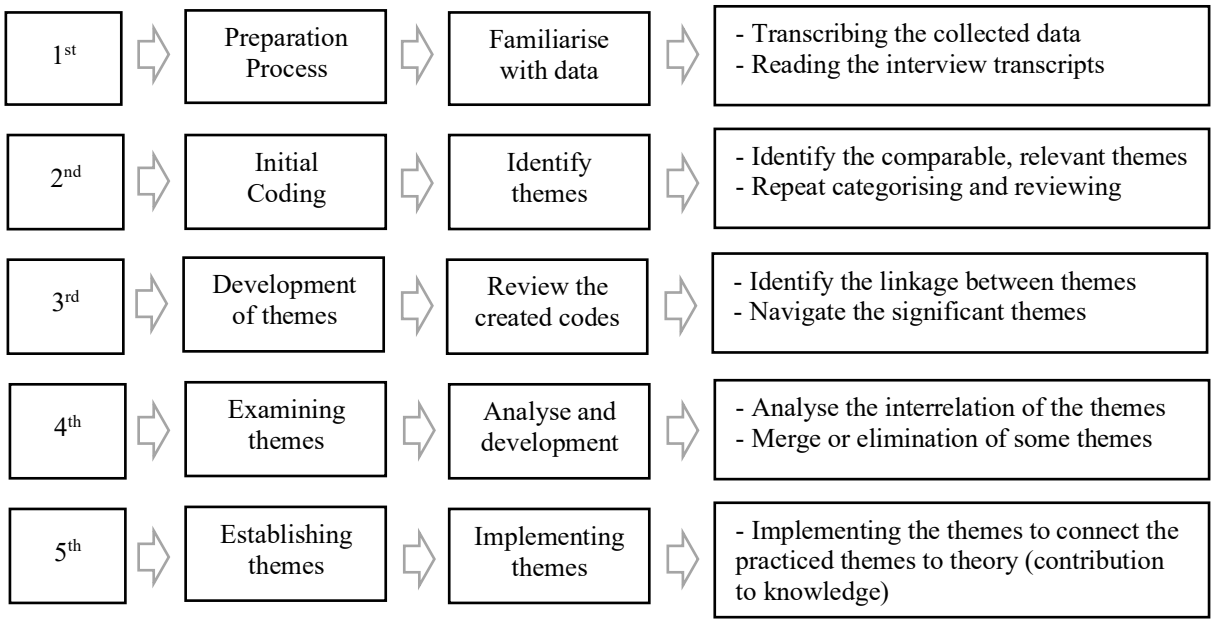
The researcher followed a rigorous process to analyse the interview transcripts. The first step of reviewing the text format word by word to ensure that the data is accurate and free from transcription errors. This attention to detail provided a deeper understanding of the participants' experiences and perspectives.

The second step was the initial coding process for the collected data; the researcher applied the categorising of the data and identifying themes. This process was time-consuming, but it allowed the researcher to identify patterns and themes within the data. The use of hand and computer software (NVivo12) for coding made this process more efficient and systematic. In this step of thematic analysis, it generated several different codes and sub-codes, which were then reviewed and categorised based on their relevance to the research objectives.

The third and fourth steps involved developing the main themes by linking the codes together and identifying the most significant themes. This process took a long time due to the richness of the data and the need to carefully eliminate and merge codes. However, the flexibility of the thematic analysis method allowed for new themes and categories to emerge as the analysis

continued. This approach helped the researcher gain a comprehensive understanding of the themes based on what emerged from the analysis, as well as other epistemological and ontological perspectives. Figure 3-3 present the applied steps of thematic analysis for this study.

Figure 3-3. Applied steps for thematic analysis procedure



Source: Author's illustration

In the analysis process, the framework method also assists in overcoming the most promising aspects of the collected data. The framework method was appropriate for the thematic analysis of interview transcripts. It assists in studying participants' perspectives on the analysis procedure and reviewing the interviewees' voices concerning pre-existing conceptions and theories about the issues being addressed by this study. To enable the findings' relevance and applicability, it was important to compare and contrast data by themes in the context of each perspective while maintaining the connection to theoretical aspects (Gale et al., 2013).

Although thematic analysis is commonly used in qualitative data analysis, researchers must carefully consider the theoretical framework and data coding procedure to ensure the validity and reliability of the findings. The main weakness of qualitative analysis is that it can easily miss important data representations (Creswell & Poth, 2016). This study covered this weakness by going back to the coding process several times until the most important themes and connections were addressed.

3.12.2 Manual and computer coding of the data

The researcher considered both manual and computer coding in this research. The researcher's decision to use both manual and computer software for analysing qualitative data had several benefits and limitations. Manual coding allowed the researcher to have a more hands-on and in-depth approach to organising and making sense of interview transcripts. By manually coding the data, the researcher had greater control over the analysis process and a better understanding of the collected data. Moreover, the manual coding process allowed the researcher to develop with more care and a detailed understanding of the data, enabling them to identify patterns, themes, and relationships that may not have been immediately apparent using computer software alone.

However, the use of manual coding also has some limitations, such as being time-consuming and prone to subjective interpretations. To address these limitations, the researcher combined manual coding with computer software (NVivo12), which offered several advantages. NVivo helped to manage and organise data, create themes based on theory and collected data, and code content for establishing the validity of results. Additionally, NVivo allowed the researcher to analyse large volumes of data more efficiently and to collaborate with other studies on the same project. However, the researcher also faced some challenges in using NVivo. Effectively using NVivo required a few months of focused practice and learning, which was difficult due to time limitations. Moreover, there was a learning curve associated with using NVivo, and it was not as intuitive as manual coding for the researcher. Despite these challenges, the combination of manual coding and NVivo software helped to enhance the overall analysis process by providing a more thorough and deeper understanding of the data.

3.12.3 Development of coding process from literature review to data collection and analysis

Throughout the research process, significant developments have occurred in the coding structure, evolving from the initial "Literature Review Version" to the "Final Version" tailored for the analysis of collected data in the context of ICT valuation approaches and methods. This evolution aimed to enhance clarity and incorporate new insights gleaned during the research journey.

Initial Coding from Literature Review: The initial coding structure derived from the "Literature Review" encompassed a total of six main codes and fifty-eight sub-codes, around different

valuation methods and their component calculations. This coding structure was initially organised under the overarching category of "Valuation Approach - Sub Method or Technique."

Refinement and Development: Over several months of rigorous data categorisation and analysis, numerous changes, merges, and adaptations were made. These adjustments were necessary to align the collected data with the predefined codes from the literature review, ensuring that the final version would be helpful to clarity and prepare for the subsequent analysis phase.

The coding format used in the transition from the pilot to the main studies incorporated six primary themes, surrounding a range of aspects related to Applied ICT valuation methods. These themes included assessments of method efficacy, justifications for method selection, examination of the Discounted Cash Flow (DCF) valuation process and associated adjustments, considerations regarding risk, exploration of alternative valuation methods, and the manner in which valuation results were presented. Additionally, two supplementary categories were included: "Suggested Methods for Future Use" and "Challenges to Consider."

Emphasis on DCF Valuation Method and Process: A primary focus was placed on the DCF valuation method and its associated processes. This emphasis was rooted in both the existing literature and empirical findings from Germany and Iran, where the DCF method was prominently applied. Specifically, the coding structure investigated into aspects such as forecasting, the determination of discount rates, and the consideration of growth rates. Furthermore, it addressed areas of data overlap, such as risk profile considerations, to ensure a comprehensive analysis. To improve the overall organisation and thematic categorisation, new headings were introduced. These headings aimed to provide a clearer understanding of the content and facilitate the grouping of themes.

Systematic Categorisation: To enhance clarity and organisation, the approaches, sub-methods, and techniques were systematically categorised. Each sub-method or technique was explicitly listed and categorised to foster a deeper understanding of the data. This process allowed for the removal of redundancies and the merging of related information.

Incorporation of New Sections and Codes: To better accommodate the collected data, new sections and codes were added. These additions included "Final Valuation Conclusion," "Suggested Valuation Methods for Future Use," and "Challenges to Consider in the Valuation Process." These enhancements were essential for addressing the research objectives systematically.

Comprehensive View: Throughout this development, the coding structure underwent substantial revisions, resulting in a more refined and improved framework. These changes provided additional insights and offered a more comprehensive view of the valuation approaches and methods under examination.

Alignment with Research Findings: The main goal of these changes was to ensure that the coding structure effectively presented the relevant information and aligned seamlessly with the research findings. This alignment was crucial for preparing the data for systematic analysis.

Visual Representation of Coding Development: To provide a visual representation of this coding evolution, Figure 3-4 within the research documentation illustrates how the researcher transformed interview transcripts into emerging themes. This process was meticulously executed in accordance with the research objectives, ensuring a robust and comprehensive analysis.

Figure 3-4. Visualisation of Coding Development

Coding after reviewing the Literature Review: "Literature Review Version"

Valuation Approach- Sub Method or Technique

1. Cost-Benefit Analysis:
    - 1.1. NPV, IRR and Flow to Equity Method
    - 1.2. Cost-Effectiveness Analysis (CEA)
    - 1.3. Incremental Cost benefit ratio
2. Income Approach:
    - 2.1. Discounted Cash Flow (DCF) Analysis
    - 2.1.1: Financial planning Development
        - Revenue estimation
        - Cost estimation
        - Depreciation and amortization
        - EBIT estimation
        - Tax estimation
        - Earnings estimation
        - Working capital analysis
        - Free cash flow estimation
    - 2.1.2: Discount rate (CoC)
        - WACC-CAPM
        - Modified CAPM
        - Multifactor models
        - Average historical return
        - Current market return adjusted for risk
        - Formal risk analysis
        - Hurdle rate
        - Earnings/price ratio
        - Fama-French Five-Factor
        - Peer group
    - 2.1.3: Beta Consideration
        - Peer group
        - Accounting beta
        - Building up method
        - Formal risk analysis
    - 2.1.4: Growth Rate Consideration
        - Revenue growth rates
        - FCF growth rate
        - Cash Return on Invested Capital
        - Earnings growth rate
        - User acquisition growth rates
        - Daily- Monthly active user
        - Market share growth rate
        - Peer group growth rate
        - Inflation and interest rate base
    - 2.2. Adjusted Present Value
    - 2.3. Dividend Discount Model (DDM)
    - 2.4. Capitalization of Earnings Method
    - 2.5. Economic Value Added (EVA)
    - 2.6. Relief from Royalty Method
    - 2.7. Direct assessment for future income
3. Market Approach:
    - 3.1. Comparable Company Analysis (CCA)
    - 3.2. Comparable Transaction Analysis (CTA)
4. Cost Approach:
    - 4.1. Replacement Cost Method
    - 4.2. Reproduction Cost Method
    - 4.3. Depreciated Cost Method
5. Option Pricing Models:
    - 5.1. Real Option Models
    - 5.2. Binomial Model
    - 5.3. Black and Scholes
6. Venture Capital Method

Coding Edited from Literature after Data Collection and Findings: "Final Version"

Valuation Approach- Sub Method or Technique

1. Applied Valuation Approaches
- 1.1. Discounted Cash Flow (DCF)
- 1.2. Dividend Discount Model (DDM)
- 1.3. Market Approach
    - 1.3.1. Comparable Company Analysis (CCA)
    - 1.3.2. Comparable Transaction Analysis (CTA)
- 1.4. Option Pricing Models (OPMs)
    - 1.4.1. Real Option Valuation
    - 1.4.2. Black and Scholes
- 1.4. Replacement Cost Method
- 1.5. Venture Capital Method

2. Methodology Efficacy

3. Rationales for Method Selection

3. Discounted Cash Flow (DCF) Analysis Process:
- 3.1. Financial Planning Development
    - Qualitative Detail Analysis
- 3.2. Discount Rate (CoC)
    - WACC-CAPM
    - Simulation-Based Method
- 3.3. Beta Consideration
    - Accounting beta
    - Peer group
    - Simulation-Based Method
- 3.4. Risk Profile Analysis
    - Scenario and Sensitivity Analysis
    - Qualitative Risk Analysis
- 3.5. Growth Rate in Cash Flow Projection
    - Historical Growth Rate
    - Industry - Peer Group Growth Rate
    - Judgmental Analysis
- 3.6. Terminal Value Growth Rate Consideration
    - Inflation and interest rate base
    - GDP growth

4. Final Valuation Conclusion

5. Suggested Valuation Methods for Future Use

6. Challenges to Consider in the valuation process

Thematic Analysis Facilitation: Once the thematic elements were finalised, they served as a valuable framework for systematically analysing qualitative data. This structure facilitated the organisation and interpretation of interview transcripts, aligning with the research objectives.

In conclusion, the transition from literature to the pilot and to the main studies brought about an enhanced coding format, designed to capture, and analyse qualitative data effectively. The coding structure was thoughtfully adapted to accommodate the emphasis on DCF valuation methods and processes, aligning with both existing literature and empirical findings. The inclusion of a "free code" category allowed for the incorporation of emergent data, ensuring the research remained dynamic and responsive to unexpected insights. This coding evolution has prepared the structure for the analytical phase of the research, transforming it from its initial state in the literature review into a more refined and insightful "Final Version." These changes were driven by the need for clarity, organisation, and alignment with the research objectives. As a result, the coding structure now stands equipped to address the research questions systematically and comprehensively, facilitating a more robust analysis.

3.13 Ethical consideration

This section discusses the ethical considerations that should be considered when conducting research with participants. It refers to the societal norms governing behaviour and distinguishing between acceptable and unacceptable conduct (David & Resnik, 2013). Ethical consideration is to ensure that the study adheres to the University of Gloucestershire guidelines and those of GDRP (UoG, 2020). Ethics is a branch of philosophy that deals with the conduct of people and guides the norms or standards of behaviour of people and their relationships with each other (David & Resnik, 2013). Ethical considerations are concerned with specifying the use of ethical and moral values while conducting the research study (Council, 2004; Mauthner et al., 2005). These include ensuring the physical, social, and psychological well-being of participants, obtaining informed consent, maintaining participant anonymity and confidentiality, and being aware of power relations between the researcher and participant during the interview process.

This study adhered to ethical principles and guidelines throughout the research process, which were upheld by obtaining informed consent from participants and prioritising their comfort during the interview process. Additionally, the researcher informed participants about the

importance of ethical considerations and followed applicable ethical guidance, demonstrating the researcher's commitment to protecting participants from harm and ensuring duty of care.

This study respected participants' autonomy and agency by volunteering participants, and they could withdraw at any time and request the deletion of their interviews. Changing participants' information in the transcribing process and securely storing collected data also demonstrates the commitment of the researcher to protecting participants' confidentiality and privacy. Participants reviewed the interview information leaflet and questions two weeks before conducting the interviews, and the collected data were kept with care in external hardware and stored securely for confidentiality. Finally, it explained to participants that the findings were used only for research purposes.

3.14 The study's reliability and authenticity

This study's reliability and authenticity were evaluated using Lincoln and Guba (1986) criteria, which include credibility, transferability, dependability, confirmability, and trustworthiness. These criteria helped ensure the quality and integrity of the study's findings by considering aspects such as this study's methods, participants, and potential sources of bias.

3.14.1 Credibility

Research needs credibility for its findings to be trustworthy and believable—a degree of assurance in the veracity of the research findings. Credibility determines if the research findings represent believable information derived from the participants' original data and are an accurate assessment of the participants' original perspectives. In this study, the chosen participants were all at senior and managerial levels with over seven years of experience in ICT valuation, which adds to the study's credibility. Choosing the participants carefully with defined criteria by purposeful and snowball sampling method as well as applying the pilot studies, helped to meet the credibility of the study. Overall, the motivation for the study was to provide an accurate representation of the current ICT valuation profile in Iran, which also adds to its credibility.

The potential criticism of a research study's methodology, in which predetermined criteria are used for selecting participants, may limit the variety of perspectives or experiences this study represents. However, the researcher needed to create criteria to enhance the richness of the

participants' narratives within a specific sector of valuation. To address concerns about the study's credibility, the researcher followed Lincoln and Guba (1986) strategy to label and produce specific themes throughout the study. This study used thematic analysis to code the data, ensuring that all relevant themes were covered in the interviews. Additionally, participants were provided with an information leaflet and interview questions, which helped validate the authenticity of their narratives. Eventually, while the use of predetermined criteria may be a potential criticism of the study, the researcher took steps such as triangulation method to mitigate this concern and ensure the credibility of their findings.

3.14.2 Transferability

Transferability refers to the degree to which the findings of a study can be transferred to other contexts or settings beyond the immediate research setting. This research facilitates transferability by providing a comprehensive description of the research context, methods, and findings. This description is detailed to enable potential research users to judge the degree to which the findings may be relevant to their own context or setting (Leung, 2015; Nowell et al., 2017). Purposive sampling of participants with characteristics or experiences relevant to the ICT valuation enhanced transferability in this research. By selecting participants representative of the research population, the researcher increased the likelihood that the findings would be relevant to other contexts or settings. Also, to improve transferability, a detailed description of the research objectives and process allows potential research users to understand the context in which the research was conducted and judge the degree to which the findings may be relevant to their own context (Cope, 1969).

3.14.3 Dependability

Dependability is a critical aspect of research quality, which refers to the consistency and stability of research findings over time and across different contexts. Dependability ensures that the findings of a study can be trusted and replicated (Leung, 2015). To ensure dependability, the researcher used reliable and valid dimensions in collecting and analysing data, used appropriate research methods, and documented the research methods and procedures thoroughly so that others could replicate the study (Nowell et al., 2017). Moreover, engaging with participants throughout the research process and seeking their feedback and input can enhance the

dependability of the study. Dependability ensures that the findings are accurate, relevant, and applicable to the research context (Uwe Flick et al., 2004).

3.14.4 Confirmability

Confirmability is one of the criteria for trustworthiness in qualitative research. It refers to the extent to which the research findings are consistent, reliable, and can be confirmed by other researchers. To ensure confirmability is met, the researcher triangulates the current literature from multiple sources and the empirical study conducted with German specialists as well as the empirical study with Iranian specialists plus a follow up interview to clarify the collected data; it also helped to minimise the bias in the participant's findings. The aim was to establish the credibility and trustworthiness of the research findings by providing evidence that the findings are derived from different sources and not the subjective interpretations of the researcher (Teacher, 2017).

3.15 Methodological limitations

The issue of reliability and authenticity is a major concern in qualitative research. Qualitative research often relies on subjective interpretations of data, making it difficult to ensure the reliability and validity of the findings (Middleton, 2020). One challenge involved ensuring the accurate representation of the studied community in the research. Consequently, the researcher implemented procedures to ensure the accuracy and consistency of the collected data. To overcome this, the researcher used multiple data sources and methods, such as reviewing the current literature, conducting three phases of interviews, and thematic analysis, to cross-check findings and ensure that they are consistent. Using established frameworks and theories guides the researcher in analysing and helps to ensure that the findings are relevant and meaningful. In addition, the researcher established trust and connection with research participants to ensure they felt comfortable and open when discussing their experiences. This helped ensure that the data collected was accurate and reflected their perspectives.

The lack of research about ICT valuation in emerging markets was a significant limitation, so the researcher could only assess how Western countries reviewed the ICT valuation before applying Iranians' view on this concept. The researcher interviewed German ICT valuation

specialists to overcome this issue. Even though the empirical research was conducted on German and Iranian specialists, it is notable that these two countries cannot be compared due to many setting differences. However, the perspectives of German specialists assist in understanding the ICT valuation setting in this study. Then, the main study of Iranian specialists was undertaken, followed by follow up interviews to clarify the acquired data and confirm the study's validity. The collected data were examined continuously to explain the significance of the participants' views.

Since the interpretative method was used in this study, it was necessary to address the issue of data reliability and authenticity. Also, to ensure the research's credibility and motivation, the study examined the literature, pursued alternative perspectives, and ensured that the study's methods, data, and backgrounds supported the research outlook. This study also addressed the difficulty of selecting the most relevant issues from the collected data. The researcher solves this by developing codes for significant categories and examining the emerging themes. Even though the interpretive method has its limits, this study demonstrates the triangulation of the literature with German and Iranian specialists to address the evaluation of the ICTs.

3.16 Chapter summary

This chapter explained how the researcher chose the proper philosophical position, research strategy, and methods for collecting data for this research. The author has stressed the importance of understanding each research philosophy's essential characteristics and features and how they impact the research design. The comparison of different paradigms provided a clear understanding of each method's advantages and disadvantages. The author also highlighted the importance of using previous knowledge to formulate data collection and sampling methods and incorporating practical applications of the theory into research. Employing the interpretivism position was the proper strategy to apply for this study and help the reader better understand the research and its findings on the current topic. The process to collect, analyse, and code the data was described, and it was explained how the collected data from the participants' interviews were analysed through thematic analysis. The author has also mentioned the importance of addressing validity, reliability, conformability, and flexibility issues, followed by ethical considerations during this study.

Chapter Four
Findings and results

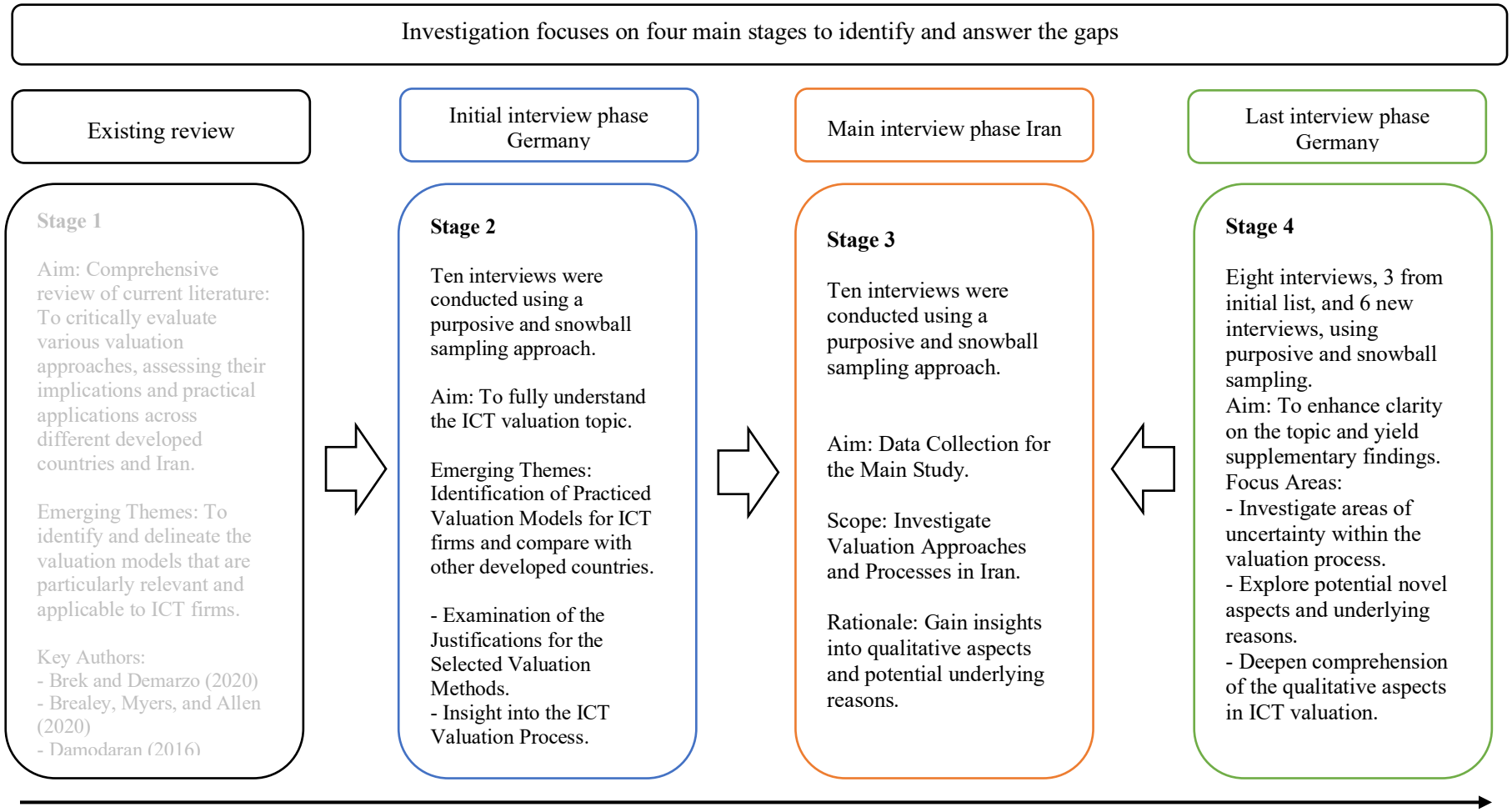
4.1 Introduction

In this chapter, the researcher aims to fulfil three designed research objectives (ROs), by presenting relevant research findings and results. Following a qualitative thematic analysis of these outcomes, significant themes or categories are reported, with direct quotes from participants to illustrate the findings. The study's findings are presented in a direct and declarative manner, with the researcher systematically explaining their significance and underlying meaning.

This chapter consists of several key themes and components. It begins with addressing the findings and results of the first research objective (RO), which involves a critical evaluation of the models, effectiveness, justifications, and valuation strategies used for ICT firms, assessing valuation practices in Germany compared to other developed countries as derived from the existing literature. This evaluation includes the findings on the applied valuation methods, their efficacy, and the rationale behind employing those approaches. It is followed by an analysis of the valuation methods used by Iranian advisors and the rationale behind their choices. Subsequently, the chapter examines into the second RO, involving a critical analysis of how these models have been used in the ICT valuation process in Iran, and contrasting the practices observed in Germany, especially given the differences between the two countries. The second RO section includes the detailed DCF valuation process, financial planning procedures, adjustments made, methods for computing the cost of capital and associated adjustments, techniques for calculating growth rates, and the various adjustments made throughout the valuation process. Finally, the chapter addresses the third RO, from the findings generated, provides new academic insight as to how Iranian ICT companies are evaluated, presents suggested methods for future valuations of ICTs, approaches to presenting par values, and addresses the challenges analysts should be mindful of throughout the valuation process. The chapter concludes with a summary of findings and insights gleaned from both Iranian and German specialists.

Figure 4-1 illustrates the progression from Stage 2 (initial interviews), Stage 3 (main study), and Stage 4 (the follow-up study) of findings that reviewed in this chapter.

Figure 4-1. Stages 2, 3 and 4 from the initial and main to the follow up study findings



Source: Author's illustration

This study has organised the findings and results by research objectives and the subcategory themes to aid readers' understanding of the claim, results, and relevance to the study's themes. The findings for current literature and both Germany and Iran are presented with each theme at a time, in second research objective the Iran findings being discussed first since it is the primary focus of the research. In some themes, the study highlights the contrasts between the approaches used in both countries. Additionally, for ethical reasons, the researcher has altered the names of the participants and has provided their abbreviation, position, and role to facilitate readers' comprehension. In this chapter, the researcher differentiated participants from different countries by employing the first two characters of each country's name when incorporating participants' quotations. Specifically, when describing a participant as IR, it indicates for Iranian advisors, and when referred to as DE, it signifies Germany (Deutschland).

4.2 Results for the first research objective

To critically evaluate the models, effectiveness, and justifications of valuation strategies used for ICT firms, assessing valuation practices in Germany compared to other developed countries as derived from the existing literature.

To fulfil the first research objective, the researcher queried the participants about the methods they used to value ICT companies, the models' effectiveness, and justifications for using these models. Section 4.2 consists of different segments. Initially, it unveils the discoveries pertaining to valuation techniques, shedding light on the diverse methodologies commonly employed by other developed countries according to current literature, practitioners from both Germany and Iran when assessing ICT companies. The researcher diligently examined and showcased the valuation approaches commonly discussed in the literature, such as option pricing models, which were not used by the participants of this study. This review included the perspectives of these practitioners, aiming to unveil the motivations driving their method selections and assess their efficacy. Subsequently, this section investigates into the underlying justifications behind the chosen approaches. Examining participants' explanations for ICT valuation methods helped to achieve the first objective of the study.

4.2.1 The summary of methods applied for valuing ICT companies from current literature

Commonly used valuation models from developed countries for intellectual and intangible assets, such as those in the ICT sector, include the Discounted Cash Flow (DCF) model. The DCF model estimates the value of an investment based on its expected future cash flows, discounted back to their present value (Karius, 2016; Sanchez-Segura & Ruiz-Robles, 2014; Tkachenko et al., 2018). This method provides a clear estimate of value based on projected cash flows. The advantages of using the DCF model include better projections of cash flows by taking into account the internal financial accounts of ICT companies, providing a reliable valuation, and aiding in comprehensive analysis by considering all aspects of future cash flows and the time value of money. However, the DCF model has its limitations, including assumption sensitivity, as it is highly sensitive to the accuracy of input assumptions such as discount rates and future cash flows. It also requires detailed financial projections, which can be complex to develop (Berk and DeMarzo, 2020; Berleay et al., 2020; Ryan, 2007).

The second method commonly used in the current literature is the market approach (multiples). This approach values a company based on the valuation multiples of comparable companies in the ICT industry. The rationale behind this model is that it is market-based, reflecting current market conditions and investor sentiment. The market approach helps in benchmarking the ICT company being valued against similar companies or previous transactions. Its advantages include simplicity, as it is quicker and easier to apply and understand compared to more complex models. Additionally, it uses real market data, making it relevant and current. However, the limitations include comparability issues, as finding truly comparable companies can be challenging (Analytics, 2021; Brushwood, 2015; Ong & Mohd-Rashid, 2021; Young & Zeng, 2015).

The third valuation method includes Option Pricing Models (OPMs), such as the Black-Scholes-Merton model, which value options and other financial derivatives based on factors like volatility, time to expiration, and the underlying asset's price. The rationale behind this model includes its flexibility, which can help value complex investments such as ICTs with intangible assets and embedded options, and assist in strategic decision-making for investors in uncertain situations. The advantages of OPMs are that they capture managerial flexibility and strategic options in investment decisions, providing a sophisticated analysis of financial derivatives and contingent assets. However, the limitations include the complexity of the

model, requiring a deep understanding of financial theory and advanced mathematical calculations, and reliance on assumptions like constant volatility, which may not hold true in real-life scenarios (Strickland, 2022; Ullrich, 2013; Damodaran, 2012; Ryan, 2007).

The replacement method was another valuation approach that suggested, which estimates the value of an ICT by determining the cost of replacing it with a similar new ICT. The rationale behind this method is that the value of an asset can be effectively gauged by understanding the current cost to replace it, reflecting the asset's utility and function. This method is particularly advantageous due to its straightforward nature, providing a clear and tangible basis for valuation. However, it has significant limitations, including difficulties in accurately estimating the replacement cost, especially for specialised or obsolete assets like ICTs. Additionally, it does not account for the asset's actual condition, potential depreciation, or the economic value added by the asset beyond its mere replacement cost (Kozyr, 2014).

Rationale behind using these models from current literature

DCF Model: Widely used because it provides a detailed and thorough valuation based on intrinsic value. Its reliance on future cash flows and discount rates makes it particularly suitable for stable, mature industries where projections are more reliable.

Market Approach: Preferred for its straightforward application and immediate reflection of market conditions. It is especially useful for quick valuations and comparisons in industries with abundant comparable data.

Option Pricing Models: Valued for their ability to incorporate flexibility and uncertainty, making them ideal for high-growth industries and investments with significant intangible assets and strategic options. However, the complexity and reliance on stable assumptions can limit their practicality in some contexts.

4.2.2 The methods applied for valuing ICT companies in Germany

Valuing companies in the information communication and technology (ICT) sector is challenging due to various factors such as rapid technological advancements, intangible assets, and high competition. The valuation process requires theoretical and practical knowledge to assess accurately. Factors such as a company's financial performance, market

conditions, and management practices must be considered. Regular revaluation of the ICT company's value is often necessary to ensure it remains competitive and attractive to investors.

To address the initial research objective, the researcher formulated the following sub-questions and posed them to the participants within this section of the interview. The intention was to ascertain the preliminary findings concerning suitable valuation methods for ICT companies and their underlying rationale in both Iran and Germany:

- What method(s) does your company (you) apply when valuing ICT companies,
- and how is the effectiveness of the method(s)?
- Why have you used/not used these methods?

This study applied interviews with German ICT valuation specialists, and the analysis of outcomes highlighted contrasting valuation methodologies employed by participants from Germany. Participant MK-DE highlighted that in Germany, they employ various valuation methods based on the specific context. Participant MK-DE mentioned using the DCF and multiple valuations, particularly sales and EBITDA. Money multiples based on captured information are also used in the valuations process. For early-stage companies, the participant MK-DE mentioned the use of the venture capital method, which suggests considering factors relevant to start-ups and emerging ICT businesses. These methods collectively form the range of valuation approaches. However, participant MK-DE stated that they do not use the APV (Adjusted Present Value) method or the real option method.

> "We are using methods like DCF calculation, and multiple valuations, especially sales and EBITDA, and we do also use money multiples based on captured information. And we use the venture capital method for early-stage companies, so these are the bucket of valuations. We do not do the APV method and these kinds of things. We also used the real option but only to determine the values for different share classes" (Participant-MK-DE, senior valuation specialist, buying and selling).

Participant GU-DE expressed that applied valuation methods primarily consist of DCF model and trading and transaction multiples. These methods are commonly used by Participant GU-DE valuation practice team. However, when discussing start-ups or ICT companies in a younger phase, participant GU-DE mentioned an alternative approach of venture capital method. This implies that participant GU-DE consider specific factors relevant to ICT start-

ups companies when determining the value. Participant GU-DE further emphasised that the choice between these methods depends on the circumstances surrounding the company and the specific context of the valuation.

> "Basically, we apply a discount cash flow model and, in addition to that, trading and transaction multiples. And when we talk about start-ups and situations where you have an ICT company in a younger phase, I would call that an alternative to applying the venture capital method. That depends, I think, on the circumstances" (Participant-GU-DE, senior valuation specialist, buying and selling).

The findings from the follow up interviews with German specialists in the third phase also agreed on the use of multiple methods to assess the value of ICT companies, such as the DCF method and market approaches. The participants NC-DE and RO-DE expressed a preference for a combination of methods, specifically DCF and multiples. The DCF valuation method, widely employed, enables the evaluation of a company's past performance and its potential for future growth. Multiples are used to compare ICT companies with relevant market peers and transactions. It was noted by RO-DE that trading and transaction multiples offer a previous traded of ICTs and gives valuation indication of market practiced.

> "We apply a discount cash flow model [...], and in addition to that, trading, and transaction multiples. I would not say that [multiples] as a preference. But we do both. […]. In our valuation models, in regard [to] income approach, we apply the free cash flow method. We consider the Sales, EBITDA, EBIT multiples, and operating cash flow multiples" (Participant-NC-DE, valuation advisory, selling).

Participant-NC-DE employed a mix of valuation methods, including the discount cash flow model and trading/transaction multiples. NC-DE do not have a particular preference for multiples but use them alongside other approaches. Within the DCF, specifically the free cash flow method, was used in their valuation models. For market approach German specialists considered multiples related to sales, EBITDA, EBIT, and operating cash flow to capture different aspects in their analysis.

> "In the valuation of ICTs, using multiples depending on what information is available, using sales, EBITDA, and P/E multiple to check if they [ICTs] have negative EBITDA or other multiples. We say the DCF model comes up with this value, and in

> the end, we should come up with something within the market practice" (Participant-RO-DE, valuation advisory, selling).

The participants in this study in Phase Three discussed different aspects of valuing ICT firms. There was an emphasise towards the importance of both quantitative and qualitative methods, including looking at multiples such as P/E, EBIT, EBITDA, revenue, free cash flow, debt, and average working capital, then as to analysing recurring revenue, customer lifetime value, and key performance indicators. For the German specialists, the participants also used sensitivity and scenario analysis. The findings shows that the focus was more on using DCF methods and checking plausibility with multiples, as well as considering trading and transaction multiples. Some of the participants in Phase Three highlight the need for experience and a holistic approach to valuing ICT firms.

> "In most circumstances, we would use multiple approaches for cases so we can do a plausibility check whether it's reasonable or not" (Participant-KB-DE, valuation advisory, selling).

The Participant KB-DE commented that, in most situations, these specialists, they employed multiple approaches when conducting their analysis. These specialists did perform a reasonability check, which helps to determine whether the results obtained from different methods align and are reasonable. By using multiple approaches, German specialists were able to cross-validate the findings to ensure the accuracy and reliability of the conclusions.

> "We typically use EBITDA and EBIT multipliers; we hardly use revenue multipliers because it has a large drawback of lacking comparability when that is by the profitability of your either comparable transactions or comparable companies" (Participant-PK-DE, valuation advisory, selling).

4.2.3 The methods applied for valuing ICT companies in Iran

The insights shared by Iranian participants include the following viewpoints. Participant-MS-IR, for instance, detailed their use of the Dividend Discount Model (DDM) and Discounted Cash Flow (DCF) methods in estimating the value of an ICT company. Furthermore, MS-IR employed multiples like EBITDA, EBIT, and Price-to-Earnings ratio to benchmark the

company's performance with other ICT industry peers. The convergence of these methodologies enabled MS-IR to derive an estimated value for the company.

> "We use the DDM model and DCF. These two methods are common methods we use. We also use multiples such as EBITDA, EBIT, and P/E. I used these models to estimate the company's value. If the clients are aware of these models, I will explain a little more to them and tell them we used this series of multiples" (Participant-MS-IR, M&A advisory specialist, buying and selling).

Participant-MM-IR expressed that for the valuation of ICT companies in Iran, typically rely on DCF and multiples such as P/E, P/S (Price-to-Sales ratio), EBIT, and EBITDA. MM-IR also consider the industry multiple average to benchmark the company's performance within the sector.

> "For valuation of ICT companies, the multiple like P/E, P/S, EBIT, and EBITDA multiples are usually used by us. We also take the industry multiple average. With the DCF and DDM model, we calculate the profit and dividend then discount the cash flows to the present. Well, the discount rate calculation is a different issue here. We don't use the option model, but I saw colleagues using occasionally venture capital. But I can say almost all the valuations here are on DCF, multiples, and sometimes replacement" (Participant-MM-IR, senior valuation specialist, buying and selling).

Participant MH-IR highlighted, that to value ICT companies, the DCF model and examining industry multiples exercised. In some cases, a replacement model may be used if the company is not profitable or has foreign currency costs. The replacement model should be based on the current exchange rate US dollars.

> "We use the DCF model, multiples, and check the multiples of the ICT industry. We do not use the venture capital and option models at all. But sometimes, use the replacement model if the company is not very profitable. Or, in some situations, if an ICT company has bought the technology in dollars. We calculate the replacement value in US dollars today, because if we want to buy this technology, we have to pay in dollars at the current rate" (Participant-MH-IR, deal advisory valuation, buying and selling).

The vast majority of Iranian participants has agreed the commonly used of two widely accepted DCF and multiples approaches for valuing ICT companies. Multiples are employed to facilitate peer comparisons, while DCF proves valuable for operational and profit assessments. Notably, several Iranian interviewees mentioned the continued use of the Dividend Discount Model (DDM) in ICT valuation, with replacement valuations being a less commonly adopted approach. In the context of replacement value, participant MS-IR also commented that "*We also examine the replacement value model, and we say that if this company wants to be established, this amount of dollars or euros needs to be invested, sometimes buyers ask us to do these calculations*". This observation was made by a few interviewees, who mentioned employing the replacement method on occasion, primarily to grasp the cost context of the ICT.

Analysing the findings revealed that almost all of the interviewees in Germany were primarily used a combination set of valuation methods, including DCF, company multiples, trading, and transaction multiples. In specific cases, especially for start-up ICTs, German specialists also employed the venture capital valuation method. In contrast, while both countries' specialists acknowledged the usefulness of DCF and multiples for evaluating ICTs, there is a stark contrast in the approaches. Many Iranian specialists still relied on the DDM for valuing ICTs, whereas their German counterparts disagreed with DDM application in the ICT sector.

4.2.4 Methods Commonly Used by Other Developed Countries but Not Adopted by Iranian and German Advisors

While the DCF model and market approach are often considered the most suitable models in literature and practice, recent literature also suggests that employing option pricing models (OPMs) for valuing ICT companies can be a valuable tool for assessing investment opportunities and making informed decisions. By incorporating this model, companies like Google and Microsoft (as mentioned in literature review chapter) have been able to strategically allocate resources, manage risk, and maximise returns on their ICT projects as well. As the ICT industry continues to evolve, the option pricing model valuation will likely play an increasingly important role in helping companies navigate complex decision-making processes and drive business success in a competitive market. The options pricing method

has been proposed in theory and current literature for the valuation of ICT enterprises and examined by different countries such as US, UK, and France. However, findings from Iran and Germany reveal a lack of option pricing models compared to other developed countries. Iranian advisors encountered difficulties in using and comprehending option pricing models for valuing ICTs in practice. Due to a lack of knowledge and opportunities for hands-on experience, they faced limitations in applying these models. Moreover, the absence of an option trading platform in the Tehran exchange market hindered their ability to learn and practice OPMs. Consequently, this contributed to the decision of Iranian advisors not to incorporate option pricing models into their valuation processes.

From the perspective of the participant-AE-DE in Germany, neither the option pricing approach nor the auction approach is currently employed for valuing these types of companies in Germany. The participant's statement suggests that alternative methods (DCF and market approach) are preferred or more practical in their context. The participant highlighted the decline in interest in certain approaches and the absence of their practical application in the valuation of specific company types like ICTs.

> "Regarding the option pricing approach, there was a high talk around 2000, 2001, but not now. There was also the auction approach that Prof. Schäfer published in German literature. But in practice, it disappeared, and from my point of view, it's not used for the valuation of these types of companies, so no we don't use this model here" (Participant-AE-DE, deal advisory valuation, buying and selling).

During the discussion on valuation models, the interviewer questioned why interviewee AE-DE did not use the option valuation model. This absence could be attributed to the limited practical application of option models in their experience and industry context. Interviewee AE-DE acknowledged awareness of the technique but noted its uncommon practice, stating, "*I'm personally aware of the technique, but it hasn't been commonly applied in practice here in Germany. Option Pricing Models may be applicable to early-stage and start-up companies with no historical record* ".

Another perspective on OPMs was provided by participant GU-DE, who agreed that option pricing models can be beneficial in ICT valuation, especially during their early stages. The rationale behind this lies in the uncertainty surrounding the future profitability of early-stage ICT companies and the unpredictable framework conditions that affect cash flow estimation.

Participant-GU-DE acknowledged that early-stage projects lack a well-defined valuation standard. Despite this, the participant's organisation did not currently use the option pricing approach for their valuations.

> "I believe that different methodologies like option pricing models occasionally can be used for ICT projects that are still in the early stages. Because it is unclear when the company will be lucrative and what framework circumstances will exist to estimate correct cash flows. There is, in my judgment, a less defined standard for early stages projects, so can apply the option models. However, we are not applying the option pricing approach in our valuation"(Participant-GU-DE, deal advisory valuation, buying and selling).

Regarding the preference for DCF and market approaches over OPMs, Participant RB-DE remarked on the disconnect between DCF, market approaches, and OPMs.

> "There is a crucial difference and a disconnection between DCF valuation, market approach and the real option method. We rarely use the option method, but we would do so just to analyse specific financial instruments. My impression is that there is a theoretical mismatch or disconnection between the valuation of a complete company, accounting, and legal types of transactions, and the valuation performed to determine the value of shares, options, or other instruments. So, my impression is that these are two separate valuation worlds that don't communicate with each other. They are clearly separate entities" Participant-RB-DE, deal advisory valuation, buying).

Participant LK-DE mentioned a preference for the detailed Monte Carlo model over the option pricing model. They believe that this approach can lead to more robust results in the DCF and various aspects of the valuation process. By conducting several thousand iterations, Monte Carlo method can yield more logical outcomes, enhancing the overall analysis.

> "We use the Monte Carlo model to simulate various layers of valuation, because of its flexibility over option pricing models. This approach allows for the simulation of complex payoff structures. Monte Carlo simulation is used in companies with complex market conditions, such as those in the ICT sector where share-based payments rely on future rankings within peer groups. It's crucial to emphasise that stable simulation results need running enough simulations, typically more than 20,000 iterations" (Participant-LK-DE, senior associate valuation advisory, buying and selling).

Participant MH-DE also did not widely use the option valuation model, but in some cases, he mentioned "*Yes, we use OPMs but only to determine the values for different share*". However, the option pricing valuation model was not preferred due to its limited applicability and their organisational policy. The interviewee MH-DE emphasised the use of DCF method that are widely recognised and accepted in Germany.

> "The cost approach and real option are not applied very much here. So, our organisation preferred to use income approach and market approach. I believe that the key difference between the real option and DCF-based models lies in their communication with clients and the meaningful output they provide. These models are generally well-received by clients. At our company, we primarily use the Discounted Cash Flow model. It allows us to assess the value of various alternatives more comprehensively, especially when considering income approaches" (Participant-MH-DE, deal advisory valuation, buying and selling).

He also mentioned that while DCF-based models work well as alternatives, OPMs have fundamentally different principles.

> "The DCF method, along with the dividend discount model, can serve as alternatives for valuation. However, choosing the real option method over the income approach isn't a straightforward valuation decision. Despite this, discount-based models yield similar outcomes. Therefore, our fundamental approach involves applying the DCF model to ICT companies as a whole, and we also use it for equity valuation" (Participant-MH-DE, deal advisory valuation, buying and selling).

Participant SE-DE primarily relies on the DCF model for valuation purposes and employs the market approach for validation. However, the option pricing valuation model is not used. This decision may stem from the perceived complexity and uncertainty associated with integrating option pricing models into the valuation process. Additionally, the participant emphasised the focus on cash flow projections and risk assessment provided by the DCF model, which they find more applicable for their valuation needs. In their own words,

> "We do not use the option pricing valuation model. This decision has to do with the complicated nature of using option pricing models, such as managerial flexibility and strategic decision-making, into the valuation process. Given the focus on traditional

> financial metrics and cash flow projections, I see the OPMs model as less applicable or practical for our valuation purposes" (Participant-SE-DE, deal advisory valuation, buying and selling).

Participant CH-DE expressed awareness of the real option technique but noted its limited adoption in practice, particularly in Germany.

> "I think PwC was one of the companies that attempted it in the early 2000s but it is uncommon in German business practices. I think the complexity of the underlying theory, that only a few upper management individuals understand option theory make it less use in our valuation practice. It is also totally different approach and outcomes from other methods like DCF and market approach. In our twenty years of experience, we haven't encountered any requests from companies in Germany for the option models valuation" (Participant-CH-DE, deal advisory valuation, buying and selling).

After discussing the absence of Option Pricing Models (OPMs) in Germany, the researcher followed up with Participant GU-DE to inquire about why German specialists do not commonly use OPMs, unlike their counterparts in the US, UK, and France. The focus was his perspective on this matter and the reasons behind the limited use of OPMs in Germany. Additionally, the researcher mentioned that it was suggested that firms such as PwC, KPMG, Deloitte, and Ernst and Young, which operate across the EU, might have valuation policies that go beyond national boundaries and could potentially use OPMs. Participant GU-DE's response was as follows:

> "There is no artificially favoured methodology as it is driven by the scope of the respective engagement. There are plenty of ICT projects in Germany, where “classical” DCF is more appropriate. For the projects, where other models are more appropriate, KPMG Germany applies them, like Monte-Carlo Simulation, OPM, PWERM [Probability Weighted Expected Return Method] etc. This might be relevant for the projects like equity share class valuation, earn-out, carry, management incentive program valuations etc. To consider differences between geographies the differences between standard scope to be considered as well, which may vary dramatically between the mentioned countries [US, UK, and France]" (Participant-GU-DE, deal advisory valuation, buying and selling).

Participant GU-DE mentioned before that they used advanced Monte Carlo Simulation methods at various stages of the valuation process, particularly in conjunction with the DCF model. This approach helped estimate volatility for different inputs and predict future beta calculations.

In regard to the absence of Option Pricing Models (OPMs) in Germany, the researcher further engaged with participant AE-DE to understand why German specialists typically did not use OPMs, in contrast to their counterparts in the US, UK, and France. Participant AE-DE provided the following insight:

> "We can certainly have several follow up more detail discussion, but I'll probably have nothing new to add. Primary valuation approaches in Germany are based on DCF and cross-checked using market data and we are using them. OPM would be applicable in specific cases, such as early stage and start-up company phases, where classical DCF won't work properly" (Participant-AE-DE, deal advisory valuation, buying and selling).

When asked participant RF-DE about the reasons for not using Option Pricing Models (OPMs) and uncertainty surrounding why OPMs are less commonly used in Germany compared to the US, UK, and some other countries.

> "As I mentioned we are using DCF and market data because these are standard in Germany. I have tried to ask various colleagues/friends who are very experienced in ICT valuation to give you a more satisfactory answer, but I haven't really gotten a satisfactory answer why we are not using OPMs. We all agree it's far too complicated to use OPMs in practice and most clients wouldn't understand it. That's why OPMs are not commonly used in Germany. At this point in time, I can't give a better answer. I am sorry" (Participant-RF-DE, M&A associate, valuation, buying and selling).

4.2.5 Summary of justifications why German participants didn't used Option Pricing Models (OPMs)

After reviewing the collected data and conducting follow-up interviews with all the German participants to understand why Option Pricing Models (OPMs) are not commonly used in

Germany compared to other countries, unfortunately, none of the participants were able to provide a fully satisfactory answer. They mentioned several reasons:

- Following German standard guidelines, which emphasise the use of Discounted Cash Flow (DCF) and market data.
- Complexity of implementing OPMs in practice, with concerns about robustness compared to DCF.
- Clients find OPMs too complex to understand and effectively present.
- OPM methodology is perceived as not aligning well with DCF and market approaches, which are seen as complementary and robust methods.
- Monte Carlo simulation is a common practice in Germany for valuing ICTs and is considered effective for this purpose.
- The OPM methodology would be applicable in specific cases, such as during early-stage and start-up company phases, where traditional DCF methods may not work effectively.

These reasons collectively contribute to the limited adoption of OPMs in Germany for valuation purposes.

In conclusion, critics highlighting the neglect of option pricing models by German valuation advisors present a compelling argument for the importance of considering flexibility and strategic options in ICT investment decisions. By integrating option pricing model valuations into their analyses, advisors could enhance their ability to assess the value of investments involving uncertainty and strategic decision-making, particularly for firms like ICTs, where intangible assets represent a significant portion of their portfolio. Looking ahead, it is imperative for specialists to expand their toolkit and integrate option-based valuation models into their assessments to achieve a more comprehensive and accurate understanding of ICT investment opportunities.

4.2.6 Summary of justifications why Iranian participants didn't used Option Pricing Models (OPMs)

Iranian advisors face significant challenges in using and comprehending option pricing models (OPMs) for valuing ICTs. These difficulties stem from several factors:

Lack of Knowledge and Training: There is a notable deficiency in specialized education and training on option pricing models within Iranian financial institutions. This gap in knowledge impedes advisors' ability to understand and effectively implement these models in their valuation practices.

> "We do not use option pricing models because there are no institutions available to provide theoretical and practical experience in applying these models to our valuation processes" (Participant-HS-IR, brokerage deal advisory valuation, buying and selling).

Limited Practical Experience: Opportunities for hands-on experience with OPMs are scarce. Theoretical knowledge alone is insufficient; practical application is crucial for mastering these models. The limited exposure to real-world scenarios where OPMs could be utilized further restricts their effective use.

> "Even though we learn the theoretical aspects of option-based models, without a practical platform to apply them, it's challenging to advance our valuation processes using these models. Without real-world application, we cannot fully understand how different scenarios in option pricing models work and how they might impact our valuations" (Participant-MS-IR, M&A advisory specialist, buying and selling).

Absence of an Option Trading Platform: The Tehran Stock Exchange lacks a dedicated platform for trading options. Without such a platform, advisors are unable to engage with and apply option pricing models in a practical setting. The absence of option trading infrastructure inhibits their ability to learn, practice, and validate these models.

> "We currently lack option pricing models in our stock market. However, if option trading platforms were introduced, it could significantly accelerate the development of knowledge and provide a practical venue for applying these models" (Participant-HM-IR, valuation specialist, buying and selling).

Regulatory and Market Constraints: The regulatory environment and market practices in Iran may not support the integration of option pricing models into standard valuation procedures.

This regulatory gap, combined with the lack of market mechanisms to facilitate the use of these models, contributes to their limited adoption.

> "We live in a world governed by Islamic finance principles, which must adhere to specific rules and regulations. One challenge is the prohibition of usury (riba) in Islamic finance. It is crucial to demonstrate that certain financial instruments do not contravene these principles and that their use is consistent with Islamic finance regulations" (Participant-MS-IR, M&A advisory specialist, buying and selling).

In summary, these factors collectively contribute to Iranian advisors' reluctance to incorporate option pricing models into their valuation processes for ICTs. Addressing these challenges would require enhancing education and training, developing market infrastructure, and possibly revising regulatory frameworks to support the use of advanced valuation techniques.

4.2.7 Assessing ICT valuation effectiveness through various analyses

Scenario and sensitivity analyses are widely used techniques in financial modelling to evaluate the impact of market conditions or variable changes on ICT businesses. Scenario and sensitivity analysis involves creating different scenarios with varying assumptions and calculating relevant metrics to identify potential risks and opportunities for effectiveness of decision-making (Aswath Damodaran, 2016; Kossecki et al., 2017; Pareek, 2012). Some Iranian specialists employed scenario and sensitivity analysis within the valuation process or at the request. Participant MM-IR mentioned that they use different scenarios and conduct analysis of sensitive elements. This approach allows them to gain an understanding of the potential outcomes in various situations, both at the macro and micro level, and how these circumstances might impact the value of the ICT company being evaluated. By considering different scenarios and analysing key factors, participant MM-IR aim to assess the potential risks and opportunities associated with the company's valuation.

> "We use different scenarios and the analysis of the sensitive elements in order to understand what will happen in different situations at the macro and micro level and how it will affect the value of the ICT company" (Participant-MM-IR, senior valuation specialist, buying and selling)

Participant MS-IR mentioned that on the buyer side involved the use of scenario and sensitivity analysis. By examining the existing scenarios and sensitivities of various elements within the companies being evaluated. Scenario and sensitivity analysis are conducted when the buyer requests a more detailed assessment considering different scenarios and sensitive factors. Participant MS-IR further highlighted that typically adopt three perspectives: optimistic, realistic, and pessimistic views. This suggests considering a range of potential outcomes and assess the company's value under different assumptions. However, participant MS-IR expressed that not employ Monte Carlo simulations in the valuation process. Monte Carlo simulations are a statistical technique used to model uncertainties and generate possible outcomes.

> "We use scenario analysis and sensitivity for the buyer side mostly. We examine the existing scenarios and sensitivities of the companies' elements. We do these analyses if the buyer wants to be detailed in different scenarios and with sensitive items. We usually adopt optimistic, realistic, and pessimistic views. We don't use Monte Carlo simulations" (Participant-MS-IR, M&A advisory specialist, buying and selling).

Participant HK-IR mentioned, due to the higher-risk setting in current situation in Iran, only realistic and pessimistic scenarios are considered, and judgments are based on the pessimistic scenarios.

> "We apply sensitivity and scenario analysis and use optimistic, realistic, and pessimistic scenarios. But with current economic situation, we put aside the optimism. The focus is only on realistic and pessimistic scenarios, and the decision is based on the pessimistic scenario. We don't use Monte Carlo simulations either" (Participant-HK-IR, senior deal advisory valuation, buying and selling).

In the context of scenario and sensitivity analysis, only one Iranian interviewee delved deeper into this aspect and provided a description. Participant MH-IR is the only Iranian specialists that goes into further detail in the scenario and sensitivity analysis and consider the variables, such as interest rates, macro-risk, inflation, the foreign currency exchange rate, etc., are assigned probabilities of occurrence. These assumptions of scenarios applied to future

projections, discount rate calculations, and other DCF components, as well as the company's multiples to review the efficacy.

> "We even create different scenarios considering the various possibilities. Due to the uncertainty of the macro situation. We focus a lot on scenario and sensitivity analysis, as valuations depend on many variables. In the scenario analysis, I give the weight probability of occurrence to key factors" (Participant-MH-IR, valuation specialist, buying and selling).

In contrast, the overwhelming majority of German specialists employed comprehensive scenario and sensitivity analyses to ensure the effectiveness of their valuation methods. Additionally, most German specialists used Monte Carlo simulations throughout the valuation process to estimate outcomes. Participant AE-DE also recognised the importance of accounting for unforeseeable elements when valuing an ICT firm, and many German specialists suggested that using Monte Carlo simulations with considering thousands of potential scenarios could enhance the efficacy of the results. By doing so, German specialists could provide to clients with a solid justification for interpreting the valuation results and factors.

> "Through certain drivers' simulations analysis via Monte Carlo software, [which] needs to be gone through ten thousand probabilities related to some specific technological. We will not focus on one or two parameters or scenarios. Let's say five thousand or ten thousand scenarios and run simulations to get a better understanding of the risk involved in the cash flows" (Participant-AE-DE, deal advisory valuation, buying and selling).

Participant MAR-DE mentioned that the valuation methodology involves conducting several analyses, including the creation of numerous scenarios. Participant MAR-DE acknowledged that there are many unpredictable factors that can impact the valuation process. However, participant MAR-DE emphasised the importance of finding rational explanations and ways to justify the estimated revenue and other aspects of the valuation. Providing a clear and coherent explanation for these elements is considered a crucial part of the valuation approach.

> "We do several analyses, for example, making hundreds or thousands of scenarios, so there are many things which are unpredictable. You need to find ways to the rational

> explanation and the way to explain the revenue side and other things you estimate, and I think this is the important part" (Participant-MAR-DE, deal advisory valuation, buying)

Participant DJ-DE also used various analyses and simulations to comprehend the volatility of the business that being valued in relation to its specific peer companies.

> "So, if we have DCF of ICT companies, they are highly related to some specific technology drivers. We will not try to focus on one or two parameters. We will try to do a Monte Carlo simulation of different outcomes. So, we would not try to do one, two, ten, or twenty scenarios, rather let's say five thousand or ten thousand scenarios and simulations with Monte Carlo, just to see how sensitive the value of the company is to the specific assumptions. […]. We try the business plan derivers in Monte Carlo simulation, to see how the volatility of our business plan is compared to the historical relativity of specific peer companies that are already established companies" (Participant-DJ-DE, deal advisory valuation, buying and selling).

Several German interviewees acknowledged the challenges associated with valuing ICT firms. The complexities and criticisms surrounding the valuation of ICT companies include issues such as employing DCF and multiple valuation methods in cases of negative earnings. Research has explored the valuation of US tech IPO firms with negative earnings spanning from 1994 to 2013, illuminating the inherent difficulties in accurately assessing ICT's worth. However, in long run, the valuations tend to converge towards peer levels, but IPOs with negative income are more vulnerable to uncertainty (Zörgiebel, 2016). Negative earnings can happen when a company reinvests cash flows or has high operating expenses. Using peer multiples may not work if the peers also have negative earnings. Participant WIL-DE also highlighted the challenges related to valuing tech companies, particularly the lack of profitability even after several years. This poses difficulties in applying negative EBITDA and other multiples for valuation purposes. In response to this challenge, participant WIL-DE emphasised the significance of considering the expected future cash flows of the business and its internal elements. To tackle this issue, simulations and various analyses were employed by participant WIL-DE to assess the potential future performance of the company. Revenue multiples can be used, but these multiples may not be sufficient for an ICT business that has been making losses for a long time. The DCF model requires a positive operational earnings record to forecast future cash flow correctly.

> "One of the main challenges is that some tech companies are not profitable even after several years, making it difficult to apply a negative EBITDA multiple. In this case, it is important to consider the expected future cash flows of the business and its internal pecking order which we are doing that with simulations and different analyses. The revenue multiples can be useful but can be tedious due to the lack of profitability and high costs associated with tech companies" (Participant-WIL-DE, valuation associate, buying and selling).

To obtain a comprehensive understanding of the fundamental aspects of an ICT business, participant GU-DE suggested utilising simulation-based analysis, particularly Monte Carlo. Participant GU-DE argued that formulating only three simple potential scenarios for complex business plans like ICTs may not provide adequate indication.

> "Also, the simulation-based approach that we do, which is based on Monte Carlo simulation, covers all the aspects because the determination of the cash flow and cost of capital is part of that simulation, and as a core element of that simulation, the determined expected value of the cash flows going forward. This means the output is not a simple best-case, worst-case, or middle-case scenario. You can derive the specific performance and risk profile of the underlying business case from a holistic point of view. So that is why we apply the Monte Carlo simulation to see the probability of thousands of effects and not a simple scenario-based approach" (Participant-GU-DE, deal advisory valuation director, buying and selling, DE).

The vast majority of interviewed German specialists recognised the significance of conducting detailed component analysis through the application of scenario and sensitivity analysis, as well as simulation practices. These methodologies are employed to effectively address uncertainties and challenges encountered when valuing ICT companies. As participants PK-DE, NC-DE, TM-DE, and RO-DE all-highlighted different methods for valuing ICT companies from the buyer and seller perspective. These methods include deep DCF analysis, simulation-based analyses using detail and deep scenarios and Monte Carlo simulations. The German specialist participants in Phase Three noted the significance of sensitivity analysis, internal rate of return, and payback periods as crucial factors to consider during the valuation process. This extends to the depth of comprehension regarding the company's model, as it directly impacts the realism of simulations and the values generated.

> "Within the DCF, […] we would usually try to use the Monte Carlo simulation. So, if we have DCF and an ICT company that is highly related to some specific technologies, we will focus on parameters or scenarios. Then also do the full set of multiple running" (Participant-PK-DE, valuation advisory, selling).

Participant PK-DE commented the use of the Monte Carlo simulation in the DCF method for evaluating an ICT company. PK-DE, mentioned as the DCF method, aids in analysing and estimating the value of the ICT asset by discounting its future cash flows, the Monte Carlo simulation serves as a valuable complement, employing statistical techniques to explore numerous potential scenarios. It accomplishes this by generating random variables using various parameter values. This simulation empowered German specialists to explore a wide array of scenarios and parameters tailored to the company's unique technological landscape. By running multiple simulations, it becomes possible to account for uncertainties and risks associated with the ICT investment, providing a range of potential outcomes.

> "We do actions like the simulation and scenario analysis. These analyses are also running under DCF. For example, we do DCF scenarios and use Monte Carlo simulations as part of that process too" (Participant-NC-DE, valuation advisory, selling).

Similarly, Participant NC- DE has stated that they engage in activities such as simulation and scenario analysis. These analyses are carried out as part of the DCF method framework to achieve more robust outcomes.

> "We use the multiples model to have an indication [...], in the end, there is the operating model, which is based on DCF valuation. […]. We work on at least three scenarios, especially when forecasting the revenue stream and DCF basis [...]. We do sensitivity analysis [at] different levels of the EBITDA calculation. [...] we also calculate IRR and payback periods" (Participant-TM-DE, valuation advisory, selling).

Participant TM-DE commented that often employed was the multiples model as a preliminary indicator. However, in the end, the German specialists tended to rely on the operating model, which is based on DCF valuation. There was an emphasis on working with at least three scenarios, particularly when forecasting revenue streams and establishing the DCF basis. Sensitivity analysis was conducted at various levels of the EBITDA calculation to assess the

impact on the results. Additionally, TM-DE also calculated the internal rate of return (IRR) and payback periods as part of their analysis.

> "We examine DCF methods with set of multiples when valuing ICT. [...] the more precisely you understand the company model, the more realistic the simulations and the more reasonable the values will be" (Participant-RO-DE, valuation advisory, selling).

Several published articles including Damodaran (2017), Pettit (2012), and Pratt et al., (2007) have attempted to address various aspects of valuing ICT firms and have demonstrated the relevance of using DCF and multiples in ICT valuation, confirming the linkage between the primary findings of this study and existing academic theories. Although studies by Dehghani et al. (2020), Ullrich (2013), Milanesi et al. (2013), Tas and Ersen (2012), Tansey (2009), and Herbst et al. (2006) indicated that that real option method, and venture capital could be applied for ICT companies. But empirical studies from Iran and Germany suggest that real option method did not apply to ICT companies. In certain instances, when German specialists assess ICT start-up companies with limited historical data, they employ the venture capital model to ascertain the company's valuation.

Majority of the German participants discussed their approach to conducting sensitivity and scenario analyses in the context of valuation advisory, specifically in relation to determining the value of a high-growth ICT business. The participants stressed the importance of conducting different analyses to determine the value of ICT company. German specialists tended to use different approaches but share a focus on developing scenarios that are realistic yet slightly implausible and ultimately making decisions based on the best or most likely scenarios depending on the characteristics of the business being evaluated.

> "We do sensitivity analyses in the range of –2%, –1%, 0%, +1%, +2%, and we increase the free cash flow or the risk premium, and for the scenario, we use the worst, base, and best-case scenarios. Obviously, we review the past and do scenarios. Usually, we try to do a mid-range scenario, which is most likely implausible. When we are done with scenarios, you usually have to operate with the best if you have a high-growth business. If not, we use the worst or most likely scenarios" (Participant-RH-DE, M&A advisory, selling).

Participant RH-DE commented that in conduct sensitivity analyse there was a need to explore various percentage changes, which ranged from -2% to +2%. Therefore, the focus lies in adjusting the free cash flow or the risk premium, and considering different scenarios such as the worst-case, base-case, and best-case scenarios. In scenario planning, the German specialists used historical data from the ICT company. During the analysis, the focus was to create a mid-range scenario that captures a plausible outcome. Once the scenarios have been developed, the best-case scenario would be most suitable for ICT businesses with high growth potential. However, if an ICT business does not exhibit high growth potential, the worst-case or most likely scenarios employed.

> "We also apply the sensitivity analysis and scenario analysis on the growth level. We think about realistic growth rates on the revenue streams we define the best-case, mid, and worst-case scenarios. We calculate the terminal value growth rate, theoretically, take the last year and add the inflation rate as the growth rate. But in reality, we are dealing with a distinct, and the game is on the revenue side of the company. For example, sometimes we take ten, twenty per cent growth rate of FCF, depending on the company, then take out the costs until to reach a steady rate, then use the last year as the terminal value and put the inflation rate on it" (Participant-KB-DE, M&A advisory, selling).

Similarly, Participant-KB-DE highlighted that their team defines best-case, mid-range, and worst-case scenarios, while applying sensitivity analysis and scenario analysis to carefully evaluate the components of the discounted cash flow (DCF) model, including growth rate and revenue streams. When determining the terminal value growth rate, the German specialists considered historical growth rates and the inflation rate. However, the primary focus tended to be focused on the revenue side of the company, specifically in adjusting the free cash flow (FCF) and costs until a steady rate is achieved.

Numerous literary resources explained the process of conducting sensitivity and scenario analyses, as well as Monte Carlo simulation, in the context of DCF valuation models. Leading literature on this subject includes works from Damodaran (2017), Koller et al. (2010), and Pignataro (2013), which provide an extensive overview of valuation techniques such as DCF analysis and emphasised the significance of conducting sensitivity and scenario analyses in valuation process. In addition, several academic papers, including Hulett (2016), McLeish (2011), and Clark et al. (2010) research, concentrate explicitly on the use of Monte

Carlo simulation in valuation process, covering its applications in valuation and risk management.

During the valuation process, participants emphasised the significance of reviewing and addressing unpredictable events. Participant MT-DE highlighted the following aspect:

> "The methods are the DCF approach, and we set the amount based on multiples and peer group compatibility. [In analyses] sometimes we do a number of scenarios analysis, for example, making hundreds or thousands of scenarios, so there are many things which are unpredictable. You need to find ways to the rational explanation and the way to explain the revenue side and other things you estimate, and I think this is the important part" (Participant-MT-DE, deal advisory valuation, buying).

Participant MT-DE noted when doing the valuation and applying the multiple and DCF methods, it is important to cover the things that might be unpredictable. For this reason, applying the Monte Carlo simulation to the DCF model components, which includes additional outcomes, assist advisors in developing a logical justification for explaining the DCF outcomes and components to clients.

All the participants in Germany from the follow up phase interview also indicated that they apply different scenarios and simulations under the DCF to ensure they are doing deep analysis and looking at different aspects of the business. The German specialist could adjust the outcome of the values by changing the elements. Utilising various statistical methods such as Monte Carlo simulations and distribution probabilities assist in finding out possible volatilities. Most of the German specialist participants expressed that they had run thousands of scenarios and simulation-based studies within the DCF valuation process. Through testing the probability examinations of components with Monte Carlo simulations can guide the specialists in determining the sensitivity of drivers and the significance of the company's value to certain components (Gleißner & Ernst, 2019). In practice, a wide variety of unexpected outcomes could occur, and it is impossible for anyone to forecast the future. Therefore, it is essential to test different probabilities and select those that have the highest likelihood of occurring according to the statistics.

4.2.8 The justification for applying the selected valuation approaches

First part of the findings of this study revealed that Iranian specialists primarily employed the DCF, DDM, and multiples, as well as the replacement approaches, when valuing ICT firms in Iran. The Iranian specialists provided several justifications for their choice of valuation methodologies. Participant MA-IR explained that these methods, namely DCF, DDM, and multiples, have proven to be effective for evaluating ICT companies in the Iranian context. Moreover, Participant MA-IR noted that since a significant number of Iranian companies still pay dividends, the DDM model is still used for valuing such firms. Additionally, Participant MA-IR expressed that they are unaware of any other superior alternatives to these models.

> "In my opinion, there are several reasons why DCF is mostly used. One is that we know these models and don't know any better models than these. With the ICT companies we value, there is often some background, and with the characteristics of these companies, it is better to use these models to value them because they work in valuation. We still use DDM because dividends are still common here." (Participant-MA-IR, valuation specialist, buying and selling).

As indicated by participant MHB-IR, in valuing ICT companies in Iran, the commonly employed valuation methods include the DCF, DDM and multiples approaches. These approaches are considered valuable for determining the ICT company's worth. Various multiples are used to gain insights into the market value of comparable or peer firms, aiding in the valuation process. Participant MHB-IR also highlighted the calculation of the dollar replacement value of the ICT company. This step is undertaken to account for the potential impacts of macroeconomic decisions, high inflation, and exchange rate fluctuations, which can significantly influence the company's value.

> "The valuation of ICT companies is typically carried out using DCF and multiples models, as they are useful in determining the company's value. Different multiples are utilised to gain insight into the market value of comparable or peer firms. The DDM model is still beneficial as most profitable companies aim to distribute cash dividends. Moreover, the dollar replacement value of the ICT company is calculated because macroeconomic decisions, high inflation, and exchange rate fluctuations can significantly impact its value" (Participant-MHB-IR, deal advisory valuation, buying and selling).

In the perspective of participant MM-IR, the DCF method and multiples such as P/E, P/S, and EBIT are widely used in valuation practices. These methods are favoured because these methodologies allow for comparisons with peer groups, enabling a benchmarking analysis. Additionally, multiples are considered advantageous as could be calculated relatively quickly. Participant MM-IR also mentioned the occasional need for the replacement method. This method is employed to understand the worth of the ICT company in terms of current U.S. dollar rate. By considering the replacement value, which accounts for the current exchange rate and potential fluctuations, a more comprehensive assessment of the company's value can be obtained.

> "The DCF and multiples like P/E, P/S, and EBIT are widely used because we can compare them with peer groups, and multiples can be done faster. Sometimes replacement method is required to understand how much the worth of the ICT with today U.S. dollar rate will be" (Participant-MM-IR, valuation specialist, buying and selling).

Based on the insights shared by participant HS-IR, several key points can be highlighted. Firstly, while multiples offer simplicity in valuation, there is also a potential for manipulation in these models, the non-operating profits should be identified, because it impacts the company's profitability and financial ratios. Consequently, Iranian analysts conducting ICT analysis need to be vigilant in identifying and accounting for such factors. Secondly, participant HS-IR pointed out that the DCF model is a comprehensive valuation approach, and no other alternative can provide such a detailed analysis of an ICT company. Therefore, participant HS-IR has consistently used the DCF model in ICT valuations due to the lack of a better option. However, participant HS-IR raised an issue regarding the limitations of the DCF model and recognised the need for exploring alternative valuation methods such as cost approach in certain situations.

> "Beside the simplicity of multiples, there can be a lot of manipulation in these models. For example, non-operating profits can be identified that change the company's profitability or have an impact on the company's financial ratios, which the analyst should pay close attention to in ICT analysis. The DCF model is a complete model, in my opinion. I think no other alternative can analyse an ICT company in such detail, so since I don't have a better option than DCF, I have always used this model in ICT valuations. But we must pay attention to the question: what would be the best

> alternative if DCF is not used?" (Participant-HS-IR, brokerage, deal advisory valuation, buying and selling).

The majority of Iranian participants emphasised that the discount-based model and market-based approaches stand as comprehensive valuation methods. Many of Iranian participants expressed unfamiliarity with alternative options capable of delivering an equally intricate analysis of an ICT company. Consequently, the DCF and DDM models have been consistently employed in Iranian ICT valuations, primarily due to the absence of superior alternatives.

In justification of applied methods in Germany, almost all of the German specialists agreed that the DCF approach is dominant in valuation in Germany because it is guideline from the Institute of Chartered Accountants in Germany (IDW, 2009). Even though they applied the market approach in their valuation, but they criticized the market approach, particularly in choosing the appropriate peer group for benchmarking. To use the peer group method, evaluators analyse a list of comparable companies to the target company, using financial records to compare multiples. Comparable companies should be from the same industry, operate similarly, and have similar financial and physical dimensions. Finding sufficient comparable peers is challenging but critical to deriving accurate value. Despite the challenges, using the multiples method is found to be helpful by participants in determining the value of ICT firms.

> "It's commonly the high-level discount cash flow approach, sensitivity calculation, and IE scenarios that we use here. That is primarily driven by the fact that we have guiding standards in Germany, especially for the big four audit companies, which are close to the IDW (Institut der Wirtschaftsprüfer in Deutschland). They issue the valuation standards and the primary guides to use cash-flow base valuations and only use multiplies and the like as sort of a sense-checking approach" (Participant-AE-DE, deal advisory valuation, buying and selling).

Participant MK-DE highlighted that the utilisation of DCF and multiple valuation methods is primarily driven by the status as market standards. These methods are widely accepted within their organisations, and the preference for DCF and the market approach stems from the ability to provide desired outcomes and facilitate productive discussions. Participant MK-DE further explained that their preference for DCF and market-based methods is based on their

effectiveness. However, alternative valuation approaches revealed difficulties. These challenges included issues with result interpretation and discussions surrounding the obtained valuations.

> "Because these [DCF and multiple] are market standards, that's why we also use them. These are acceptable in our organisation, and we prefer to have DCF and a market approach because we can discuss them, and these methods give us what we are looking for. Because we have tried other methods and had many problems with results and discussions" (Participant-MK-DE, deal advisory valuation, buying and selling).

As indicated by participant TM-DE, the DCF model is a straightforward and communicative method of valuation. Participant TM-DE highlighted DCF's ability to incorporate ICT's financials, profits, cash flows, and a discount rate, making it transparent and facilitating discussions regarding underlying assumptions. Participant TM-DE also suggests that the market multiples approach is the next best alternative for valuation of ICTs.

> "I believe that the DCF model is easy to understand and communicate because it involves financials, profits, cash flows, and a discount rate. The model is transparent, and underlying assumptions can be discussed. The market multiples approach is the next best and easiest approach" *(*Participant-TM-DE, deal advisory valuation, buying and selling).

Participant LK-DE expressed that the real option method was complex and unreliable when it comes to arriving at an effective value and effectively communicating ICT firms' valuation process. Participant LK-DE also highlighted that the DDM and cost methods as outdated and unsuitable for the current situation of ICTs. Instead, Participant LK-DE identified the DCF approach as the best option, because of DCF's ability to provide a detailed analysis in the valuation process of ICT companies and the DCF approach is more relevant and capable of capturing the details of ICT valuation compared to the real option method, DDM, and cost methods.

> "I think that the real option method is complex to arrive at an effective value and to communicate, so making it unreliable. I also think that the DDM and cost methods are very old and not applicable to the current situation of ICTs. Therefore, I have the DCF

> approach as the best option since it provides detailed analysis on the company's valuations process" (Participant-LK-DE, valuation advisory, buying).

Overall, the insights obtained from participants in both Iran and Germany shed light on the valuation methods employed and justifications for ICT companies. In both countries, the vast majority of specialists agreed that the DCF approach was favoured due to its effectiveness, clarity, and communicative nature, and the absence of a superior alternative. German specialists emphasised the widespread adoption of DCF and multiple valuation methods as accepted market standards in Germany, while also acknowledging the viability of the market multiples approach for peer perspective and benchmarking purposes. German specialists expressed the unsuitability of the real option method and considered the DDM and cost methods as outdated. In contrast, Iranian specialists continued to use the DDM and replacement methods, with a particular emphasis on the replacement method due to its consideration of the dollar proxy value in Iranian ICT valuations.

4.2.9 Summary of applied methods and the justifications

This investigation discovered that Iranian specialists utilised various valuation techniques, such as DCF, DDM, and the market approach, along with the replacement method, to assess ICT companies in Iran. Majority of Iranian specialists think the multiples approach to be effective and common for valuing ICTs in Iran. Replacement valuation was used because of economic uncertainty, high inflation, and fluctuations in foreign currencies. DDM was employed in Iran due to the commonality of cash dividends among profitable Iranian ICTs. Valuation was affected by several variables, including macroeconomic policies, inflation, and exchange rate fluctuations. DCF and DDM was preferred as it could predict future cash flows. Finally, the scenario and sensitivity analyses were often employed in a cursory manner, lacking the necessary depth in component detail. In many instances, these analyses were conducted primarily at the request of clients, without the requisite level of seriousness. Furthermore, the application of simulation techniques such as Monte Carlo was notably absent from Iran's valuation processes.

In contrast, all the German specialists agreed that the DCF method was the primary technique used for valuing ICT companies. This methodology involved conducting various analyses, such as scenario and sensitivity assessments, and Monte Carlo simulations to evaluate cash

flows, growth, and discount rate forecasting. Multiple approaches were also employed as a plausibility check. Nevertheless, some German specialists criticised the multiple methods because of the absence of peer comparisons, while others questioned the DCF method's forward-looking nature and the strong connection between growth, interest, and discount rates. German participants in a study highlighted the significance of communication in valuation models and found DCF and multiple approaches to be the most effective. They also argued that the cost approach and DDM are not suitable for valuing ICT companies.

One notable shortcoming identified from the empirical evidence is that neither Iran nor Germany has utilised option pricing models in their ICT valuation processes. Despite the widespread suggestion of these models in developed countries for valuing assets with significant intangible components, both countries have yet to incorporate them into their standard valuation practices. This omission highlights a significant gap in the methodologies currently employed, potentially limiting the accuracy and comprehensiveness of ICT asset valuations in these regions.

4.3 Results for the second research objective

To critically analyse how these models have been used in the ICT valuation process in Iran, and contrasting the practices observed in Germany, especially given the differences between the two countries.

After reviewing valuation methods from current literature and the practices employed by Iranian and German specialists, it was found that option pricing models (OPMs) were missing in both countries, despite being widely suggested in developed countries. Additionally, the findings suggest that the Black-Scholes option pricing model could be a valuable approach for the ICT valuation process due to the intangible nature of these assets. While Discounted Cash Flow (DCF) and multiples are commonly used for comparison and valuation purposes, the asset/cost approach is employed to estimate the lowest possible value. Option-based methods, however, are not used at all, and venture capital is considered unreliable for valuing ICT firms.

The purpose of this section is to present the findings that fulfils the second research objective by providing an in-depth investigation of the valuation process using the DCF method. Since all participants in this study used the DCF method, and contrast it with German perspective, the section highlights the most significant findings, including financial planning projections. The section also discusses the challenging steps in the valuation process, such as the discount rate calculation techniques, along with the outcomes of the influential risk concerns in the valuation. Moreover, the section presents the findings of the growth rate projections and methodologies. Finally, since option pricing models are among the key valuation methods suggested by current literature, this section will further explain the application of the Black-Scholes option pricing model. The section will conclude by summarising the findings on how these models have been utilised in the valuation process.

4.3.1 Financial planning in the DCF model and adjustments made

As the financial planning projections are the first step in developing the DCF model, the researcher asked both countries participants about their financial planning processes and any adjustments they had made.

As presented in more detail in Chapter two, the initial step in developing the DCF model involves projecting the company's future cash flow, which raises concerns about how the specialists implemented the future financial planning projections. To forecast revenue, which forms the basis of financial planning, analysts must estimate the growth rate of the company's revenue, leading to further questions regarding how the growth rate was determined and applied to future costs. The next step involves calculating the free cash flow (FCF), and questions were raised about this calculation. After determining the FCF, the discount rate used to discount future free cash flows needs to be established, prompting questions about this aspect. The process then moves on to calculating the terminal value, which involves calculating the perpetual growth rate (Berk & DeMarzo, 2020; Brealey et al., 2020). Before starting the financial planning forecasts, it is crucial to gain a thorough understanding of the ICT business plan. Each company has its own unique characteristics, and it is essential for specialists to grasp the underlying ideas behind its specific business model. Once the company is comprehended, the next step involves conducting an analysis of its competitors. Ideally, the management should provide a list of confirmed competitors, as identifying the most relevant ones can be challenging, especially when dealing with an ICT business model that stands out from the norm (Visconti, 2020b).

4.3.1.1 Requirement for financial planning process

When asked about the financial planning process and requirements, the Iranian participants acknowledged the significance of historical financial information and a detailed business model for ICT. Participant MHB-IR pointed out that in the context of valuing ICT companies in Iran, it is crucial to consider the current situation and any recent changes that have occurred. Participant MHB-IR emphasised the need to review various variables involved in the valuation process to ensure accuracy and relevance. This is particularly important because the current conditions in Iran present higher risks for ICT companies. By taking these variables into account, a more comprehensive and informed valuation could be achieved.

> "In order to conduct future financial planning, it is crucial to have a detailed understanding of the ICT company's business plan and past financial records. Additionally, the current situation and any recent changes must be taken into consideration, along with the review of various variables involved in the valuation process. This is especially important because the current conditions entail higher risks

> for ICT companies." (Participant-MHB-IR deal advisory valuation, buying and selling).

Overall, based on the opinions of almost all of the Iranian interviews, it is evident that a holistic and comprehensive approach to financial planning is crucial for ICT companies in the country. This approach includes a detailed understanding of the business plan, past financial records, political and macroeconomic variables, and proactive strategies to address inflation and other economic risks. The consensus among Iranian interviewees emphasised the need for adaptability, risk management, and contingency planning in navigating the challenging environment faced by ICT companies in Iran.

German participant AE-DE noted the importance of fulfilling specific requirements during the valuation process. These requirements include obtaining a business plan and understanding the underlying assumptions through discussions with management. Historical financial statements are also necessary as an absolute minimum. Conducting market studies, competitor analyses, and using proprietary benchmark data are essential for evaluating the current business plan. These steps collectively contribute to challenging management's assumptions and fostering discussions about their decision-making process. Overall, these requirements establish a minimum set of criteria for conducting a comprehensive valuation.

> "We would need a business plan, and we would need to get an understanding of the underlying assumptions in the business plan, which typically involves discussing the business plan with management and challenging their assumptions. That sort of the minimum set of requirements, and we would do market study, competitor analyses, a sort of propriety benchmark data we have for previous projects and then that would actually go into challenging the management assumptions and discussing how they have arrived at this business plan" (Participant-AE-DE, deal advisory valuation, buying and selling).

Other German participant, GU-DE highlighted the importance of assessing the transaction from both the buyer's and seller's perspectives. To understand the transformation process and its impact on future projections, a detailed business plan is necessary. Additionally, it's important to consider the impact on synergies for the buyer side. Also stressing the significance of taking a holistic perspective when developing these forecasts, including technology overlap and commercial and technology perspectives. A comprehensive view is

needed to understand the transaction rationale, especially when combining two different business models (Bauer & Friesl, 2022).

> "There are other aspects like potential dyssynergies in that are potentially driving this transaction. So that means all need to be taken into account from a holistic point of view. When we talk about individual circumstances and individual valuation aspects of ICT companies" (Participant-GU-DE, deal advisory valuation, buying and selling).

The collective perspective of German specialists emphasised the importance of historical company data, a comprehensive business plan, a grasp of underlying assumptions, interview and discussions with management and staff, market analyses, and also a holistic approach in detail analysis of ICT needed. Several German specialists additionally highlighted the influence of synergies on the process.

4.3.1.2 Projected period for financial planning

Some of the Iranian specialists pointed out that five-year projections are made in financial planning, and they use the company's previous growth to anticipate future cash flows. For the DDM model, they consider the retention rate and inflation, while in the DCF method, historical growth and inflation are considered to estimate the growth rate.

> "For the financial planning, we predict the next five years. And based on the company's past growth, the growth rate is estimated. Unless the company's information is unreliable, when the company is newly established, a higher growth rate is sometimes considered for them. And after 4-5 years, we will proceed to the industry growth rate. From the company's past records, we find the growth rate for terminal value. For example, in the DDM model, we look at the retention rate and consider inflation if it is high. And for the DCF method, we usually use historical growth and the inflation rate to calculate the FCF" (Participant-MS-IR, M&A advisory specialist, buying and selling).

Participant MHB-IR noted that in the context of Iran, there has been a shift in the approach to future financial planning and the consideration of time horizons. When the economic condition was more stable and GDP of Iran had positive rate, it was common practice to

consider future periods up to the next five years and calculate cash flows accordingly. However, MHB-IR mentioned that now the situation has changed, the economic condition is not stable, and GDP of Iran has negative rate in past three years and the Iranian specialists tend to use shorter planning period in future projections. This suggests that there has been a transition towards a more focused on shorter future financial projections in Iran.

> "Here, to some extent, for future financial planning, we used to consider future periods up to the next five years and calculate cash flows. But recently, the situation has changed, and this period has become shorter" (Participant-MHB-IR deal advisory valuation, buying and selling).

Many Iranian specialists considered the current situation of instability and high inflation when forecasting the financial planning of ICT companies. Iranian specialists shorten the forecast period to the next two to three years, to come to a better decision making they estimate and calculate the valuation process in US dollars. This requires a thorough evaluation of the industry and competitors, assessing all sales and profits in US dollars, and assessing the company's position based on its US dollar cash flow conversion. Various factors need to be considered during the evaluation process, such as the company's expansion plans, exchanges rate in the US dollar value, inflation rate, and general economic conditions as they have a significant impact on valuations. Participant MH-IR reflected that these adjustments to the valuation model and the shift to US dollars in calculations resulted in a more precise valuation of the ICT company.

> "We plan financials for the next 2-3 years. We consider the predicted inflation; many variables must be included in the valuation process. We give more weight to events that we think are likely to happen shortly. For example, in the past three years, the dollar value has significantly increased, impacting valuations considerably. So, because the tolerance for changes is very high, we are looking at the ICT company for the next two years. To be more precise, we consider the US dollar valuation. We say that this ICT company has this amount of US dollar value and will have this amount of dollar profitability for the buyer" (Participant-MH-IR, deal advisory valuation, buying and selling).

Likewise, participant MB-IR underscored that the significant volatility and numerous variables within the ICT industry call for a short-term perspective (spanning two to three years) when forecasting future cash flows. Consequently, participant MB-IR gave precedence to the short-term horizon in projecting the future to arrive at a more realistic valuation.

> "Financial analysts here focus on the short-term when planning for the future of ICT companies due to high volatility and increased risk. We typically evaluate the next two to three years and discount future cash flows based on variables due to the unpredictability of the market beyond that period" (Participant-MB-IR, deal advisory valuation, buying and selling).

The majority of Iranian specialists indicated that they employed a two- to three-year modelling approach in discounted cash flow (DCF) analysis to forecast future cash flows. Only a single Iranian participant cited a four-year modelling period.

When German participants were asked about the projection period, their responses indicated that the time frame they considered for future financial planning was longer. Participant RH-DE emphasised that in Germany, the standard projection period for future financial planning in the valuation of ICT companies is five years. Participant RH-DE highlighted the significance of incorporating carefully reviewed relevant data and market insights in this process to accurately forecast future performance and estimate the present value of the company. This underscores the importance of thorough analysis and informed decision-making in financial planning for ICT companies in Germany.

> "The projection period for future financial planning is usually five years, although some may occasionally apply for six or seven years. We review historical data, business plans, and market analyses to project revenues for the next five years, which we use to determine the current value of the ICT company" (Participant-RH-DE, M&A advisory, selling).

Participant KB-DE mentioned that the valuation method in Germany involves using historical financial data spanning a minimum of three years. This historical data is then used to project future cash flows for a period of five years. By leveraging past financial performance, participant KB-DE aim to forecast the future financial outlook of the ICT company and assess its potential cash flow generation over the specified timeframe.

> “We use historical financial data from at least three years to project future cash flows for the next five years” (Participant-KB-DE, M&A advisory, buying and selling).

Some of the German specialists like participant SE-DE stated that the financial planning forecasting period depends on various factors such as the ICT being valued, and contracts involved. They typically use five, or maximum seven-year periods, but they do not extend beyond seven years due to uncertainty about the future. Participant SE-DE noted that longer forecasting periods make the model more complex and difficult to forecast.

> “The reason for using five, or six-year approaches is that it becomes harder to predict the future as the forecast period gets longer. Additionally, unexpected events such as a global pandemic can occur, making it difficult to model. Therefore, the maximum forecast period for DCF is usually around five or six years, what if another thing happens between this forecast period?” (Participant-SE-DE, deal advisory valuation, buying and selling).

The "what-if discussion" technique, mentioned by participant SE-DE, was an interesting approach to address qualitative aspects. This technique allowed for the examination of qualitative characteristics specific to ICT companies that could not be assessed quantitatively within classical theoretical valuation models. By engaging in these discussions, participant SE-DE could consider and analyse issues that may not have a straightforward numerical representation but hold importance in the valuation process. This qualitative analysis approach complements the numerical aspects of valuation models, enabling a more comprehensive assessment of ICT companies.

> "In our qualitative analysis we have something calling it what-if discussion technique to address qualitative characteristics of ICTs that cannot be evaluated numerically in theoretical valuation models." (Participant-SE-DE, deal advisory valuation, buying and selling).

All German specialists agreed that they used a five-year method, with some extending it to a six-year period, for projecting future cash flows. Additionally, a few German specialists

noted that they might extend projection modelling to seven years in cases involving ICT companies with longer contracts and greater stability.

4.3.1.3 Summary of financial planning

To analyse and contrast the Iranian and German specialists' perspective in developing the financial planning process, both countries analysts rely on historical data, business plan, competitor research, market analysis to forecast future cash flows for ICT companies. The typical period of five years method used in Germany, and majority of German specialists spent more time to evaluate the business plan and interviews with management and challenge management team for their assumptions. Meanwhile, almost all Iranian specialists shortened the period for cash flow projections to two to three years due to the country's instability status.

4.3.2 Discount rate calculation methods and risk analysis

This section discusses the findings about using different discount rate or cost of capital (CoC) methodologies by Iranian and German specialists to determine discount rates for cash flows in DCF-based approaches. The discount rate plays a crucial role in the DCF model as it involves discounting the expected future cash flows of an ICT firm. It represents the cost of capital or required rate of return and reflects the time value of money. To ensure the validity of the DCF model, it is vital to estimate the discount rate accurately, which should reflect the risk of the ICT firm. As the DCF model is based on estimates and assumptions, it is necessary to evaluate their reliability carefully (Berk & DeMarzo, 2020; Brealey et al., 2020; A Damodaran, 2016). The CoC calculation is determined after developing financial planning forecasts or expected future cash flows. There are multiple techniques to calculate CoC within the DCF approach, such as WACC (CAPM), which provide information on the risk profile of the enterprise and how to discount cash flows to determine their present values. Chapter Two presents strong academic evidence supporting the effective use of discount rates in the DCF model, as demonstrated by writers such as Abelson and Dalton (2018) and Allee et al. (2020); Penman (2001, 2015). This study examined the various CoC methods used by Iranian and German specialists to determine the discount rates.

4.3.2.1 Weighted average cost of capital (WACC)

Majority of Iranian participants noted that the discount rate was calculated using the Weighted Average Cost of Capital (WACC) approach for DCF. In some cases, they use a made-up or simplified computation method, which only considers the risk-free rate plus the risk premium for the ICT sector and ignores the beta effect in their calculation. As stated by Participant MH-IR, in the discount rate considering the risk-free rate along with a premium risk. To account for the potential impact of inflation, a risk premium rate is calculated and added to the risk-free rate, resulting in the final discount rate. Additionally, Participant MH-IR highlighted the use of the WACC in assessing the discount rates. This approach ensures that the valuation accounts for both on the risk owners' equity and credit provider risk.

> "We calculate the discount rate by considering the risk-free rate plus a premium risk. We obtain the tolerance of the company's calculated profits based on the different financial periods in the past and the fluctuations that these companies have had. We always consider that the buyer should not be behind inflation in the discount rate. That's why we calculate the risk premium rate and add it to the risk-free. We also use the WACC and calculate and weight how much the owners brought in and how much credit from the bank at what interest rate borrowed" (Participant-MH-IR, deal advisory valuation, buying and selling).

Similarly, several interviewees raised a notable point regarding the discount rate method, as Participant HK-IR mentioned that the discount rate method involved using the risk-free rate of return or the bank's risk-free rate as a reference point, alongside with a risk premium. The risk premium is considered based on publications of risk premium studies in Iran. This risk premium served as a reward for the owner and covers the impact of inflation, as well as the influences of macroeconomic and political variables.

> "We use a risk-free rate of return or the bank's risk-free rate as a reference plus a risk premium as a reward for the owner, which is calculated and published here, and we use it as the minimum discount rate. For a more accurate calculation, we include the inflation rate, and we have to adjust things. Macro-economic [inflation effect] and politic variables must be addressed in the calculations, because there are many other variables in market practice that we should also take into account" (Participant-HK-IR, senior deal advisory valuation, buying and selling).

Evident from the Iranian interviewees shows that most Iranian specialists used the simplified version of WACC approach and adjusted the standard model to arrive at a more reasonable discount rate according to Iran's current market. These adjustments included factoring in beta, size risk, and liquidity risk, and other premium. Iranian specialists calculated the discount rate as the risk-free rate plus risk premium. Iranian specialists not considered the effect of beta in the CAPM model as they reflected that other variables such as macro risks have a more significant impact on valuation. As highlighted by participant MM-IR that the macro risks associated with the current investment climate in Iran is the primary obstacle in the valuation process and minor changes in the discount rate is not affecting that much in the end value.

> "In the ICT market, we typically apply a risk-free rate plus the risk premium as the discount rate. However, we believe that minor fluctuations of one or two percent in the discount rate estimation do not hold significant weight in Iran market. The valuation process is primarily influenced by crucial variables such as currency crisis, sanctions, and high inflation, which require more attention than minor changes in the discount rate "(Participant-MM-IR, senior valuation specialist, buying and selling).

Another crucial consideration in establishing the discount rate for an ICT company in Iran involved the assessment of various variables. Among these, Iranian specialists emphasised the significance of medium-term inflation, industry and company-specific risks, and currency fluctuations. Notably, certain Iranian specialists pointed out that elevated inflation rates and pronounced fluctuations would result in a heightened discount rate, which made developing the cash flow projections beyond a two to three-year horizon less relevant.

In contrast, in Germany, the calculation of discount rates for ICT companies is regulated by the IDW S1 standard. German specialists use the WACC (CAPM) framework as a crucial component of the company's discount rate calculation, which is applicable for ICT company valuations in the country. IDW S1 is a valuation standard established by the Institute of Public Auditors in Germany (IDW). It provides guidance for the consistent and transparent valuation of companies, including the selection of valuation methods, determination of discount and capitalisation rates, and assessment of risks and uncertainties and determining the fair values (IDW, 2009; IDW, 2017). All the participants in Germany used the WACC

method for discount rate calculation. Participant DJ-DE mentioned that in Germany, it is standard practice to apply the Capital Asset Pricing Model (CAPM) without any adjustments. Unlike practices in the UK, Australia, or the US, German specialists did not incorporate company-specific premiums or factors such as small size or liquidity that may be used in other countries. This distinction in valuation practices was emphasised by Participant DJ-DE as a notable difference observed in the German context.

> "We always apply the CAPM; I think we would always drive the levered beta first, and then we would drive the unlevered beta. And usually, we do not make a further adjustment to the cost of capital here in Germany. We are not applying something like company-specific premiums, and we would not be including small size or specific other parameters which other people maybe in the UK or Australia or US might do. So, I think it is also a big difference when it comes to the valuation in Germany" (Participant-DJ-DE, deal advisory valuation, buying and selling).

Participant AE-DE emphasised the use of the CAPM standard and highlighted the incorporation of the Nelson-Siegel-Svensson approach in the assessment of interest rates.

> "We usually apply the CAPM for discount rate, standard CAPM, and we drive the risk-free rate for that. We do a bit of international practice in Germany in terms of the risk-free rate. And because we have a specific method here in Germany called the svensson-siegel approach, which has come across anyone. [...] The data has been published by the Deutschland Bundesbank. You get similar data from the Fed in the US. You get similar data from the Bank of England in the UK." (Participant-AE-DE, deal advisory valuation, buying and selling).

Participant GU-DE highlighted that in Germany, the Fama and French method not employed (Fama & French, 2003). Instead, the valuation approach in Germany relies on a simulation-based approach. This approach considers the specific business plan projections and risk profile, ensuring that equivalent principles are maintained throughout the valuation process.

> "My U.S. colleagues use asset factors based on Fama and French, which is driven by empirical observation and difficult to substantiate. We use a simulation-based approach that considers the specific business plan projections and risk profile to ensure equivalent principles are fulfilled in valuation. Despite the differences, if the US and German teams valued the same company, we would end up in nearly the same ballpark" (Participant-GU-DE, deal advisory valuation, buying and selling).

Collectively, the insights gathered from German interviewees underscore the prevalent adoption of both the WACC and CAPM methods for discount rate determination. Within the framework of CAPM, the risk-free rate and beta emerged as two pivotal components that underwent thorough analysis and consideration. Notably, some of the German specialists highlighted their reliance on reports from the German Bundesbank to derive the interest rate and use the Nelson-Siegel-Svensson approach to estimate risk-free rates.

4.3.2.2 Methods to calculate the beta

The beta which is one important component of risk premium calculations is a challenging part of the CAPM method for specialists in the practice environment which stated by many academic such as Festel and Wuermseher (2013); Mergner and Bulla (2008); Roque (2021); Travassos et al. (2018). Although Iranian specialists have largely eliminated the influence of beta in their risk premium calculations, and only used it when the data was available, German research indicates that it remains a significant factor that should be carefully considered when determining risk premiums. The German participants agreed that the beta calculation is particularly difficult due to the lack of available data. Upon thorough review and categorisation of the findings, it became evident that German specialists utilised two primary techniques to account for beta: the first involved identifying a peer group beta to estimate target beta, while the second method involved using simulation-based tools like Monte Carlo to determine beta for their risk assessments.

a) Using the peer group to calculate beta

In various studies, such as those conducted by Brotherson et al. (2013) and Harrington (2014), researchers have explored the calculation of cost of capital using different methods and highlighted the effectiveness of utilizing peer group beta in risk premium calculation. Additionally, Schwarzbichler et al. (2018) found that the use of peer betas is commonly employed by practitioners. As highlighted by Participant AE-DE, in Germany, there are specific guidelines for determining the market risk premium and the beta factor. These guidelines are typically derived from a peer group analysis and a thorough examination of comparable companies. By using peer approach, German specialists aim to accurately assess

the market risk premium and the beta factor, which are crucial components in the valuation process. Peer approach ensures that the valuation analysis is grounded in relevant market data and industry comparisons, providing a more robust and reliable estimation of the company's value.

> "We have specific guidance for market risk premium and the beta factor, which is obviously derived from using a peer group, a comparable company analysis" (Participant-AE-DE, deal advisory valuation, buying and selling).

Also, participant DJ-DE mentioned that in Germany, there is a regular cost of capital (CoC) study conducted each year. This CoC study involves gathering data from numerous companies in Germany, Austria, and Switzerland. The purpose of this study is to perform a probable check by comparing the cost of capital of the ICT company with that of its peer companies. By leveraging this study, German specialists can ensure that the cost of capital used in the valuation analysis aligns with industry standards and is in line with the performance of comparable companies. This approach adds an additional layer of validation to the valuation process, enhancing the reliability and accuracy of the results.

> "We have a cost of capital study in Germany, every year, we are asking a lot of companies in Germany, Austria, and Switzerland. This could be something that is done for a plausibility check with peer companies" (Participant-DJ-DE, deal advisory valuation, buying and selling).

Another significant element within the framework of CAPM, beta, garnered attention as nearly all German participants in the interviews agreed on their reliance on peer group studies. These studies played a crucial role in comprehending the beta factor within ICT company valuation in Germany.

b) Using simulation-based to calculate beta

Monte Carlo simulation has been extensively researched by academics (Clark et al., 2010; Hanada & Matsuura, 2022; Hulett, 2016) for its usefulness in estimating outcomes in the DCF method. This technique is known for its flexibility and value in assigning probabilities

to variables and generating simulations to determine potential outcomes and their likelihoods. Its practical applications are especially evident in cost of capital and financial modelling, where it fosters transparency, comprehension, and informed decision-making. As participant SE-DE noted, the main weakness of the CAPM lies in the difficulty of determining an appropriate beta and its relevance to the company being valued.

> "In situations where peer companies are not available to perform a market approach, developing a beta for the CAPM can be challenging. This presents a significant obstacle when valuing middle market, small, closely held businesses or early-stage companies. As a solution, we use simulation-based methods which is more suitable and commonly used approach for such companies in Germany" (Participant-SE-DE, deal advisory valuation, buying and selling).

Some other German specialists, like participant DJ-DE, noted that in Germany various methods employed to determine the beta factor in the CAPM specifically for ICT businesses. These methods are using peer group or market data and conducting Monte Carlo simulations of cash flow and beta to estimate volatility of ICT business. This approach enhanced the precision and reliability of the valuation process, given the unique characteristics and uncertainties associated with ICT companies.

> "We are using different methods to determine the beta factor in the CAPM for ICT businesses. These methods include using peer group or market data and we also conducting Monte Carlo simulations of cash flow and beta to estimate volatility. This approach is particularly useful for ICTs with a lack of data with higher uncertainty. We want to estimate the beta factor within the cost of capital based on the volatility of the business plan and Monte Carlo simulation" (Participant-DJ-DE, deal advisory valuation, buying and selling).

Likewise, participant GU-DE added that their team developed a simulation-based approach to determine the cost of capital, which involved incorporating specific value drivers for the determination of the beta factor. While the peer-group approach is a common practice in valuation, Participant GU-DE noted that the use of Monte Carlo simulation to derive the beta factor is becoming increasingly prevalent in Germany, especially for ICT companies.

> "[The] reason why we developed a simulation-based approach to determine the cost of capital, which using specific value drivers of the business model, we have a forward-looking approach to determine beta factor. The peer-group approach is common practice here, but in our evaluation practice the Monte-Carlo simulation used to derive the beta factor is becoming more common, particularly for ICT companies" (Participant-DJ-DE, deal advisory valuation, buying and selling).

Several German participants highlighted, concerning the beta element within CAPM, the significance of Monte Carlo simulations. Monte Carlo simulations were commended for their ability to assess a range of probabilities, effectively encompassing the complexities of an ICT business plan and providing a more comprehensive evaluation of the company's risk profile when considering the beta.

In contrast to the German specialists, the Iranian specialists did not employ simulation tools such as Monte Carlo to aid them in the valuation process of beta and other critical components like risk-free rates. While various researchers integrated influential factors into both comparable studies and simulation methods.

4.3.2.3 Examination of ICT risk profiles and risk analysis

Some of the German participants in follow up interviews added some qualitative reviews that should be considered in addition to the risk factors and variables for the company's risk assessment. Participant RH-DE highlighted some distinct steps that must be taken for risk assessment in the fundamental qualitative elements of the business model. Management or owners, technical support, customer loyalty, and the competitiveness of the ICT companies are just a few of the qualitative factors that must be examined during the valuation process.

> "Very often, we review the owners' risk, the risk of their technological capabilities, customer contact risk, or workforce, and customer" (Participant-RH-DE, M&A advisory, selling).

In conducting the risk analysis, Participant RH-DE distinguished the business model of the ICT firm and the sort of customer service. However, for typical ICTs, Participant RH-DE believes it is all about a company's promised cash flow and growth.

> “If you are a standard software company, it is all about sales and how much you can grow. If you have software, you have a few choices. You can say I have standard software by the end to build the integration for your customers. And the risk factor is about how certain you are about your cash flows. If you have a broad customer base, they are usually pretty certain because if they ask: can you do this and that? You grow deeper into the customer with every development you do. You have all the mitigations and interphases, and it's very difficult to get you off. I think the basic risk, without really having to do with specific risk adjustments, is that we look at the business model in the past and somehow in the future. And if this is the case, we extrapolate the growth rate or the continuation rate” (Participant-RH-DE, M&A advisory, selling).

Participant SE-DE further added that although the valuation assumption typically presumes the business will continue indefinitely, it is imperative to assess the quality, age, and health of the management team and the presence of a viable succession plan. Without these crucial elements, there exists a notable risk to the future cash flow of the business.

> “We also consider the quality, age, and health of the management team and whether they have a succession plan in place. Let's keep in mind when you're doing a valuation that the business goes to perpetuity, so if the management team has no succession plan in place, that is a significant risk to the future cash flow of the business. So, when we consider that this is probably a part of the risk factor in determining the discount rate” (Participant-SE-DE, deal advisory valuation, buying and selling, DE).

Participant RO-DE also emphasised the significance of the management team and their desire when valuing a family-owned ICT company. According to Participant RO-DE, these are the qualitative components, and analysts must consider both qualitative and quantitative aspects to provide a successful result.

> “I sold an ICT business that the owner hasn’t done vacation for seven years. It is a good question, think about Tesla without Elon Musk is it worth more or less? It’s a very dependent company. Look at Warren Buffet business. Is it really worth that much? He is 92 years old; he's going to die very soon. So, what's going to happen for the business? Can the other guys really make judgment calls? So, those are the qualitative factors. You have to factor in qualitative factors. And then you have to contrast it with quantitative part” (Participant-RO-DE, valuation advisory, selling,).

In addition, NC-DE mentioned the additional risk considerations, such as dependence on management and unpredictable market risk.

> "Other factors affect the risk, like the risk of depending on the management and unexpected market risk" (Participant-NC-DE, valuation analyst, buying and selling).

Participant LK-DE emphasised that financial analysts should not only focus on the detailed analysis of cash flows from a business plan, but they should also consider the risk assessment of regulations. This is because regulations can significantly impact the financial performance and sustainability of a company. Therefore, assessing the regulatory risks associated with a business plan is critical for making informed investment decisions. By incorporating regulatory risk assessment into their analysis, financial analysts can gain a better understanding of the potential challenges a company may face, and identify opportunities for value creation (Matsuo, 2022; Mukherjee, 2019).

> "Besides the business plan, occasionally, there may be some regulatory issues that need to be considered in the risk profile" (Participant-LK-DE, senior associate valuation advisory, buying and selling).

Another factor that can influence the risk profile of ICT companies, as highlighted by RO-DE, is the impact of reputation on risk assessment. RO-DE also noted that a company's negative reputation or history of scandals can elevate its company-specific risk.

> "The companies that had some scandals, maybe ten, twenty years ago, where everyone who hears the name has a bad feeling about that. There was a scandal in Germany, maybe thirty years ago. So, suppose we're going to such a company. In that case, we might say, the risk is if something in the media or the average risk of the peer companies just might say, which chooses to beta factor, makes it the upper end, because we say that's a higher risk for that specific company" (Participant-RO-DE, deal advisory valuation, buying).

Regarding systematic and unsystematic risk, the researcher asked the German specialists' participants on how they assessed the risk of ICT firms by reviewing the company or project itself. Participant AD-DE answered that the risk consideration is already reflected in the cash flow and that adjustments have been made in this section in relation to the riskiness of the business in comparison to the market and peers; therefore, AD-DE does not take on an additional risk profile.

> "In terms of unsystematic risk, we reflect that in the cash flows and on the income adjustments. For example, we do a really deep dive analysis of the business plans and the assumptions. We benchmark these against either a market study or analysis and experience. And then we have sort of an informed opinion about whether or not the business plan as provided is acceptable for a valuation. Most of the adjustments are made in the terminal value period. Why this sort of forecasting to perpetuity? Then you think about what sustainable long-term margins are?" (Participant-AD-DE, deal advisory valuation, buying and selling).

Participant SE-DE stated there are two methods to address the risk profile associated with the business plan used for valuing ICT companies. The first method involves adjusting cash flows based on the level of ambition relative to peers to determine the cost of capital or incorporating additional risk into the cost of capital using simulation-based techniques. The second method involves modifying the derivation variables used in the risk calculation, without differentiating between systematic and unsystematic variables.

> "You can stick with the business plan and ambitiousness level. And then, of course, you need to add certain components that reflect this additional risk in the cost of capital. So that is the way I look at it, and what we do not is to distinguish between systematic and unsystematic risk because, from our point of view, that is not part of what we are considering in the company valuation. So, we have those two alternatives: adjusting the cash flow to expected values or, alternatively, sticking with the business plan and adding in the additional premium cost of capital to end up in a situation where you have risk equivalent and cost of capital" (Participant-SE-DE, deal advisory valuation, buying and selling).

Participant WL-DE prefers to quantify and estimate the risk as much as feasible in the cash flows.

> "Preferably, even to the extent that it is possible to quantify it as much as possible, a risk factor that you would try to model into your cash flows, as I am a strong believer that you need to model as much as possible from a cash flow perspective, and that will get behind when you can't model it into your discount rate"(Participant-WL-DE, senior associate valuation advisory, buying and selling).

Participant MT-DE emphasised the importance of understanding business risks in the market practice. According to these German specialists in the last phase interview, comprehending the extent of business risks is crucial to factor them into the capital cost. Participant MT-DE stated that market practice plays a vital role in enabling them to gain a better understanding of

the potential risks involved in a particular business venture. By leveraging market practice, participant MT-DE could assess and evaluate business risks in a systematic manner, which allows them to make informed decisions on capital allocation. Participant MT-DE's approach to risk management demonstrated the importance of being aware of the various risks involved in any business venture and taking proactive steps to mitigate them.

> "The market practice helps us to understand if the business is high-risk and gives us the scope of investment. Because most of them are ICT start-ups, no one knows which one will be successful in the future and which one will not. So, running this kind of business is very risky, with a high rate of failure, and most of them in the future may have some problems. So, you need to calculate these risks in the capital cost" (Participant-MT-DE, deal advisory valuation, buying and selling).

Participant CH-DE has stated that they employ a risk assessment strategy for ICT start-ups by considering revenue and expected cash flow risks. This approach helped them to evaluate the potential risks associated with new ventures in the ICT industry. By factoring in revenue and cash flow risks, they can understand the financial viability of a start-up.

> "The higher risks for the ICT start-ups are the expected revenue from how many customers, how much market share, and the expected cash flow risk. These already put a lot of risk on top of the systematic risk" (Participant-WL-DE, deal advisory valuation, buying and selling).

KB-DE elaborated on the risks associated with family-owned ICT businesses as additional factors that must be considered during the valuation process.

> "The higher risk is on the cash flow side. The free cash flow is the result of the revenue, so it is already reflected in the cash flow. Definitely, if we are dealing with companies that are family-owned businesses, you need to consider the soft factors as well; you need to find out the drivers. Is the owner doing all the selling, business development, or so? If I take this guy out, what happens to the company? So, this is a great risk for this company. [...] I am referring to its operating model, which is the most important thing. Especially when you are dealing with family-owned companies, there are so many factors that are affecting or impacting my valuation, which can be found out by really good due diligence. And not just checking all the documents, but the topics of the people" (Participant-KB-DE, M&A specialist, buying and selling).

Participant PK-DE stated that the company's characteristics and business strategy, as well as an examination of the company's many components, aid in identifying the primary risk concerns in the cash flow evaluations. And that when the beta in the CAPM model is calculated, unsystematic risk should be considered.

> "The unsystematic risk depends on the company's characteristics and business strategy. Therefore, looking at the different components and also examining various issues that the firm relies on can help to identify the key risk concerns in the cash flow assessments and bring it to beta" (Participant-PK-DE, deal advisory valuation, buying and selling).

Participant SE-DE noted that while business valuation assumes indefinite longevity, the quality of management, age, and succession planning are crucial in assessing future cash flow. Without these factors, the business faces significant risk. Participant NC-DE also highlighted dependence on management and unpredictable market risk as additional considerations for risk assessment.

> "We also consider the quality, age, and health of the management team and whether they have a succession plan in place. Let's keep in mind when you're doing a valuation that the business goes to perpetuity, so if the management team has no succession plan in place, that is a significant risk to the future cash flow of the business. So, when we consider that this is probably a part of the risk factor in determining the discount rate" (Participant-SE-DE, deal advisory valuation, buying and selling).

Participant NC-DE highlighted the risks of depending ICT operation on management may introduce additional uncertainties. For example, the unpredictable market shifts like consumer preferences or economic downturns significantly could impact on the performance of an ICT company. This broadens the perspective beyond financial risks, emphasising the importance of quality management and considering unforeseen market changes for a comprehensive risk assessment.

> "Other factors affect the risk, like the risk of depending on the management and unexpected market risk" (Participant-NC-DE, valuation analyst, buying and selling).

Overall, the insights provided by German specialists underscore the intricate nature of risks within the ICT industry. German participants emphasised the essential role of a holistic approach that integrates both qualitative and quantitative factors in risk assessment. These diverse perspectives from German specialists illuminate the industry's complexity, underscoring the necessity for flexible and adaptable risk assessment strategies to navigate it effectively. Furthermore, the majority of German specialists employed simulation-based techniques to perform thorough risk assessments. These specialists recognised the critical significance of various factors, including the business model, management quality, technological capabilities, competitive positioning, regulatory aspects, reputation, and key personnel, as essential considerations in their risk assessments.

4.3.2.4 Summary of discount rate methods and risk analysis

In summary, most of the participants from Iran agreed that when valuing an ICT company, the discount rate should be determined using the WACC (and CAPM) approach and should take inflation and some other variables into account. Iranian specialists have simplified the method to the risk-free rate plus the ICT risk premium and eliminated the beta factor. Almost all of the Iranian interviewees held a robust conviction that the prevailing high inflation within the macro-risk landscape engendered fluctuations across all variables impacting valuation. Noteworthy among Iranian specialists was the observation that the elevated inflation rate made the calculations ineffective. This was noted by a few Iranian interviewees that underlying assumptions in discount rates calculation have minor differences and limited influence on the final value, and discount rate heavily depends on Iran's current situation, and the fluctuation of foreign currency.

However, the empirical study in Germany aligns with the view of IDW (2017), Berk and DeMarzo (2020) and Brealey et al., (2020) on the use of WACC for calculating discount rates. Nearly every German specialists adopted a minimum of one among two different strategies to overcome challenges in beta calculation for ICT companies with lack of data. These strategies include the use of peer groups and simulation-based methods. The finding of this study from German interviewees suggests that to enhance accuracy, simulations are utilised to adjust for the challenging aspect of beta determination by predicting future occurrence probabilities of relevant factors.

German participants extensively deliberated on risk profiles and analysis within the ICTs. While some Germans focused on aspects like management and team dynamics, others explored topics ranging from succession planning to specific characteristics of ICT companies and regulatory considerations. Notably, German professionals adopted sensitivity analyses and simulations to effectively address risks.

4.3.3 Growth rate calculation methods

The selection of the expected long-term growth rate in the discounted cash flow method often causes disagreements between researchers. This is because even small changes in the growth rate can greatly impact the valuation of a company, and because the long-term growth rate is a judgment-based input. This can lead to researchers questioning the validity of the growth rate selected by analysts. Therefore, it is crucial for analysts to carefully consider their choice of expected long-term growth rate (Rotkowski & Clough, 2013). There are few methods to estimate the growth rate in a DCF model. The first method is the *Historical Growth Method*, which uses the company's historical earnings or cash flows growth rate to estimate future growth rate. The second method is the *Industry Growth Method*, which estimates growth rate based on the industry growth rate. The third method is the *Analyst Estimates*, which uses analyst forecasts of future growth rate. However, this method relies on the accuracy of the analyst's estimates (Berk & DeMarzo, 2020; Brealey et al., 2020; Damodaran, 2012).

Some finance papers, including Friedl and Schwetzler (2011), have supported the original Gordon-Shapiro model and emphasised the importance of focusing on accounting earnings and free cash flows. The Gordon-Shapiro model is commonly used to establish the correlation between retention rate and growth, this model developed by Gordon and Shapiro (1956) and links the return on investment to the retained earnings and assumes a constant growth rate in dividend payments. However, it is suggested by academies that analysts thoroughly assess the long-term growth potential of the company and adjust it based on the influencing variables that mentioned in the discount rate consideration. The specialists also could employed the Return on Equity (ROE) × (1 – retention rate) formula for DDM (Brealey et al., 2020; Damodaran, 2012). During the investigation into how participants from Iranian specialists and German specialists perceived the growth rate in their DCF method, the findings' results from both countries shows that the participants considered a variety of references to develop growth rate in their DCF analysis.

In terms of determining the growth rate for the ICT sector, participant MH-IR emphasised the consideration of factors such as predicted profit, historical profit margin, and the stability of profitability. Additionally, the ICT company's ability to sustain profitability is evaluated as part of the growth rate assessment. To arrive at an appropriate growth rate, an analysis of the industry's growth rate is conducted, and conservative forward multiples are used. In the context of the Dividend Discount Model (DDM), the focus was on using the Return on Equity (ROE) and considering the company's historical performance. Overall, the valuations are approached with a conservative mindset, particularly when working on the buyer side, ensuring that estimations are made in a prudent manner.

> "The growth rate for the ICT is calculated based on factors such as predicted profit, historical profit margin, and stability of profitability. The company's ability to maintain profitability is also evaluated to determine an appropriate growth rate. Industry growth rate is reviewed, and conservative forward multiples are used. We use ROE and company history for DDM. The estimations are made conservatively for the buyer side" (Participant-MH-IR, deal advisory valuation, buying and selling).

Participant HK-IR acknowledged the challenges of computing growth rates for cash flow forecasting and terminal value growth rate, given the recent negative macroeconomic trends caused by the prevailing situation. So, they are exercising with caution and factoring in variables when determining the long-term growth rate, to ensure its continued relevance despite the high inflation in the current circumstances.

> "We determine the growth rate by analysing its historical performance, domestic or global (IMF) economic data. However, high inflation has made it challenging to rely solely on these models. Instead, we are using the recent performance and government budgets for the ICT sector to estimate the growth rate. Due to negative medium-term growth rates, the usual references are not applicable, so these factors must be considered when calculating the current growth rate" (Participant-HK-IR, senior deal advisory valuation, buying and selling).

In addition, participant MM-IR argued that their calculation of growth rate considers an assessment of the company's expansion strategy and translates the projected growth potential into U.S. dollars to determine whether the ICT firm still exhibits substantial growth.

> “When we are estimating the growth rate for forecasting future cash flows of ICT companies varies depending on whether they have a development plan or not. Then we analyse the growth rates from previous years, which is adjusted for inflation and local currency depreciation. Then we analyse and estimate growth of ICT companies based on the U.S. dollar, because the currency has had fluctuated recently.” (Participant-MM-IR, senior valuation specialist, buying and selling).

Participant HM-IR highlighted that all assumptions are converted to U.S. dollars. This ensures consistency and enables a standardised evaluation across different companies. Additionally, various scenarios of future profitability are examined to determine whether the ICT company's growth reflected in U.S. dollars value or not. This analysis helped participant HM-IR in understanding the potential impact of currency fluctuations and provides insights into the company's performance from a U.S. dollar perspective.

> “All assumptions are converted to U.S. dollars. Different scenarios of future profitability are considered to see if the company will grow in U.S. dollars base or not” (Participant-HM-IR, valuation specialist, buying and selling).

The findings of this study revealed that a majority of Iranian specialists determined growth rates for ICT companies through a comprehensive analysis of historical growth, industry growth rates, and inflation assessments provided by analysts, all within the framework of the DCF approach. Moreover, in the context of the DDM approach, Iranian specialists employed the Return on Equity (ROE) alongside retention rates and the historical performance of the ICT company as a foundation for forecasting future growth rates. Furthermore, the inclusion of economic growth rate considerations has been neglected in the calculation of growth rates, attributed to the negative economic growth experienced over the past few years in Iran.

However, the investigation into growth rate calculation methods in Germany reveals a diverse range of approaches adopted by German specialists. While some methods bear resemblance to those employed in Iran, there are also distinct supplementary techniques that came into play within the scope of growth rate assessment. As participant RH-DE stated, when it comes to the growth rate calculation the key factors such as growth potential, profitability, management, and customer retention are of utmost importance.

> “The venture business is all about growth potential, profitability, management, and customer retention. To sell businesses, growth metrics are emphasised. New development should prove growth, but the focus is typically on past performance and potential for profitability to predict future success” (Participant, RH-DE, M&A advisory, selling).

Also, participant DJ-DE mentioned, the growth rate involved examining long-term margins and using historical revenue growth rates to project future revenue for companies. In addition, when determining the terminal value growth, the normal inflation rate is used as a reference.

> “We examine the margins in the long term and use historical revenue growth rates to project revenue for companies. And for the terminal value growth the reference is the normal inflation rate” (Participant-DJ-DE, deal advisory valuation, buying and selling).

The impact of inflation on the growth values of corporations was examined by the researcher, and concerns about declining value as inflation rates rise have been raised due to the attention brought to the issue by Bradley and Jarrell (2008). Participant AE-DE highlighted that in Germany, the long-term growth rate in valuations is constrained by inflation, preventing the application of perpetual growth factors. The terminal value growth rate is somehow a flat rate, ensuring a realistic assessment. In cases where a business is deemed non-sustainable, the business plan is extended until a sustainable model is identified. In high-inflation environments, the long-term growth rate may be adjusted to account for the increased inflation risks. Consequently, the discount rate is modified to reflect the inflation risks on a same way, maintaining consistency and accuracy in the valuation process.

> “In Germany, the long-term growth rate is limited by inflation, and growth factors are not applied perpetually. The terminal value growth rate is capped, and if a business is not sustainable, the business plan is extended until a sustainable model is found. In high-inflation environments, the long-term growth rate may increase, and the discount rate needs to be adjusted to reflect inflation risks on a like-for-like basis” (Participant-AE-DE, deal advisory valuation, buying and selling).

Furthermore, participant GU-DE added that the growth of ICT company also should be particularly considering the ICT's transformation stage.

> “The determination of the growth projection is dependent on individual circumstances such as the company's stage of transformation and the technology driving the transformation” (Participant-GU-DE, deal advisory valuation, buying and selling).

Based on the insights shared by participant SE-DE, the growth rate in Germany begins with an economic forecast, such as GDP and inflation. Subsequently, industry growth rates for the upcoming five to eight years are analysed, considering the company's market share and position. These evaluations served as a basis for determining the ICT company's growth rate. By incorporating macroeconomic indicators and industry-specific data, German specialists aimed to establish a comprehensive understanding of the company's growth prospects within its respective market landscape. The assumed growth rate is expected to decrease over time. Calculating the growth rate is based on industry and economic data, and relies on judgement rather than quantitative models (Berk & DeMarzo, 2020).

> “We start with an economic forecast for GDP and inflation and then examines industry growth rates for the next 5 to 8 years, its market share and position to determine the company's growth rate” (Participant-SE-DE, deal advisory valuation, buying and selling).

In contrast, some specialists, like participant LS-DE stated that the ICT sector's ongoing digitalisation has a significant impact on the future growth rate. While historical data is not enough to rely for future predictions. The industry has more potential for growth, and historical data serves only as a baseline.

> “I think the digitalisation is significantly impacting revenue projections for ICT companies. The companies are shifting from traditional license-based selling approaches to cloud and SaaS models, which is changing the future growth rate. Although historical data serves as a starting point, it cannot be used to predict the future growth rate” (Participant-LS-DE, senior associate valuation advisory, buying and selling).

The spectrum of growth rate methods discussed by German interviewees encompasses a variety of approaches. Predominantly, nearly all German specialists employed the ICT historical growth rate, considering both the growth potential and developments specific to the ICT company. Additionally, used the industry growth rate and analysts' judgmental insights.

When determining the terminal value growth rate, reference points included the historical inflation rate and economic growth rate of Germany over recent years, as well as forecasts for future economic conditions. These elements collectively contributed to the calculation of growth rates for DCF modelling analysis in Germany.

4.3.3.1 Summary of growth rate consideration

It is noteworthy that when analysing the methodologies employed to determine growth rates in DCF analysis within both countries, there is variation depending on the specific country of the analysts involved. The Iranian study seems to have taken a conservative approach by ignoring the economic growth and analysing factors impact growth rates, such as past performance, industry potential, high inflation, and currency depreciation to predict the growth potential of a firm.

In contrast, the German specialists seem to have focused more on macroeconomic factors, such as GDP growth potential, for long-term terminal value perpetual growth estimation. While considering industry and firm performance is still important for cash flow growth projections, the emphasis on macroeconomic factors may reflect a more positive view of the economy and its potential impact on the firm's growth.

4.3.4 Black Scholes Option pricing model

Since option pricing models are among the key valuation methods suggested by current literature from developed countries but have not been applied in either Iran or Germany, as mentioned in section 4.2, and addressing this gap is essential, this section will elaborate on the application of the Black-Scholes option pricing model. The formula is provided in Appendix 8.1: Valuation Theories and Their Concepts.

The Black-Scholes option pricing model is primarily used to determine the fair value of financial options, but it can also be adapted to value intangible assets, particularly those with characteristics similar to financial options, such as patents, research and development projects, or intellectual property. Given that ICT assets often consist largely of intangible assets, the Black-Scholes model can be effectively applied in their valuation.

The Black-Scholes model calculates the price of a European-style option, which can only be exercised at expiration. It assumes that the underlying asset follows a geometric Brownian motion with constant volatility and no sudden jumps, involves no dividends or transaction costs, and can be freely bought and sold (Hull, 2017; Ryan, 2007)

> "How the underlying prices change over time can help to explore with Black-Scholes and Merton a call option value, in part, depend upon the price of underlying, the volatility of its returens, risk free rate and the time to expire" (Ryan, 2007).

Several companies have used the Black-Scholes model call option to determine the value and price of intangible assets, including Apple Inc., which applied it to value their AirPods patent project.

"After investing an initial cost of developing the invention, the owner can run the business to receive income. If not, the maximum loss is the initial investment and the patent filing cost. This characteristic is similar to a call option which allows the holder to buy shares of stock at the strike price. Apple attempted to use the Black-Scholes model to determine the value and price of its AirPods patent project." (Nguyen-Hoang, 2020).

The Black-Scholes formula involves several key variables:

S (Current Price of the Underlying Asset): This is the present value of the expected cash flows from intangible asset.

K (Strike Price): This represents the present value of costs at which the intangible asset can be developed.

T (Time to Maturity): The time remaining until the option's expiration (in this case is years), which in the case of an intangible asset could represent the time until a critical event, that can generate cash flows.

“The time to expiry can be calculated using either calendar days or trading days. In practice, because of the relativity low variance of returns over non-trading days compared with trading days a trading days calendar of either 250 or 252 days is recommended” (Hull, 2006; and Kolb 2003, as cited by Ryan (2007).

r (Risk-Free Interest Rate): The rate of return on a risk-free investment, such as government bonds or Treasury Bills.

“The discovery of the risk free rate of interest is straightforward although, unlike the case with Capital Asset Pricing Model, a Treasury Bill rate of the same term as the option concerned is appropriate. However, Treasury Bill rate normally quoted in the financial press is calcualted using simple compounding to get the annual equivalant rate. However, in option pricing we are using continuous time discounting and more accurate estimate of continuously compounded rate of return” (Ryan, 2007).

σ (Volatility): The standard deviation of the asset's returns, representing uncertainty in the asset's future value.

“The measure of the volatiity of the underlying security is the annulised standard deviation of the continously compouneded rate of return” (Ryan, 2007).

“We can calculate the variance in the value of the underlying asset by determining the variance in cash flows of similar assets or firms. Alternatively, we can calculate the variance in present value from capital budgeting simulation” (Damodaran, 2009).

δ Expected Cost of Delay (Dividend Yield): This factor is used to adjust for a known dividend yield by reducing the present value accordingly when a project has a finite lifespan (the annual cost of delay is equal to 1 divided by the number of years).

“The expected cost of delay, often represented as the dividend yield (δ), is calculated as the reciprocal of the patent life (time to expiration) when dealing with patents and R&D options. This calculation is based on the assumption that the value of the option (or patent) decays linearly over time, similar to how dividends reduce the value of a stock” (Damodaran, 2009).

The result from the Black-Scholes formula provides the theoretical fair value of the intangible asset (ICT in this case), considering its potential future payoffs and the associated uncertainties. This value can be used in decision-making processes, such as determining whether to invest in, sell, or further develop the asset.

Some of the Limitations includes that the model assumes constant volatility and no dividends, which may not hold for all ICT projects. The Black-Scholes model only applies to European-style options, meaning it assumes the option (or asset) can only be exercised at a specific time, which might not always be applicable. ICTs often have complex and uncertain future benefits, which can be difficult to quantify accurately using a model designed for financial options (Hull, 2017).

4.3.4.1 Summary of Black-Scholes model

While the Black-Scholes model was originally designed for financial options, its adaptability allows it to be used for valuing intangible assets such as ICTs by treating them as options with future payoffs. The model provides a structured approach to estimate the value of such assets, taking into account time, uncertainty, and expected returns.

4.4 Results for the third research objective

From the findings generated, provide a new academic insight as to how Iranian ICT companies are valuated.

To address the third research objective, the study examined participants' suggested valuation methodologies for Iranian ICT enterprises in the future. It also identified the optimal means of communicating the results to customers while providing adequate justifications for the use of different valuation methods. Addressing this research objective, the researcher discusses academic understandings and interviewed German participants for their suggestions on ICT firm valuation techniques and future implications. This study further examined into determining the optimal method for presenting outcomes to clients, while also addressing the challenges analysts must take into account when assessing the value of ICTs from both Iranian and German perspectives.

4.4.1 Suggested methods for future valuation of ICT firms

The valuation of ICTs in Iran due to their recent development, dynamic business model, and reliance on intangible assets has sparked interest in this study. After reviewing the current literature and conducting interviews with Iranian and German specialists, the following approaches to valuing ICT assets have been presented: To evaluate these firms, business models, performance measurements like revenue, earnings, sustainable margins, and return on invested capital are crucial. Furthermore, six key factors have been recognised to determine a company's valuation over time, which include weighted forecasts of revenue growth, weighted cost of capital, market volatility, industry risk, and competitive position, as mentioned by some researchers such as Berk and DeMarzo (2020) and Brealey et al. (2020) and A Damodaran (2016).

To understanding the appropriate valuation methods for Iranian ICTs it is essential for comprehending the suggested approaches for valuing ICT firms in the literature and empirical research. In this section, the commonly used valuation methods and the suggested methods by participants were explained.

4.4.1.1 Application of DCF-Based Models and Market Approach for Future Valuation of ICT Companies

Regarding suggestions for future use of the methods, participant MS-IR suggested using a combination of DCF-based models and multiples series in the valuation process. By employing these methods, a comprehensive understanding of the valuation can be achieved. Combination approach allows for estimation of values derived from various methods, providing with valuable insights into the valuation from both operational and market perspectives. The integration of DCF-based models and multiples series enhances the accuracy and robustness of the valuation analysis, enabling informed decision-making for the client.

> "I suggest employing DCF-based models and multiples series. The combination of these methods provides an in-depth understanding of the valuation and can provide the client about the estimated values derived from various methods, as well as help them understand the valuation from an operational and market perspective" (Participant-MS-IR, M&A advisory specialist, buying and selling).

Using a combination of valuation techniques to evaluate the value of the ICT companies was offered the DCF-based method and the multiples since they incorporate both the operational and market viewpoints on the company's value. Participant MM-IR remarked that there was no better alternative than DCF and multiple approaches for valuing ICT companies; therefore, participant MM-IR will use and suggest them in the future valuation of such companies.

> "As previously said on the applicable approaches, I am unaware of any better methods, so I would use them and also recommend their use in the future. In the future, if I want to value an ICT company, I will employ multiple approaches, such as earnings, EBIT, EBITDA multiples, etc. I can calculate the earnings using the DCF model and discount them to the present. Because of their common use, multiples are also easily obtainable and can be performed." (Participant-MM-IR, senior valuation specialist, buying and selling).

As stated by participant MHB-IR, the suggest methods were DCF and multiple models as a valuation approach for ICT companies. However, the macroeconomic conditions and various elements should be considered in the valuation process. Participant MHB-IR mentioned that

excluding factors like inflation and exchange rate volatility could diminish the reliability of the models. Therefore, Iranian specialists should incorporate these variables into valuation models to obtain a more accurate value for ICT companies in the future. The participant MHB-IR also suggested that estimating the dollar replacement value could contribute to the valuation process.

> "I suggest DCF and multiple models for valuing ICT companies, but I would also consider macroeconomic conditions and various elements. However, eliminating various factors such as inflation and exchange rate volatility can make the models less reliable. Specialists should include these variables in valuation models to determine a more reliable value for ICT companies in the future. I think, the dollar replacement value in estimations can help on valuation" (Participant-MHB-IR, deal advisory valuation, buying and selling).

Other specialists such as HM-IR proposed implementing the DCF and market multiples, participant MH-IR highlighted the importance of applying the DCF and multiple methods with calculations in U.S. dollars to account for high inflation and avoid nominal profit distortions. Furthermore, participant MH-IR emphasised the significance of conducting scenario and sensitivity analysis to capture potential uncertainties and assess the robustness of the valuation.

> "I can say to value ICT companies, the DCF and multiple methods should be applied. Calculations should be done in U.S. dollars to avoid nominal profits due to high inflation. The company's value should be based on the current U.S. dollar price and forecast for future. Sales cash flow and market value should be presented in U.S. dollars, and the valuation should be included in the calculation of multiples. It is also important to conduct a deep scenario and sensitivity analysis" (Participant-HM-IR, valuation specialist, buying and selling).

Participant MH-IR commented on the importance of Iranian practitioners in the ICT field being well-versed in proper valuation models. Participant MH-IR highlighted the challenges associated with identifying variables, predicting changes, and assessing variables' impact on future valuations. The current situation in Iran is characterised by high volatility, particularly in inflation and exchange rates. For companies relying on foreign currency, exchange rate fluctuations could significantly affect their valuations. It is crucial to consider the impact of interest rates, inflation rates, and other relevant variables, and determine the appropriate

analysis method and weighting for each variable. Participant MH-IR suggested conducting sensitivity analysis on cash flows, profitability, and other variables, and considering conservative scenarios given Iran's current situation.

> "I think the challenges of valuing ICT companies for financial professionals beside selecting the appropriate methods is determining the variables that affect valuation. The high volatility, changes in exchange rates, interest rates, and inflation rates are some critical variables to consider, and I suggest sensitivity analysis and taking a conservative approach to consider the tolerances of cash flows and profitability of companies to avoid surprises" (Participant-MH-IR, deal advisory valuation, buying and selling).

Participant MB-IR emphasised the importance of using a combination of valuation methods and conducting in-depth analysis of influencing variables. Participant MB-IR noted that converting values into U.S. dollars is not a sustainable solution but rather a way to assess the impact of variables on valuation. Participant MB-IR suggested that the key to improving valuation lies in achieving macro-level stability, which is beyond the control of Iranian specialists. As a result, Iranian specialists should focus on incorporating the effects of variables into their valuation models to enhance accuracy and reliability.

> "I recommend using a combination of valuation methods and conduct more analysis on variables that impact valuation. Calculations can be done in U.S. dollars to understand the impact of inflation, but this is only a conversion, not an improvement. The valuer should consider and account for important variables that affect valuation as much as possible. However, to improve existing problems, stability at the macro level of the country is necessary, which is beyond the valuer's control" (Participant-MB-IR, deal advisory valuation, buying and selling).

The vast majority of Iranian interviewees underscored that for future valuations of ICT companies in Iran, the suggested methods include DCF-based models' analysis and the market approach. The market approach involves assessing various financial ratios and earnings multiples derived from both the specific ICT firm and the industry. As a third avenue, a few Iranian interviewees suggested adopting the replacement cost value, particularly doing the estimations in U.S. dollar, due to its cost-effective valuation insights. Furthermore, a subset of Iranian participants emphasised the importance of conducting scenario and sensitivity analysis to effectively encompass potential uncertainties and the

impact of various variables on valuation outcomes. The consensus among Iranian participants centred on the combined application of these three methods, which collectively offers a comprehensive perspective on ICT valuation.

Different researchers Dastkhan (2022) and Ong and Mohd-Rashid (2021); Visconti (2020a) highlighted the dominant approach for evaluating high-tech, platform, or software companies is based on the discounted cash flow (DCF) method, multiples, and examining the growing perpetuity potential of the ICT. Other studies also like Yun and Andrew (2013) have been conducted to assess the effectiveness of different valuation approaches. Yun and Andrew (2013) examined empirical valuation models in the UK and evaluated various estimation methods based on criteria such as bias and accuracy, which identified the most effective way to eliminate the bias is the combinations of valuation methods.

The investigation among German interviewees concerning suggested valuation methods includes a range of participant perspectives, as highlighted by participant LK-DE, it is crucial to establish a potential and realistic value range, ensuring consistency among the different methods used. If a valuation method yields a value outside the established range, it is important to investigate the reasons behind it and take necessary precautions to prevent errors. Therefore, multiple valuation methods are employed simultaneously to strengthen the overall valuation results.

> “In finance, there is not a universal method to determine the value of a company. Depending on the case, different methodologies may be more relevant, such as DCF, and transaction multiples or trading multiples. It is not possible to arrive at one number as there is not necessarily one answer in finance” (Participant-LK-DE, senior associate valuation advisory, buying and selling).

Participant DJ-DE also emphasised the importance of combining the DCF method with multiple valuation approaches. Participant DJ-DE highlighted the need to thoroughly understand the company's business plan and identify the key value drivers specific to ICT firms. This comprehensive understanding of the business and its unique factors is crucial for conducting an accurate and insightful valuation.

> “If I would be the decision maker, I would really go for the company's business plan and do the DCF and multiple. But I would say is highly challenging the value drivers of ICT companies” (Participant-DJ-DE, deal advisory valuation, buying and selling).

Additionally, participant KB-DE also highlighted the importance of the DCF model in relation to multiple valuations. Participant KB-DE pointed out that the DCF model should serve as the foundation for the multiple valuation approach, ensuring that the two methods align closely. If the DCF and multiple valuations yield significantly different results, it may indicate an issue that needs to be addressed or reviewed in the valuation process.

> “The DCF model should prove the underly the multiple valuation. It should be somewhere in the middle. If the DCF and multiple showing completely different valuation something is wrong” (Participant-KB-DE, M&A specialist, buying and selling).

Participant RB-DE suggested that there is no one value for ICT companies and that the value can be calculated using discounted cash flow with certain assumptions.

> “I think the key there really is that there is no one value. Because I can calculate the value using a discounted cash flow with the assumption that I want” (Participant-RB-DE, deal advisory valuation, buying).

However, participant WL-DE added the importance of having a compelling narrative and being able to effectively communicate the valuation assumptions. Participant WL-DE emphasised the need to combine multiple methodologies to thoroughly discuss and validate the underlying assumptions used in the valuation process.

> “Obviously, I would need to have a very good story to be up to convince you. But then we will combine a number of different methodologies to discuss assumptions" (Participant-WL-DE, senior associate valuation advisory, buying and selling).

Additionally, participant SE-DE noted that valuation is a process of triangulation, where multiple reference points are crucial. Participant SE-DE highlighted the importance of having

multiple sources of information and perspectives to validate and support the valuation analysis.

> "For me, valuation is very much a process of triangulation. It is key to have a couple of reference points" (Participant-SE-DE, deal advisory valuation, buying and selling, DE).

Interestingly, the study, conducted in both countries, found that all participants suggested adopting a combination approach that includes various valuation methods when assessing ICT companies. This methodology is seen as a valuable tool for future ICT valuation practices. While the DCF method emerged as the primary approach in Germany, German specialists also supported using a combination of methods. This approach serves the dual purpose of gathering insights from multiple sources and verifying results for consistency. The examination of ICT firms in Germany further confirms the value of employing a blended approach. There is a general consensus among German specialists regarding the benefits of combining DCF with multiples to enhance accuracy and reduce errors. Incorporating the market approach entails considering enterprise value alongside a wide range of financial metrics and past transactions within the ICT sector, all contributing to a more nuanced valuation of ICT entities.

The disparities between the Iranian and German valuation processes are evident, particularly in the detail analysis approaches. In contrast to the Iranian specialists, who demonstrated a broader spectrum of using valuation methods, all German specialists advocated for the employment of the discounted cash flow analysis with the free cash flow to the firm (FCFF) method. FCFF methodology, encompassing the holistic valuation of the entire ICT firm, and was acknowledged by both the IDW and German practitioners in this study. Moreover, the German specialists collectively stressed the importance of conducting thorough scenario, sensitivity, and Monte Carlo simulations across various layers of the DCF analysis. The detail scenario, sensitivity, and Monte Carlo analysis approach serves in ensuring covering uncertainties of important variables and a holistic and well-informed valuation process.

4.4.1.2 Application of Option-Based Models for Future Valuation of ICT Companies

Even though German and Iranian practitioners have not widely used option-based pricing models, theory and current literature suggest that these models are well-suited for valuing

companies, such as those in the ICT sector. After reviewing the lack of use of this model, further justification of German practitioners is provided in Section 4.2.4. The Iranian context presents additional challenges, but if Iranian practitioners can overcome these issues, this study suggests applying option-based pricing models, such as the Black-Scholes model or the binomial model, for the valuation of ICT companies in Iran.

> "One main challenge is that Islamic finance principles, which prohibit usury (riba) and excessive uncertainty (gharar), can impact the use of certain financial instruments, including options pricing models. In Iran, where these principles are strongly adhered to, the application of options pricing models may be limited due to these restrictions" (Todorof, 2020).

In situations where options pricing could be relevant, they may not be explicitly labelled as such or used because of the perceived conflict with Islamic financial principles. Therefore, the lack of options pricing models in Iran may not necessarily reflect a lack of sophistication or capability in the ICT sector, but rather adherence to Islamic financial norms and regulations.

According to a study by Uddin (2015), modifications to certain functions of the interest rate component can allow practitioners in Islamic countries to use option-based models in their valuation processes. These adjustments include profit-sharing from projects instead of receiving a fixed interest rate, as well as incorporating leasing agreements and commodity-backed contracts. These modifications align with Sharia principles and facilitate the application of the interest rate as a key valuation component in option pricing models.

> "Islamic finance relies on alternative pricing mechanisms such as profit-sharing arrangements, leasing agreements, and commodity-backed contracts, all of which align with Sharia principles and facilitate risk-sharing between investors and entrepreneurs. Although some scholars propose modified option pricing models for Islamic finance, excluding interest rate components and relying on alternative valuation methods, their practical adoption remains limited" (Uddin, 2015).

Since the option pricing model is a key valuation tool, this study suggests that Iranian advisors modify the interest rate component to align with Islamic finance principles and begin using option pricing models in ICT valuations in Iran. However, the practical

application of these models is still delayed by several factors, including limited knowledge and education about these models within financial institutions and among advisors. Additionally, the absence of option trading on the Tehran Stock Exchange further limits the opportunity to practice and implement these models effectively. Without the availability of option trading capabilities, it is challenging to envision how option pricing models would operate in practice there. Therefore, until option trading becomes a reality on the Tehran Stock Exchange, and advisors educate themselves with option pricing models, the issue of using option pricing models remains hypothetical and distant.

4.4.1.3 Summary of suggested methods for future use

The valuation advisors from both countries advised adopting a combination of valuation methodologies to establish a valuation range, rather than relying solely on a single method. The suggested approaches encompass discounted cash flow, market multiples, as well as trading and transaction records. This study also suggests that Iranian advisors consider using option pricing models with alternative interest rate components that are compatible with Islamic finance. However, the practical application of these models is hindered by several factors and challenges mentioned above. It is crucial to consider the specific circumstances and value drivers of each ICT company to ensure a reliable and consistent outcome. The objective was to present a valuation range that accounts for relevant factors and offers the client a fair estimation of the ICT company's value.

4.4.2 Final Valuation Conclusion

This study also discusses the importance of choosing the proper value presentation when arriving at multiple values from different valuation models. It is crucial to present the selected value effectively. The author questioned participants on their approach to this topic. The main idea is that applying various valuation models result in a range of values, but the focus should be on selecting and presenting the most relevant value. Researcher such as Fornaro and Barbera (2007) reviewed the adoption of SFAS 157 is a major development in fair value measurement and reporting. Its hierarchical system aligns with the FASB's goal of providing useful fair value information for decision making. By categorising valuation inputs

and increasing disclosures, users can better understand an entity's fair value valuations, the valuation reliability, and comparability. Other researchers like Gharbi (2016) have emphasised the implications of valuation techniques and emphasised the importance of finding an acceptable alternative pricing benchmark reporting standard. In terms of the methods employed to present the outcomes, Participant HK-IR articulated a dual-pronged approach. This approach involved adhering to the Iranian Privatization Organization (2020) institute's guidance to compute an averaged of values, alongside with analysts for internal purposes to assign varying weights to the values derived from different valuation methods.

> "As I said the combination of methods is better. Regarding presenting the values from different methods, we have two methods to present these values. First, there is a solution given by the IPO organisation, which says that you can consider the average of three values obtained different models. Second method is where specialist's opinion is significance their internal institution. For example, they say that they give 40% weight to the income approach value, 20% weight to the replacement value, and 40% to the market benchmark." (Participant-HK-IR, senior deal advisory valuation, buying and selling).

Additionally, participant HM-IR added the same statement that the values of these different approaches are given distinct weights. And simultaneously show the spectrum of ICT company values and explain to clients where the variances and overlaps originate.

> "When we are done with valuations, then we give each of these methods a percentage weight, and we say that this is the value that we think this ICT company is worth" (Participant-HM-IR, valuation specialist, buying and selling, IR).

For presentation of results, participant MM-IR also mentioned that they are using two techniques: weighted average with varying weights based on availability of data, and simple average when there is not enough confidence, competition, or data for the ICT company, like new ICT businesses.

> "If the company is new, it does not have many competitors in the market, and the analyst does not know which model to give more weight to, they give the same weight to all of them. For example, if we used four models, the values would be divided by four. But when there are more available details and there are enough competitors in the market that a more accurate comparison can be made, then we determine which

> model to give more weight to" (Participant-MM-IR, senior valuation specialist, buying and selling).

In the contrast, participant MH-IR was the only participant that explained they give the range of values to clients and determine which value makes the most sense through team discussion.

> "For us, the main basis for the valuation of ICTs is the DCF and different multiples, which are presented to the customer as a range of values, and finally, with the explanations and discussions we do as a team, we decide which final value to present" (Participant-MH-IR, deal advisory valuation, buying and selling).

The findings regarding the presentation of par value indicated that all Iranian specialists employed two distinct approaches, namely averaging and the weighting average method, to present estimated values. The first method involved following guidance provided by the IPO organisation, entailing the calculation of an average derived from a suite of independent valuation methods, including DCF, DDM, multiples, and replacement. The second method was founded on the collaboration between an specialist and a private institution tasked with conducting the valuation for the client. In weighting average approach, the valuation process relied upon the Iranian specialists' judgement of the ICT company's position, allocating greater weight to the methods for which the specialist held higher confidence, while assigning less weight to those less relevant to the company's unique circumstances.

It is interesting to note that many German specialists had different perspectives and standards compared to those in Iran. As highlighted by German participant LK-DE, when presenting the results, the DCF result took precedence, while multiples were used to reinforce the credibility of the valuation and to assess whether the derived value falls in the same ranges.

> "In Germany, when it comes to accounting or tax valuation, the leading approach is DCF if a complete business plan is available, and multiples are used to see if the DCF is in the range of multiples. Averaging of different valuation methods is not common practice in Germany" (Participant-LK-DE, deal advisory valuation, buying and selling).

Similarly, participant MH-DE noted that the DCF method was typically considered the leading valuation method in Germany and was widely accepted in the marketplace. Participant MH-DE highlighted the importance of starting with the DCF valuation and then using multiple valuation methods to ensure consistency and validate the results.

> "We say typically the DCF is the leading method, and this is let's say is reasonable context also to the marketplace. So, you come from DCF valuation then do the multiple valuations and see where this is in the same range" (Participant-MH-DE, deal advisory valuation, buying and selling).

In addition, participant DJ-DE pointed out that the practice of applying weights to different valuation models or giving average weights to different values is not a common practice in Germany. Instead, the German standard was to use DCF as the leading valuation method, and multiples were used to determine if the derived value is in the range with multiple. In contrast, the approach of giving equal weight to multiple models is more commonly used in the U.S. and UK.

> "When we look at U.S. colleagues or UK colleagues, we have frequently seen that they did the multiple assumptions to just see the average of multiple and DCF. I would say this common in the US. But in Germany, we never do that. We just say DCF is a leading approach if you have the complete business plan, we will just do the multiples to see whether the DCF was in the range. We would not do an average if it's come to the transactions, we would not do an averaging of the different methods, no! Not in Germany" (Participant-DJ-DE, deal advisory valuation, buying and selling).

Similarly, participant GU-DE added in the same remark that the German method differs from international norms that they are weighting the values. In Germany the DCF was the preferred method, and that the multiple method was utilised for reasonableness considerations.

> "The German way to look at company valuation I would call it. What I can see in the international practices that the weighting of certain result and you apply 25% here and 30% there. That's not the German way. As for us, the DCF is the dominant approach, and we use the multiple approach for plausibility purposes" (Participant-GU-DE, deal advisory valuation, buying and selling).

Also, participant AE-DE explained that while the DCF method was the primary approach, multiples are used to corroborate the accuracy of the estimate and ensure it was not entirely erroneous. In cases where information was not available and the business was in its initial stage, participant AE-DE might provide the client with a range of values and identify the median value that aligns with most of the range.

> "We often have DCF as leading approach at the other side there to substantiate or actually verify that we haven't come up with a completely wrong estimate. But that's given by regulation that is very specific. In a regular valuation of transaction, you wouldn't do like averaging, unless you are acting as an early-stage M&A adviser. (Participant-AE-DE, deal advisory valuation, buying and selling).

In contrast, participant RH-DE stated that they present all range of values using various valuation approaches. Participant RH-DE mentioned, it was highly dependent on the buyer's perception of the ICT business's potential in terms of synergies, solutions, emotions, and expansion plans. These factors influenced the price that purchasers were ready to pay for an ICT business, this was what making a generic valuation very difficult.

> "I don't think it's one method, we have to present all methods values. But there is no natural value for the businesses. Very often we have negotiation, the values always are in the eyes of the buyer's perception of the business's potential in terms of synergies, solutions, emotions, and expansion plans. The buyer pays what it worth to them" (Participant-RH-DE, M&A advisory, selling).

Analysing the collected data revealed that all of German interviewees agreed that DCF stood as the primary and dominant value to lean on. Nonetheless, there was a consensus that multiples ought to be employed as well, not only to validate the credibility of the valuation but also to demonstrate that the resultant value aligns with market multiples. This observation was made by a few of German participants, who stressed that if different valuation approaches practiced then to present all of values as a range to the clients.

4.4.2.1 Summary of final valuation conclusion methods

To summarise the presentation of final values, the analysis of the findings revealed interesting differences between Iran and Germany. Iranian specialists followed averaging and

weighted average approaches. A substantial number of Iranian participants disclosed their adherence to presenting an averaged value method, as recommended by the IPO, which is then provided as the final valuation. However, some Iranian specialists assigned greater weight to the approaches they deemed more reliable, leveraging their familiarity with the valuation analysis details.

Conversely, German specialists adhered to the IDW's guidance on value presentation. German specialists typically favoured the discounted cash flow method as the primary valuation approach, using multiple methodologies mainly for validation purposes. However, some German specialists proposed presenting ICT values as a range from high to low. Alternatively, the DCF method took precedence unless the ICT company was in its early stages, lacking sufficient data and facing no competitors. Overall, employing multiple valuation methodologies, considering unique circumstances, and presenting a valuation range will enhance the accuracy and reliability of ICT company valuations, providing valuable insights to clients and stakeholders.

4.4.3 Issues and challenges to address in ICT valuation process

Since specialists in Iran identified the number of variables involved in the valuation process, the researcher inquired about the challenges evaluators have during the assessment process and how they overcome these obstacles. In this regard, participant MM-IR presented macroeconomic factors as one of the most significant issues in the valuation process. As a result, the local currency depreciated against the foreign currencies. It was crucial to assess these fluctuations and apply them to future decisions. The instability of the bank interest rate and rapid changes in government directives generate uncertainty and volatility, caused a delay in the development plans of businesses, and caused the entire valuation model to fail. The only shortcut to address these issues was that some Iranian specialists have shortened the projection period to two to three years and considered calculations in U.S. dollars.

> “The problems in the valuation process are impacted by macroeconomic issues such as fluctuations in currency exchange rates, changes in tax regulations, and uncertainty in domestic and global prices. These factors can cause delays in development plans and create difficulties in the valuation process. To address these challenges, specialists have developed workarounds such as shortening the time frame and considering U.S. dollar calculations” (Participant-MM-IR, senior valuation specialist, buying and selling).

In addition, participant MHB-IR mentioned the incalculability and unreliability of the growth rate and discount rate as the process's two greatest obstacles. These obstacles resulted from the macro-risks, which made it challenging to perform the valuation and restricted them to short-term estimates.

> "The biggest challenge, if I want to express two main cases, is that the growth rate and the discount rate are not very calculable and reliable, and the variables have only made them possible to calculate for a short period of time. The instructions are inconsistent and not systematic, which means the analyst does not have evaluable parameters and they are not reliable. It causes the calculations and models to be confused to some extent. The interest rate is changing, and inflation is high in the current situation" (Participant-MHB-IR, deal advisory valuation, buying and selling).

Also, participant MB-IR addressed other issues such as the increase in investment risk due to a lack of political stability and the shift towards short-term expectations. Changes in laws, regulations, and standards, the tax system, excessive interest rates, and inflation hinder the growth of many businesses. And inflation led to a high discount rate and the vanishing of values. The inability to assign considerable weight to the future made the valuation unreliable and reduced analysts' attention to detail to an extent.

> "Among the problems that have made the valuation process very difficult is the lack of political stability, including economic sanctions and changes in laws and regulations, which increase investment risk and expectations have gone towards the short-term. High-interest rates, inflation, and tax system modifications affect company profitability and unable in development. Inflation is especially damaging, and requiring a high discount rate, which can reduce the reliability of valuations and decreases attention to detail and cannot give significant weight to the future" (Participant-MB-IR, deal advisory valuation, buying and selling).

Furthermore, the research findings revealed a lack of competitiveness and established standards among Iranian specialists in conducting comprehensive analyses of the valuation process. Participant MA-IR emphasised that the main challenge stemmed from the high level of instability in Iran, which hindered specialists from delving deeper into the valuation process. Iran's instability was caused by factors such as frequent regulatory changes, leading to fluctuations in variables that impact the evaluation of ICT companies. Additionally, the

short-term perspective adopted in the analysis was influenced by the country's situation, further affecting the valuation procedure.

> "The current valuation environment lacks competitiveness and practitioners need to pay closer attention to details and standards in their analysis. However, various external factors such as changing laws and regulations, fluctuations in government-set variables like interest rates and inflation rates, make it difficult to accurately value assets. These conditions lead to a short-term view and may cause valuations to be done incorrectly" (Participant-MA-IR, valuation specialist, buying and selling).

Most of Iranian specialists acknowledged that the valuation process for ICT companies faces significant challenges rooted in macroeconomic factors such as high inflation, shifts in tax regulations, and currency fluctuations. These elements hinder development plans and intricacies in valuations. To mitigate these issues, Iranian specialists employed strategies such as shortening timeframes and considering calculations in U.S. dollar. Additionally, some Iranian participants highlighted the unpredictability of growth, changing interest rates due to macro-risks, and the political instability, resulting in a limitation to short-term valuation estimates. The lack of competitiveness and established standards among Iranian specialists, contribute to the issues affecting the valuation of ICT companies.

As participant RH-DE and participant NC-DE also mentioned that financial planning and the ICTs' cash flow to customer dependencies can make this process challenging. Estimating revenue to be logical is particularly difficult, with uncertain assumptions that cannot be easily verified. Changes in the industry and firms also pose challenges, and obtaining information from new customers can be difficult, especially for private companies. Guler and Gomceli (2019), stated that the evaluation of innovative high-tech companies can be challenging due to their unique characteristics, such as uncertain future cash flows, intangible assets, and industry dynamics.

> "You don't know the future; the future is always a black box. Doesn't matter how the past was. There is no guarantee that your growth keeps going on in the business. So, the financial planning for future is very challenging" (Participant-RH-DE, M&A advisory, selling).

Participant NC-DE highlighted that establishing revenue rationale in valuation is challenging. Accuracy in different component of the valuation process is crucial, analysts should consider

the potential errors in all aspects of valuation. Valuation complexity and uncertainty require careful analysis and decision-making. Striving for highest accuracy level is emphasised despite challenges.

> "For me the most challenging part is to get the good rational for the revenue. Every part of the valuation is critical because it can always go wrong, and our job is to try to be the most accurate as possible" (Participant-NC-DE, valuation advisory, buying and selling).

As participant KB-DE explained the accuracy is crucial at every stage of the transaction, but some parts of the DCF valuation, such as determining the discount rate and peer group, can be problematic due to a lack of information and databases in certain industries.

> "The most problematic part in DCF is the discount rate for me, because is very hard to get all the peers or get the proper peer group. To get the whole business logic, to the operating model, to get the proper growth rate" (Participant-KB-DE, M&A advisory, selling).

Participant LK-DE mentioned some problems during the valuation process is that the buyers and sellers have different perspectives and information needs. Due diligence is a key part of the valuation process because buyers focus on achieving a minimum or fair value, in contrast the sellers seeking for the maximum sale price, which make the work of analysts even challenging.

> "When we are doing the valuation for the buyer side, and normally for the buyers are more sensitive, I think. But I would say the buyer side mostly looking for the fair value or under-priced value. In a later stage you have more information based on the due diligence" (Participant-LK-DE, senior associate valuation advisory, buying and selling).

The German participants contended that the issue is that valuation is a process of triangulation, with no one value being the definitive answer. Different methodologies should be combined, and reference points are important. Another challenging part of the process is developing a proper forecasting and assumptions in discounted cash flow model and understanding the business model to know whether the assumptions make sense or not.

> "I can say the challenge from M&A advisory perspective, I think the key there really is that there is no one value. We will combine a number of different methodologies. It is key to have a couple of reference points. When you have two, three, four, then you can start referencing and say, OK, well, this is a DCF, these are the outcomes from all the different methodologies" (Participant-SE-DE, M&A advisory, buying and selling).

Participant WL-DE highlighted the challenges of financial analysis and forecasting in evaluating an ICT investment opportunity. The importance of accurate cash flow forecasts, industry understanding, and reasonable assumptions as vital aspects of the evaluation. The participant regarded conducting a comprehensive DCF analysis as crucial for assessing the ICT's future financial performance. Participant WL-DE also considered cash flow phase to be the most challenging area of the valuation process which necessitate knowhow and attention to detail.

> "I think it is really that cash flow forecasts, developing a good DCF, understanding the industry is about, to know whether the assumptions to be a reasonable and trying to establish the starting point. I think is probably the most challenging part of the whole process" (Participant-WL-DE, valuation advisory, buying and selling).

The German specialist participants elaborate about how to approach valuations from both the buyer and seller perspective, including the limitations of available information and time constraints. They emphasised the importance of understanding the business context and potential behind the numbers, rather than relying solely on mechanical valuations.

> "Usually, the seller is more optimistic than the buyer. And the way to find the common ground for both field is sort of the main challenge. That is the fact that data gathering sometimes is problematic" (Participant-NC-DE, deal advisory valuation, buying and selling).

Participant RO-DE expressed the difficulty and additional complexities of correctly interpreting numerical data and forming a comprehensive perspective when analysing a business plan, in the context of the Covid-19 pandemic due to the uncertainties and disruptions caused by the pandemic.

> "This is sometimes the challenge you have to overcome to actually interpret the numbers in the right way and to develop a good view with the business plan, if it is ambitious, realistic or conservative in this pandemic era" (Participant-RO-DE, deal advisory valuation, buying).

Most of the German participants agreed that the ICT valuation process presents notable challenges, highlighting the intricate nature of assessing an ICT business's value. While some challenges stemming from macro variables beyond analysts' control were acknowledged, the majority of Germans primarily underscored issues related to specific intricacies within the ICT sector and the complexities of predicting future outcomes. The complexity of the valuation process is further compounded by the specificity of the industry being valued, such as ICT. The process of valuing an ICT is difficult due to the higher uncertainty of future business trends, the impact of the pandemic, and the challenge of predicting long-term outcomes (Thanh, 2022).

4.4.3.1 Summary of issues in ICT valuations in Iran and Germany

This study findings found that the difficulties Iranian specialists encountered when evaluating ICTs, was because of the lack of established organisational standards and deep analyses to aid Iranian specialists in overcoming related variables and producing accurate valuations. While Iranian specialists identified several macro-level variables as the primary hindrances to their valuation analysis, their approach was primarily focused on attitudes rather than comprehensive analyses such as detailed scenario planning, sensitivity analyses, and Monte Carlo simulations. In contrast, German specialists, despite working in a country with a very stable macro environment, approached valuation with a more professional and thorough methodology, including detailed scenario and sensitivity analysis, and Monte Carlo simulations techniques. German specialists also placed a greater emphasis on fulfilling their commitment to producing effective outcomes from their estimations.

4.5 Word cloud analysis

This section presents a word cloud of the interview results generated by NVivo in Figure 4-2 before summarising the findings discussed in Chapter Four. A word cloud is a visual

representation of the 100 most frequently used words, excluding fill words, in the form of a cloud. The size of the words indicates their frequency of use, providing an intuitive and visually appealing overview of the text. The word cloud helps obtain an overview of the most frequently used words and validates the findings based on a brief textual analysis.

A total of 25 interviews were conducted from Iranian and German specialists, with all transcripts translated into English, resulting in an English word cloud output. To enhance the usability of the output, some most frequently used words and phrases were highlighted, including those related to the general topic of the research, such as 'valuations', ‘ICT’, ‘value’, ‘rate’, ‘risk’, ‘methods’, ‘growth’, ‘model’, and 'cash'. Other often-used words were relevant terms discussed in this study, such as ‘analysis', ‘market’, 'approach', and 'DCF'.

Additionally, frequently mentioned words included ‘capital’, ‘process’, 'different', and ‘discount’. The terms ‘future', 'flow', and ‘multiple’ were also found in the word cloud. Furthermore, the phrases ‘process', ‘qualitative', ‘inflation', ‘Iran’, ‘German’, and ‘industry’ were among the most frequently used words.

Overall, the word cloud indicates that large parts of the content of this chapter were among the 100 most frequently used words, showing that the focus themes were appropriate and reflected most of the most-often discussed terms in the interviews.

Figure 4-2. Word cloud output analysis

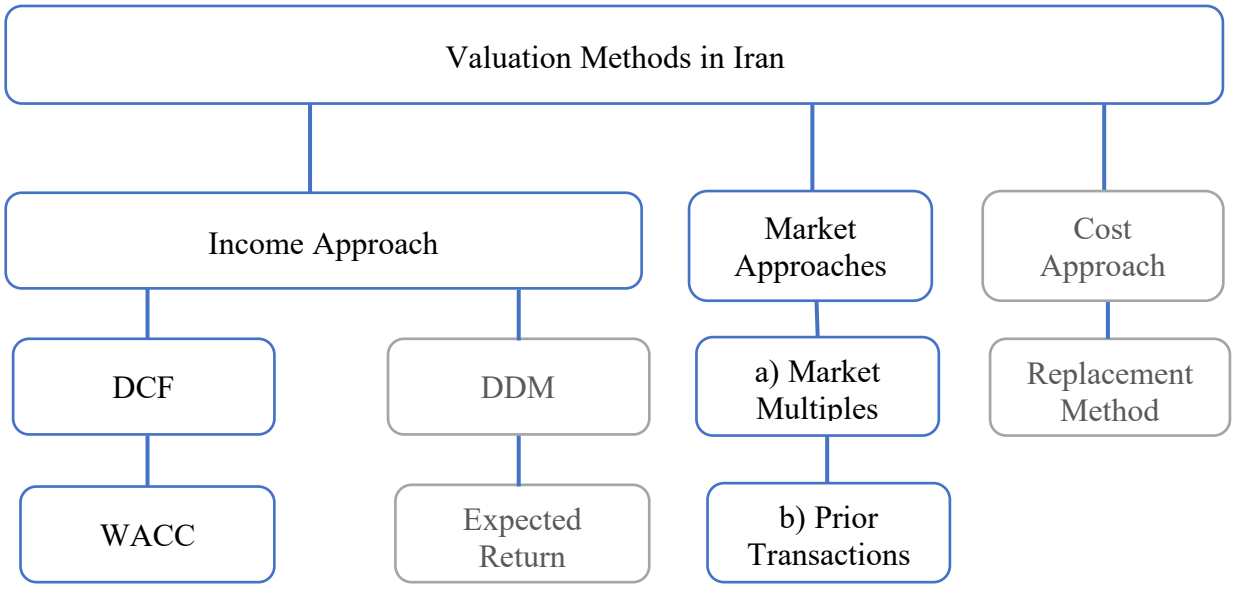
Source: Author’s illustration (Word cloud output from NVivo)

4.6 Summary of results and findings chapter

In summarising the results and findings of Chapter Four, it can be observed that in Iran, the prevailing methods used by ICT valuation specialists to determine the value of ICTs were the discounted cash flow (DCF), dividend discount model (DDM), and multiples. Iranian advisors mostly followed international standards from the UK and the US during their evaluation procedures, but the application of option pricing models (OPMs) was missing. The replacement method was occasionally employed to calculate the current cost of an ICT company. Venture capital was mentioned by some Iranian participants that was for high-risk start-ups but none of the participants practiced VC. The cost of capital, a crucial and challenging aspect of the valuation process, was simplified in Iran by primarily using the weighted average cost of capital (WACC) approach, which incorporates the capital asset pricing model (CAPM) to calculate cost of equity in the discount rate. However, the calculation of beta was not carried out by Iranian specialists. The growth rate calculation primarily relied on historical and industry averages, but external factors were also taken into consideration. Iranian specialists shortened the estimation period to two to three years and converted their calculations to US dollars due to high inflation. For future ICT valuations in Iran, a combination of the DCF and multiple approaches was suggested, while the range and weighted average methods were used for the presentation of results.

The Figure 4-3 illustrates the methodologies that were conducted by Iranian specialists, and the approaches and components utilised to determine the final value of ICT companies in Iran. The blue colour represents the primary approaches, while the gray colour corresponds to secondary approaches. These were chosen based on IPO guidelines and Iran's specific conditions, which include dividend payments and significant cost fluctuations in ICT projects.

Figure 4-3. The valuation methods applied by Iranian advisors



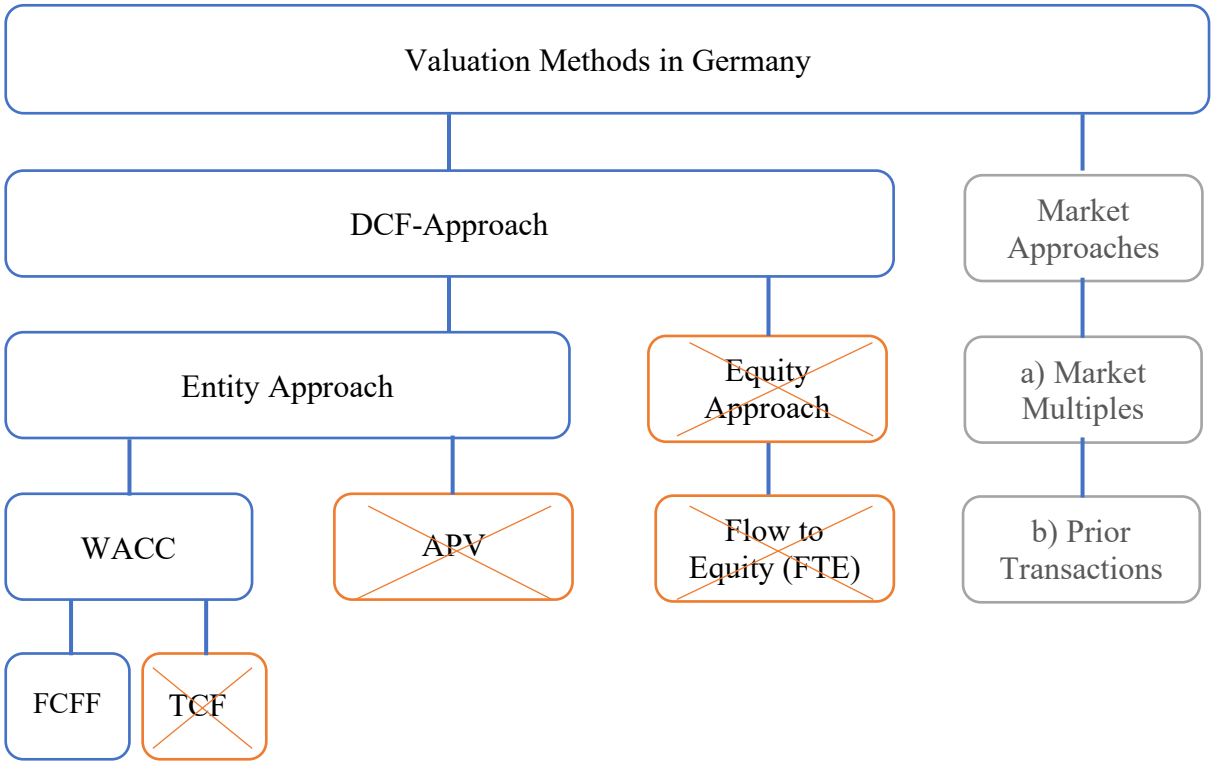
Source: Author's illustration

In Iran, among the various valuation methods employed for ICTs, the DCF and market approaches were frequently used, followed by the DDM and replacement methods as applied less frequent by the Iranian specialists.

In contrast, the dominant method of valuation used by German ICT valuation specialists was the Discounted Cash Flow (DCF) approach. Comparable Company Analysis (CCA) and Comparable Transaction Analysis (CTA) were commonly employed for validation purposes. Notably, German professionals also did not apply option pricing models (OPMs) in ICT valuations. Analyses of scenarios, sensitivity, and simulations were considered valuable and assisting tools in different level of analysing ICT projects in Germany. The WACC approach with (CAPM) was primarily used to calculate the discount rate, but because calculating beta was complex, German specialists was addressed beta by using sensitivity analysis, scenario analysis, and Monte Carlo simulation tools. Historical, industry, and judgmental methods were used for growth rate calculation, and a combination of DCF and multiples was found to be the most suitable for future ICT valuations in Germany. The DCF-based method was the primary method for presenting the final values, with only a few participants displaying values as a range and weighted average.

Figure 4-4 illustrates the various methodologies used in the discounted cash flow (DCF) approach, including entity and equity approaches. The analysis approved by IDW was the use of the DCF approach, with a focus on the weighted average cost of capital (WACC) and free cash flow to firm (FCFF) methods to determine the final value of the ICT company under valuation. While German specialists voluntarily employed the market approach (gray colour), it was not the primary method used; instead, it served to validate the market's perspective.

Figure 4-4. The valuation approaches applied by German advisors



Source: Author's illustration data adopted from IDW S1 2017 and empirical study.

In Germany, the DCF method was widely used for valuing ICT companies. However, it should be noted that the use of total cash flow (TCF), adjusted present value (APV), and equity approaches was not approved by regulatory bodies such as IDW in Germany.

Chapter Five

Discussion

5.1 Introduction

This chapter discuss and analyse the interconnection between the current literature and results and findings generated from the empirical phases of research conducted with Iranian and German specialists. To develop a robust suggested conceptual framework for the future valuation of ICT companies in Iran, the researcher used a triangulation approach. This approach involved:

a) A comprehensive examination of existing literature.
b) A thorough review of empirical investigations carried out in Germany.
c) Conducting interviews with Iranian advisors in ICT valuation to acquire insights into the unique valuation practices within the Iranian context.

The triangulation method, which combined theoretical perspectives with empirical evidence from an advanced financial hub like Germany, significantly enhanced the understanding of how Iranian valuation specialists determine the value of ICT companies.

In this chapter, the researcher combines and integrate the outcomes from current literature and findings from different research phases, to present the applicable methods, including the consideration of discount rate and risk profile, risk mitigation measures, growth rate considerations, and the challenges that Iranian specialists need to consider when valuing ICTs in Iran.

5.2 Pre-Valuation Stage, Analysing the Required Information

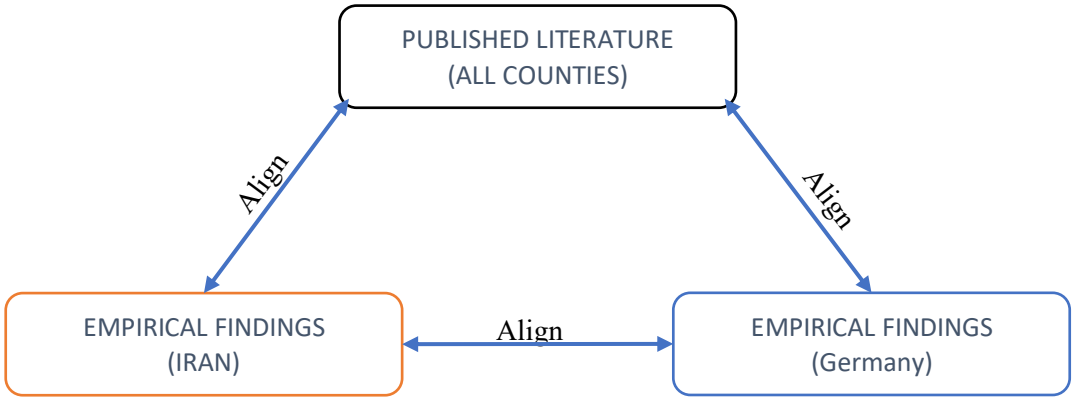
The Pre-Valuation Stage is a critical phase that entails the careful gathering and analysis of essential information to evaluate the feasibility and potential value of an ICT investment. This process includes understanding the ICT's business strategy and long-term goals, evaluating trends, the competitive landscape, market size, growth potential, and customer needs, as well as conducting stakeholder analysis. Additionally, it involves examining the regulatory environment and the technological landscape. A crucial aspect to review is the

consideration of environmental and social impacts, aligning with sustainability goals. Reviewing the financial health through a thorough review of statements, cash flow, and existing commitments. Identifying risk factors, about both market and technological aspects, is imperative, and conducting a preliminary Risk Assessment Profile (RAP) is essential. The identification and evaluation of these components will lay the foundation for subsequent valuation activities.

To commence the ICT valuation, the necessary financial information includes annual financial accounts, monthly economic statements, income statements, balance sheets, and cash flow statements. It is preferable to have several years of financial figures for evaluations. Detailed business plans and peer data are also required to determine the company's position in the market. Market data and insights from industry specialists are crucial for the ICT industry. Additionally, other factors to consider include tax situations, value drivers, and risk factors. Finally, market data and competitor analyses may also be used to ensure appropriate long-term margins are considered in the valuation and decision-making process.

Figure 5-1 portrays the congruence between empirical findings in Iran, the theoretical literature, and the German context regarding the analysis of the necessary information for initiating the valuation process.

Figure 5-1. Triangulating current study and empirical results for required information for starting the valuation process



5.3 Applicable Valuation Methods for ICTs in Iran

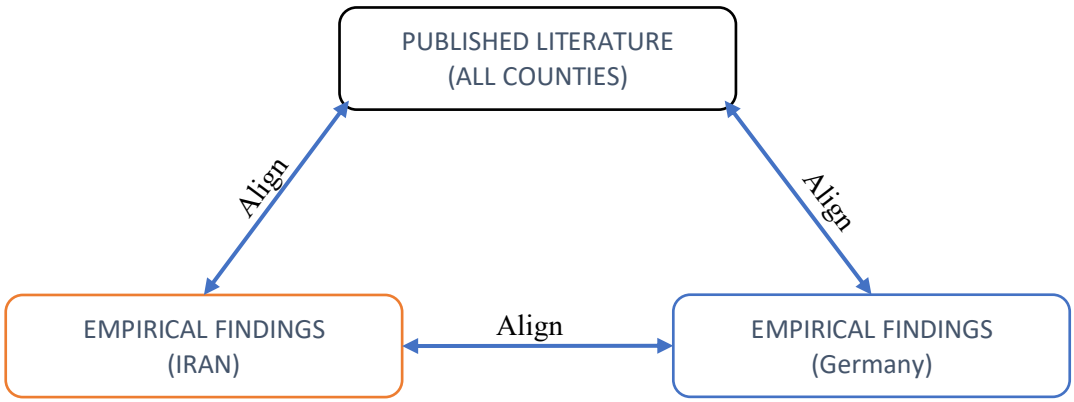
The findings of this study reveal that three valuation methods were employed for assessing ICTs. The primary approach was the Discounted Cash Flow (DCF) method, followed by the market approach. In very rare instances, mostly in Iran study, the replacement approach was applied.

5.3.1 Discounted Cash Flow (DCF):

The valuation of ICT companies relies on the efficacy of the Discounted Cash Flow (DCF), primarily due to the distinctive characteristics of this sector which is dynamic and rely on intangible assets as mentioned by Berk and DeMarzo (2020) and Brealey et al. (2017). ICT companies often have uncertain revenue streams and require forecasting future earnings potential, making DCF a suitable method for ICT valuation (Mielcarz, 2014; Shen & Stark, 2013; Vayas-Ortega et al., 2020). Empirical studies conducted by specialists from Iran and Germany have collectively affirmed the applicability of DCF in the valuation process of ICT companies.

Figure 5-2 illustrates the alignment of triangulations from empirical findings (Iran and Germany) and the theoretical framework presented in the current literature for the applicability of the DCF model.

Figure 5-2. Triangulating current study and empirical results for DCF model applicability



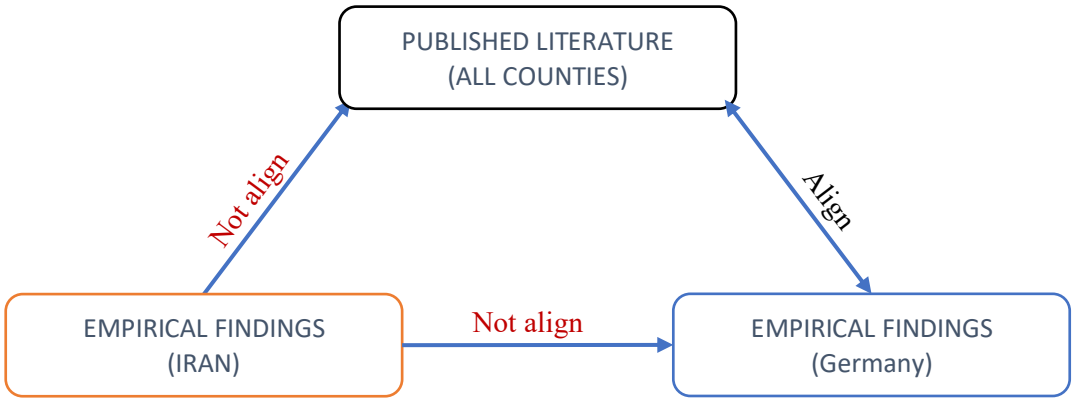
Regarding the valuation of ICT companies in both Iran and Germany, the current study has affirmed the Discounted Cash Flow (DCF) as the most suitable method. DCF is instrumental in assessing the financial position of ICT firms by projecting the future cash flows, factoring in operational inputs to estimate potential cash flows, and discounting them to present value using an appropriate discount rate. This approach proves particularly valuable for ICT companies, characterised by uncertain revenue streams and the need to forecast future earnings potential (Berk & DeMarzo, 2017; Brealey et al., 2020; Damodaran, 2012; A Damodaran, 2016).

5.3.2 Dividend Discount Model (DDM):

This study highlights the persistent use of outdated models, specifically the Dividend Discount Model (DDM), in the context of valuing Iranian ICT companies. Although the Discounted Cash Flow (DCF) and market approaches are widely accepted in Iran, many specialists in the field also employ the DDM, justifying it by the common practice of companies in Iran to pay dividends. Nevertheless, it is crucial to recognize the limitations of the DDM when valuing Information and Communication Technologies (ICTs) that are yet to turn a profit and do not distribute dividends. The high margin of error in such estimations makes this approach inadvisable, as indicated by academic and professional practices in Germany (Berk & DeMarzo, 2020; Brealey et al., 2020).

Figure 5.3 illustrates that the Iranian use of the DDM differs from the findings of the current study and empirical results from Germany regarding the application of the DDM approach.

Figure 5-3. Triangulating current study and empirical results for applied DDM approach



5.3.3 The Market Approach:

The market approach, as established in the current study and empirical investigations, emerged as the second viable method. This approach offers a benchmark valuation and aids in comprehending the market's perception of the company's value, a particularly crucial aspect in the dynamically evolving ICT sector (Berk & DeMarzo, 2020; Brealey et al., 2020; Damodaran, 2016).

Figure 5-4. Triangulating current study and empirical results for market approach applicability

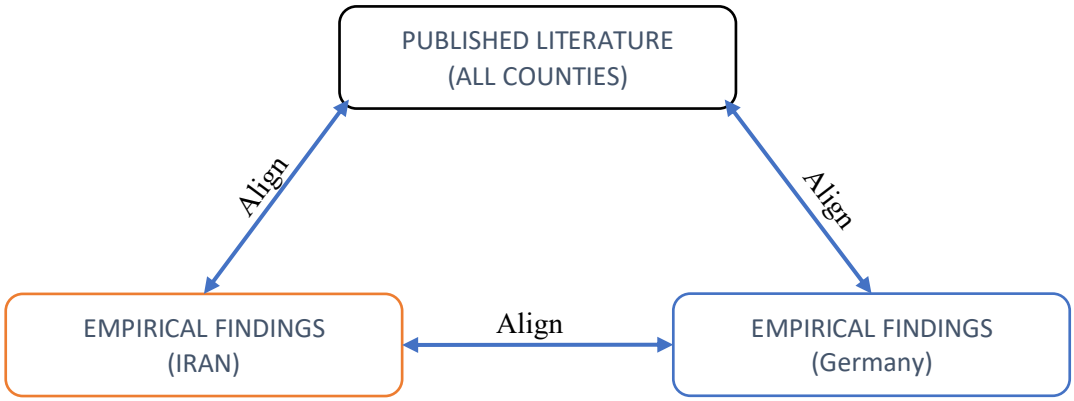


Figure 5.4 demonstrates that the Iranian use of the market approach is consistent with the results of the current study and the empirical findings from Germany concerning the use of the comparative approach and previous transactions. However, it is noteworthy that Iranian practitioners did not employ the diverse range of multiples seen in the practices of German specialists.

Applied multiples in market approach:

This study discovered the use of various multiples in the screening and benchmarking of ICT valuation processes, as mentioned by most participants in section 4.2.1. These multiples have proven to be effective in valuing ICTs based on different financial ratios, including operational and profitability multiples. The participants of this study, such as AE-DE, DJ-DE and MM-IR, noted that defining the peer group for ICTs was crucial in applying multiples, reflecting the technology used. This study also discovered that many participants MM-IR,

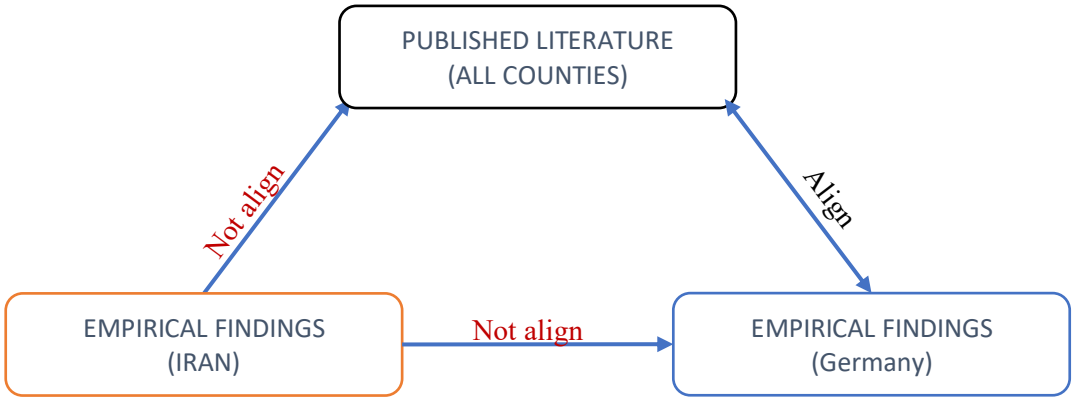
MS-IR, MK-DE, and GU-DE mentioned using different multiples, which are detailed in Table 5-1 and were previously discussed in the literature review, considering both an academic theoretical perspective (T) and empirical applicability experience (P).

Table 5-1. Different multiples applied in screening/benchmarking ICT valuation processes

Applied multiples in valuation process of ICT evidence from theory and practice (T/P)		
price-to-earnings (P/E)	(T/P)	Berk and DeMarzo (2020), Brealey et al. (2020), Damodaran (2016), Ross (2020), Fernández-Villaverde et al. (2015), Mackevičius and Tomaševič (2010), Mellichamp (2017), Kozy (2014), Schaeffer and Robins (2007), Fernandez (2001), Henschke and Homburg (2009).
price-to-book value (P/B)	(T/P)	
price-to-sales (P/S)	(T/P)	
price-to-free cash flow	(T/P)	
price-to-operating cash flow	(T/P)	
EV/EBITDA	(T/P)	
EV/EBIT	(T/P)	
EV/Sales	(T/P)	

Among the essential multiples integral to the valuation process are the following: price-to-earnings (P/E), price-to-book value (P/B), price-to-sales (P/S), price-to-free cash flow, price-to-operating cash flow, EV/EBITDA, EV/EBIT, and EV/Sales. The findings underscore the importance of a comprehensive review of financial metrics, greatly aiding in understanding the positioning and value of the ICT entity (Berk & DeMarzo, 2020; Brealey et al., 2020; Damodaran, 2016).

Figure 5-5. Triangulating current study and empirical results for applied multiples within the valuation process



While Iranian advisors largely adhered to the ratios and multiples recommended by the literature and adopted by German advisors, there were instances where not all of these multiples were uniformly employed. The primary areas of debate centred around the Price-to-

Earnings (P/E) ratio, as well as sales and EBIT multiples. When reviewing the multiple approach for ICTs in Iran, it is advisable to conduct a detailed financial statement analysis encompassing financial ratios and market multiples.

5.3.4 The option pricing models (OPMs)

The use of option pricing models (OPMs) for valuing ICT firms has become popular in recent years, driven by the distinct characteristics of these firms. ICT companies often experience heightened levels of uncertainty and volatility in their cash flows, making the integration of option pricing models alongside traditional valuation methods essential for robust and reliable valuations. Models such as the Black-Scholes model and real options excel in capturing the flexibility, volatility, and growth potential inherent in ICT firms during the valuation process.

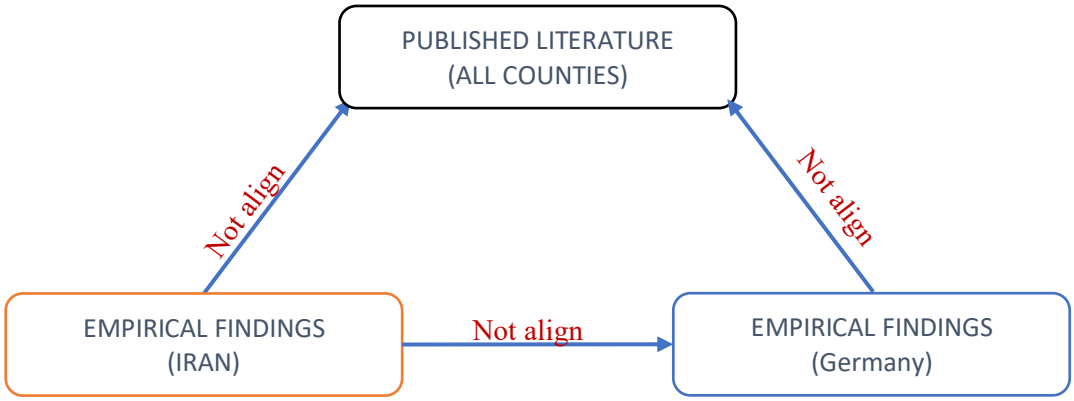
One notable advantage of employing OPMs for ICT firms lies in their ability to incorporate the value of managerial flexibility into the valuation process. Unlike traditional discounted cash flow methods, option pricing models allow for the consideration of options to expand, abandon projects, or delay investment decisions. This flexibility proves invaluable for ICT firms operating in rapidly evolving environments where strategic decisions must be made swiftly and opportunistically (Hull, 2017; Ryan, 2007).

Furthermore, option pricing models can provide a more accurate estimate of the value of ICT firms by taking into account the unique risk factors that affect these firms, such as technological obsolescence, competition, and regulatory changes. By incorporating these factors into the valuation model, analysts and investors can better understand the underlying sources of risk and uncertainty in ICT firms and make more informed investment decisions. Overall, the use of option pricing models for the valuation of ICT firms can provide a more comprehensive and reliable framework for assessing the value of these dynamic and fast-paced businesses.

While both Iranian and German advisors did not use option pricing models (OPMs) in their ICT valuations, there were instances where German participants suggested that OPMs could be applicable, albeit in rare cases, particularly for early-stage ICTs lacking historical data

where DCF may not work well. Despite recommendations from the literature advocating for the use of OPMs, Iranian advisors cited limitations such as the need for education on these models and the requirement to modify the interest rate component in the valuation process. However, with proper education and adjustments, it may be feasible for Iranian advisors to incorporate OPMs into their ICT valuations.

Figure 5-6. Triangulating current study and empirical results for application of option pricing models in the valuation process

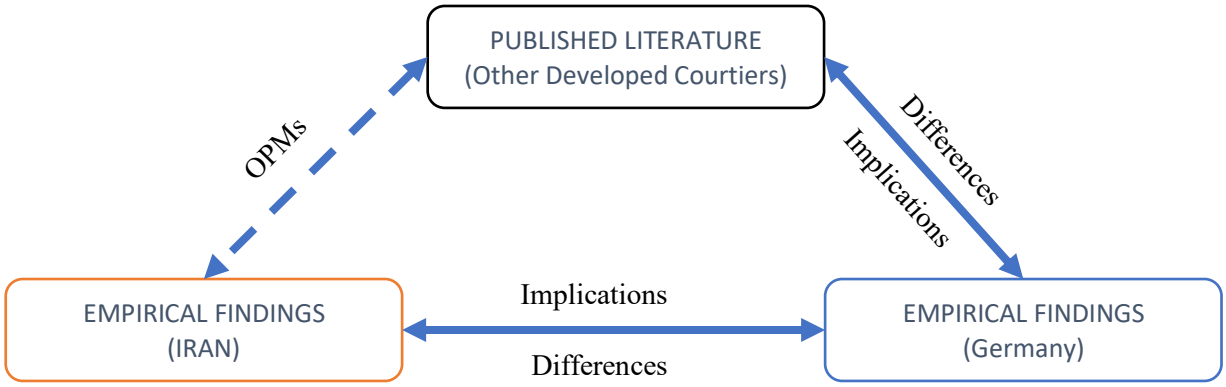


In conclusion, the use of real option model valuation by IT companies has proven to be a valuable tool in assessing investment opportunities and making informed decisions. By incorporating this model, companies like Apple, Google and Microsoft have been able to strategically allocate resources, manage risk, and maximize returns on their intangible assets' projects. As the intangible assets continues to evolve, the option pricing models valuation will likely play an increasingly important role in helping companies navigate complex decision-making processes and drive business success in a competitive market. Option pricing models' valuation is a powerful tool that allows investors and managers to assess the value of ICT investment based on the flexibility and strategic options available to them. However, some critics argue that practitioners often overlook the importance of incorporating option models valuation in their analysis. These critics believe that practitioners rely too heavily on traditional valuation methods, such as discounted cash flow analysis, and fail to adequately consider the value of flexibility and strategic decision-making in their evaluations (Ullrich, 2013).

The implications of not using the option pricing models (OPMs)

When examining the potential consequences for German ICT companies that are not being valued using market-focused methods, such as option pricing models, a diagram has been created. This diagram depicts the implications and differences.

Figure 5-7. Triangulating the implications and differences of not applying the option pricing models in the valuation process



The implications of German ICT companies not being valued using market-focused methods such as option pricing models (OPMs) can be substantial. Missing opportunities for capturing flexibility and growth potential is a significant concern, as OPMs are adept at capturing the value of managerial flexibility and strategic options, crucial in the dynamic ICT sector. Without using only traditional models, companies may undervalue projects with high growth potential and embedded options, resulting in missed investment opportunities. Additionally, the absence of OPMs may lead to undervaluing innovation and R&D efforts, as traditional models like DCF may not fully capture the value of intangible assets and strategic options inherent in ICT companies, leading to incomplete valuations and mispricing of the company's true potential (Chavas et al., 2024; Luo & Wang, 2023; Damodaran, 2012).

Market mispricing can further impact investor confidence, affecting how the market perceives a company and potentially resulting in under/overvaluation. This could disadvantage German ICT companies compared to those in the US, UK, and other developed markets that use OPMs, as they may have a competitive advantage in attracting investment and strategic partnerships. Advisory valuation companies that do not employ OPMs may also

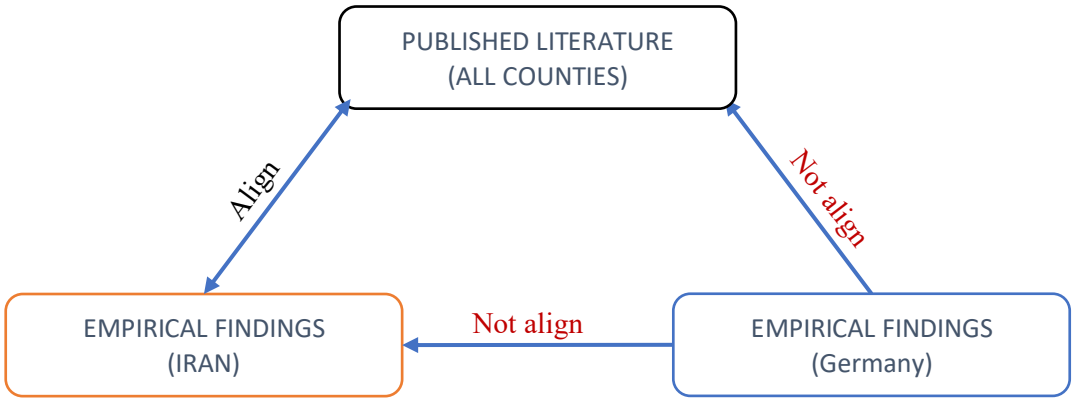
face challenges in negotiating deals, as they may not fully recognise or communicate the value of strategic options. Furthermore, OPMs can aid in better understanding and managing risks associated with ICT investments, enhancing decision-making processes. Without these models, companies might make suboptimal decisions due to a lack of insights into flexibility and uncertainty management, potentially leading to less effective allocation of capital and resources. Moreover, investors seeking detailed and sophisticated analyses may prefer companies using advanced valuation techniques like OPMs, posing challenges for German companies in attracting such investors if they do not adopt these methods.

5.3.5 The replacement cost approach:

The replacement cost approach is less suggested for valuing ICT companies due to the nature of the ICT sector, making it difficult to accurately estimate the cost of replacing the company's assets (Kozyr, 2014; Schaeffer & Robins, 2007). In addition, ICT companies often rely on intangible assets, such as intellectual property and human capital, which are difficult to value using the replacement cost approach (Bonardo & Paleari, 2008; Kostov, 2022). Furthermore, the rapid technological advancement in the ICT sector renders the replacement cost approach obsolete quickly, as new technologies can make current assets redundant in the immediate future (Berk & DeMarzo, 2020; Brealey et al., 2020; Damodaran, 2016).

The replacement method was considered for ICT companies aiming to determine the cost of starting an ICT project from scratch. While this method was not among the primary suggestions in the current study, it was discussed as an alternative approach only based on its cost value. However, due to the high levels of inflation, fluctuation, and uncertainties in Iran, Some Iranian practitioners employed the replacement method to estimate the cost of such companies based on the current value of foreign currencies like USD or EUR. Figure 5-6 demonstrates that in Iran, this method was used in conjunction with other valuation methods, as confirmed by the study.

Figure 5-8. Triangulating current study and empirical results for replacement approach applicability



The criticism of the replacement cost approach for valuing ICT companies arises from challenges in estimating the replacement costs of intangible assets that are inherently difficult to value. Additionally, the rapid pace of technological advancements in the ICT sector quickly renders the replacement cost approach obsolete, presenting another issue that hinders its ability to provide a proper valuation perspective.

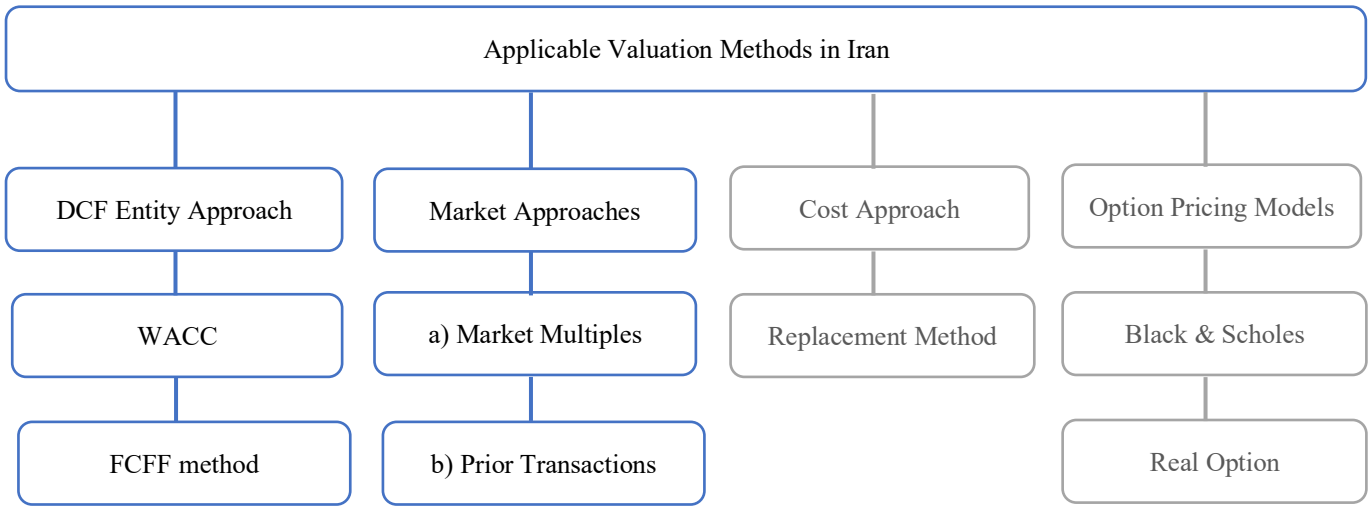
5.3.6 Summary of valuation methods applicable for ICTs

In conclusion, the Discounted Cash Flow (DCF) method has emerged as the primary choice for evaluating the financial position and analysing ICT firms due to its suitability in projecting future cash flows and providing a clear estimate of value. However, the market approach is also valuable for valuation practitioners, as it involves analysing and comparing the financial ratios and market multiples of an ICT company to those of similar companies and recent market transactions. This approach helps capture the market's perspective on the value of ICTs, serving as a useful tool for benchmarking and understanding market perceptions.

By combining the DCF method with the market approach, a more comprehensive valuation of an ICT company can be achieved, mitigating the limitations inherent in each method. Additionally, it is advisable to incorporate other methods, such as option pricing models (OPMs), to address aspects that the DCF and market approaches may not fully capture. OPMs can provide insights into the flexibility and growth potential of ICT firms, which are often characterised by high levels of uncertainty and strategic options.

On the other hand, the replacement cost approach is less suitable for valuing ICT firms. Existing literature and empirical studies from advisors in both Iran and Germany indicate that this method is typically considered only as a baseline value. It tends to result in the lowest valuation, failing to account for the future potential of the ICT company. The replacement approach is mainly useful for estimating the cost of replicating the company's assets but does not reflect the true market or strategic value of the company. Therefore, while the replacement cost approach can provide some baseline information, it should not be relied upon as the primary valuation method for ICT firms. Figure 5-9 presents the applicable valuation methods for ICTs in Iran. The blue-coloured shapes, representing DCF and market approaches, are considered the primary valuation methods for Iranian ICT companies. In contrast, the gray-coloured shapes, such as replacement and option pricing models, are considered secondary approaches due to their limitations and less potential for application in the Iranian context, particularly for option-based models which need some modifications in components.

Figure 5-9. Applicable valuation methods for ICTs in Iran



Source: Author’s illustration

5.3.7 Valuation Process and Analysis Techniques for ICTs in Iran

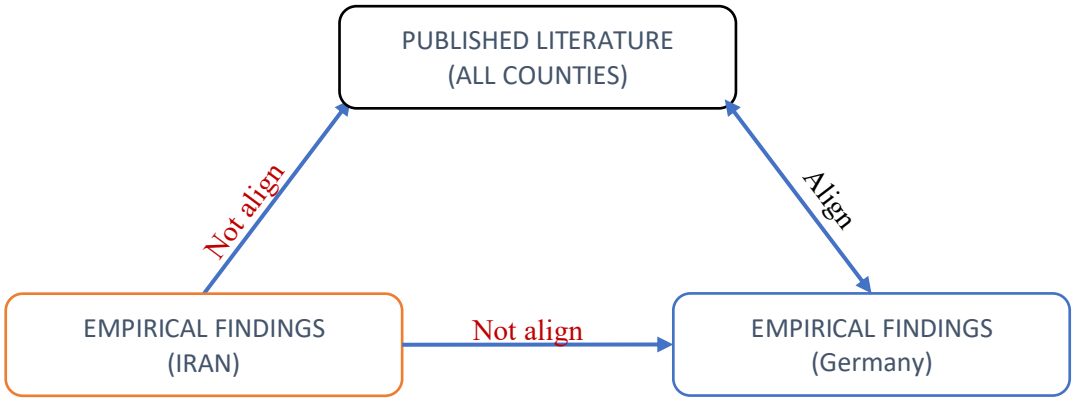
This study revealed disparities between the approaches of Iranian practitioners and the literature, as well as German practices, with regard to detail valuation process and analysing techniques.

Cash flows projection method in DCF:

Some Iranian practitioners opted for a more conservative projection period, typically ranging from two to three years, citing concerns related to high inflation. In contrast, the literature generally advocated for projecting cash flows five years into the future, or even extending to longer periods, contingent upon the business model and the company's specific characteristics (Berk & DeMarzo, 2020; Brealey et al., 2020).

The study conducted in Germany also supported the use of a five-year projection method to estimate the future cash flows of ICT companies. Figure 5-8 illustrates that, in Iran, some Iranian practitioners did not align with the projection method confirmed by the current study's investigation and the German approach to projecting future cash flows.

Figure 5-10. Triangulating current study and empirical results for cash flow projection period approach



Cash flow treatment in DCF:

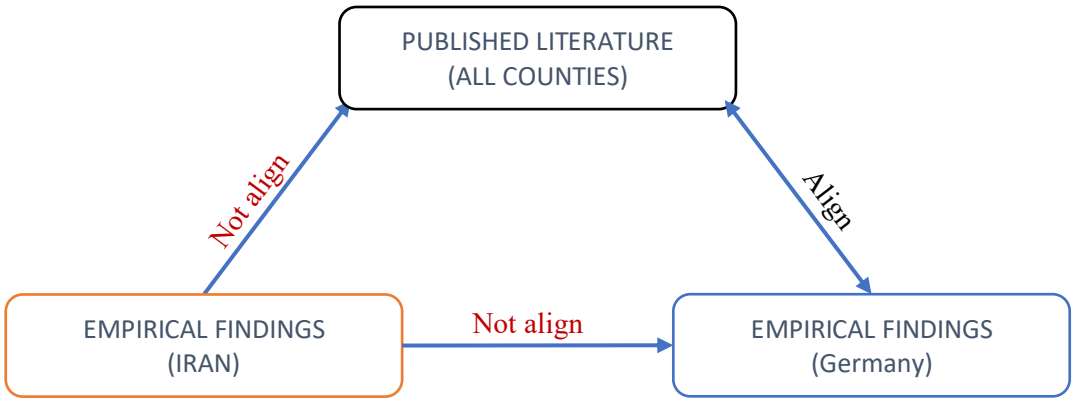
This study also identified a noteworthy divergence in cash flow treatment when valuing entities or equity, which can prove perplexing even for experienced valuation professionals.

In the context of valuing ICTs through the Free Cash Flow to the Firm (FCFF) approach, the primary focus lies on the entity approach. The Weighted Average Cost of Capital (WACC) approach, also an entity approach, is well-suited for ICT valuations owing to the stable debt to equity ratio (Berk & DeMarzo, 2020; Brealey et al., 2020). The investigation revealed that the entity approach is favoured by German practitioners and is endorsed by the literature for valuing ICTs, with the FCFF method, combined with an appropriate discount rate, being the common practical choice.

This study revealed that many Iranian practitioners still use the Dividend Discount Model, and when they employed the DCF method, they varied between using the Free Cash Flow to Equity (FCFE) and Free Cash Flow to the Firm (FCFF) approaches.

As depicted in Figure 5-11, it is evident that Iranian practices did not consistently align with the approaches affirmed by the literature and implemented by German practitioners.

Figure 5-11. Triangulating current study and empirical results for applied FCFF approach



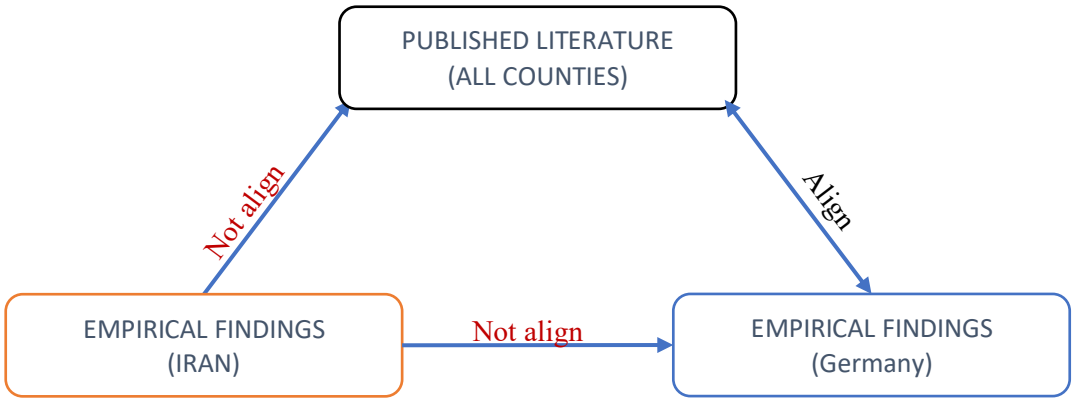
5.3.8 Evaluating Discount Rates with WACC and CAPM in ICT Valuation

Given that the DCF model with an entity approach stood as the primary model for valuing ICTs, the Weighted Average Cost of Capital (WACC) was employed for discount rate calculations, complemented by the Capital Asset Pricing Model (CAPM). CAPM was a widely accepted method for determining the discount rate in business valuation, as emphasised in the literature, and corroborated by German investigations.

WACC considers the costs associated with both debt and equity financing, considering the proportion of each in a company's capital structure. In contrast, CAPM focuses on the cost of equity financing, incorporating elements such as the risk-free rate, market risk premium, and a company's beta. The use of WACC allows analysts to consider multiple aspects of the cost of capital, ensuring that both the cost of financing and the associated investment risk are factored into the discount rate (Berk & DeMarzo, 2020; Brealey et al., 2020; Damodaran, 2017; Ross et al., 2020).

Examining the results from German practitioners evident that all of them adhered to the standard CAPM method. In contrast, while Iranian practitioners indicated the use of CAPM, there were discrepancies within its application, particularly the omission of the beta factor when calculating risk premiums. The beta factor was a prominent focus in the review of current studies and mirrored the practices of German practitioners. Figure 5-12 illustrates that Iranian practitioners did not consistently follow the literature, and the practices employed by their German counterparts.

Figure 5-12. Triangulating current study and empirical results for applied CAPM approach

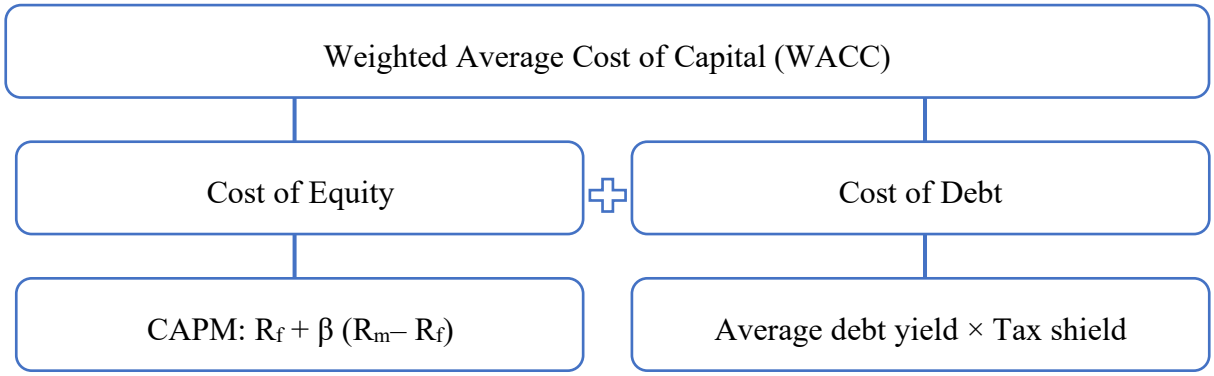


In this study, the discount rate for ICT valuation in Iran and Germany was determined using WACC and CAPM by the participants. The German practitioners solely relied on WACC since it is the standard approach in Germany, while the Iranian practitioners made modifications to the WACC by eliminating the beta factor. During the interviews with German practitioners, the inclusion of beta in CAPM generated an informative and thorough debate. The German practitioners developed different methods such as accounting, peer and simulation-based methods to determine the beta. In contrast, the Iranian practitioners were

more concerned with the macro-economic risk and other variables that could influence the valuation process.

Figure 5-13 has been devised by the researcher to illustrate how Iranian practitioners can employ the standardised method for calculating the Weighted Average Cost of Capital (WACC) in the future valuation of ICTs.

Figure 5-13. Weighted average cost of capital method



Source: Author's illustration (adopted data from Berk & DeMarzo, 2020)

5.3.9 Challenges when Considering the Market and Firm-specific Risks

Given that one of the primary concerns in Iran revolved around the qualitative risk profile and the macro-level uncertainties and variables, this section delves deeper into the examination of the risk profile during the valuation process. The researcher conducted a comprehensive review that considers both market and firm-specific risks, drawing insights from the collected evidence.

The calculation of the business discount rate in the valuation process includes two crucial elements: market risks and firm-specific risks. Market risks, can also significantly influence the valuation process and are often challenging to mitigate, encompassing factors such as interest rate fluctuations, inflation, shifts in economic conditions, and political instability, which emerged as common topics during interviews with Iranian practitioners.

In contrast, firm-specific risks are unique to each company and can be identified at various stages of the valuation process. Examples of these risks include business characteristics,

industry-specific factors, the quality of management, and service diversification. In the context of ICT valuation, it is imperative to account for both categories of risks, as they collectively determine the overall risk level of the company and have an impact on the expected rate of return. Consequently, conducting a comprehensive analysis of both market and firm-specific risks is essential for making well-informed decisions regarding business valuation (Berk & DeMarzo, 2020; Brealey et al., 2020; Damodaran, 2012).

This study affirms that the valuation process for ICT firms in Iran must encompass consideration of both risk categories: market or systematic risks and company-specific or unsystematic risks (Chui, 2011). Notably, political, regulatory, economic risks, as well as company-specific factors like business plans, technology, and management, were identified as the most critical factors in this context. Iranian practitioners showed particular concern towards economic, political, and regulatory risk due to the current situation in Iran and international sanctions imposed on the country. Regulatory risk, including frequent rule and law changes, was also considered a significant issue with a high level of risk (Damodaran, (2009). Interestingly, the study found that Iranian practitioners eliminated the beta effect due to the high market risk components such as political situation and risk increasing from regulations to ICT projects. Despite being factors that should be included in the CAPM calculation, Iranian practitioners were deemed to have too much influence on the overall risk level, making the beta effect less relevant. Therefore, this study contends the importance of considering both systematic and unsystematic risks in the valuation process for ICT firms, particularly in the context of Iran's current political and regulatory environment.

From the findings, the systematic risk encompasses attributes that are out of the direct control of Iranian practitioners and can adversely impact the entire ICT sector (Berk & DeMarzo, 2020). This category includes risks such as political instability, regulatory changes, and macro-economic fluctuations in Iran. These attributes pose significant challenges for appraisers in the valuation process as these attributes can have a wide-ranging impact on the performance and viability of ICT companies in Iran. Iranian practitioners, therefore, consider using a cognisant of these systematic risks and carefully consider their potential effects when conducting ICT valuations. Based on the findings of this study, Iranian practitioners employed certain strategies to mitigate these risks. Firstly, Iranian practitioners converted the calculations to USD-based values, which helped provide a more stable and internationally recognised currency for valuation purposes. This approach would be aimed to reduce the

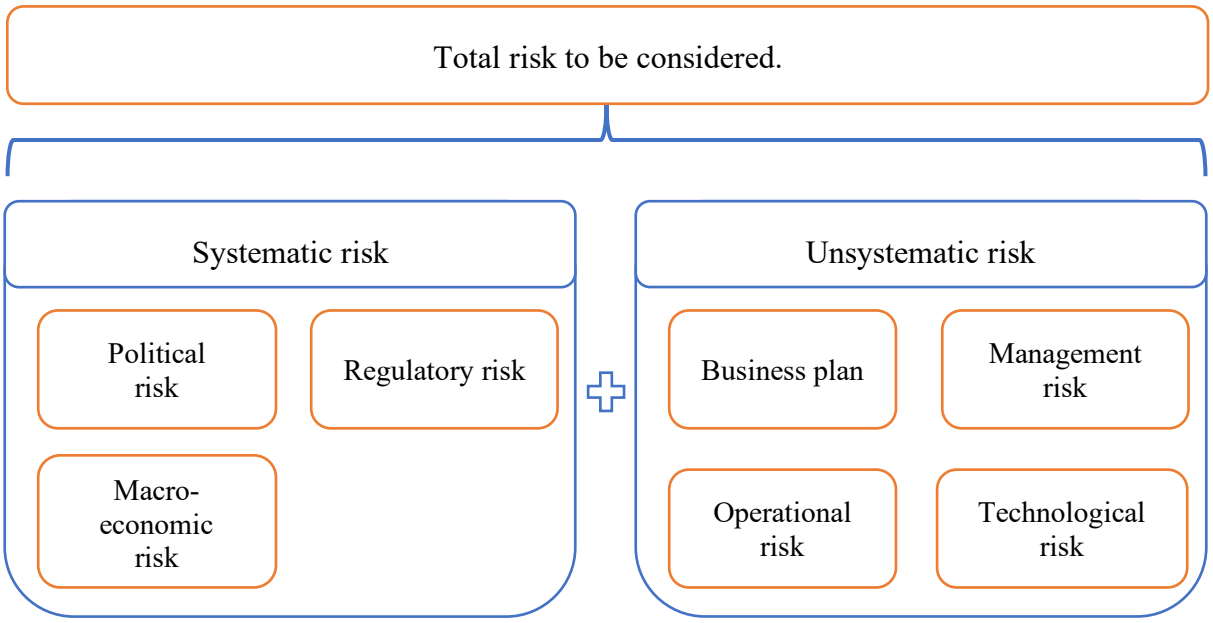
impact of political instability and macro-economic fluctuations on the ICT valuation process. Additionally, the Iranian practitioners should conduct surveys involving a diverse group of professionals to gather insights and opinions on the market risk variables. By spreading the survey among several practitioners, Iranian practitioners can aim to gain a broader perspective and a better understanding of how each market risk variable might affect the ICT valuation process. This survey-based approach, along with the simulation method of analysis, would help in predicting the potential impact of these variables and aid in making more informed decisions during the valuation process. Finally, it is advisable to conduct a thorough analysis of the beta factor, which serves as a representation of systematic risk and is integral to the Capital Asset Pricing Model (CAPM) calculations.

The unsystematic risk is related to risks that are specific to individual ICT projects. These risks tend to be unique to each venture and require specific attention from Iranian practitioners during the valuation process (Brealey et al., 2020). Key aspects to consider under unsystematic risk include the detailed analysis of the business plan of an ICT venture, operational risks, management-related risks, and technological risks. Evaluating and managing these risks is crucial to accurately assessing the value of an ICT project and ensuring the viability and success of the venture. The business plan of an ICT venture can play a vital role in determining its potential for success. Therefore, Iranian practitioners need to thoroughly analyse the market opportunity, competitive landscape, revenue projections, and scalability of the business model. Operational risks, such as the revenue and income margin, proficiency challenges, or human resource constraints, and the customer support and ICTs' friendly usage should be carefully evaluated to measure their impact on the ICT project's valuation. Furthermore, management-related risks encompass factors related to the team behind the ICT venture. These risks may include the knowhow and experience of the management team, their ability to execute the business plan, delegation to new team members, and the track record in the industry. Evaluating the competence and capability of the management team is essential in assessing the overall risk profile of the project. Lastly, technological risks are inherent in the ICT sector due to its dynamic nature. Iranian practitioners must evaluate the technological risks associated with the project, including potential obsolescence of the technology, intellectual property protection, and the pace of technological advancements in the industry. Understanding and managing these risks is crucial to accurately assessing the value of the ICT project.

In summary, Iranian practitioners involved in the valuation of ICT ventures should diligently assess both systematic and unsystematic risk factors. By taking these risk factors into account during the valuation process, Iranian practitioners can make informed decisions, ultimately enhancing the accuracy and reliability of the valuation results.

The risks' findings are summarised into key risk categories associated with ICTs in Iran are presented in Figure 5-14. This figure offers insights into the factors that shape the valuation process. These risk categories are broadly categorised into two types: systematic risk and unsystematic risk.

Figure 5-14. Systematic and unsystematic risks for ICTs



Source: Author's illustration

Upon thorough examination of the findings and their alignment with contemporary literature (Roque, 2021; Barak & Modarres, 2015), a range of techniques for estimating the beta factor in CAPM for the ICT valuation process emerges.

These techniques include peer group or industrial beta, accounting beta, and simulation-based analysis, as depicted in Table 5-2.

Table 5-2. Applicable techniques to estimate beta factor in CAPM for the ICT valuation process

Various techniques to estimate beta factor for CAPM		
Indirect approach (peer group, industrial beta) Accounting beta Risk analysis through simulations	(T/P) (T/P) (T/P)	Roque (2021), Barak and Modarres (2015), Travassos et al., (2018), St-Pierre and Bahri (2006), Kahn & Lemmon (2016),

Also, the findings demonstrate that, in numerous instances, Iranian ICT valuation's risk categories exhibited greater unsystematic risk than expected, with the most significant observations reported by Iranian participants. This finding implies that specialist calculations of discount rates significantly impacted risk preferences. Conversely, the German ICT valuation results were less affected, which raises concerns regarding unsystematic risk and its influence on revenue and cash flow estimation for analysts with German experience.

5.3.10 Managing Volatility in the Valuation Process and Mitigation Strategies

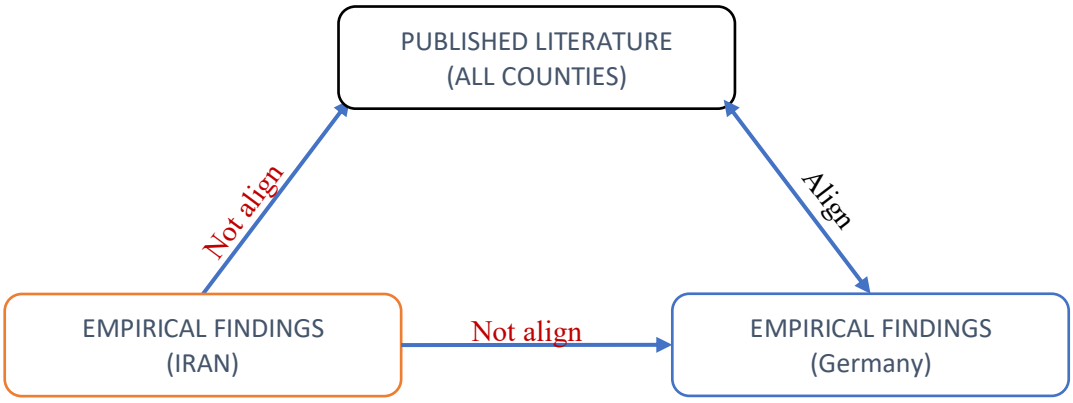
Scenario and sensitivity analysis as well as simulations, are important techniques used in the valuation process to assess the potential impact of different scenarios on the financial performance of the firm (Clark et al., 2010; Hulett, 2016; Kossecki et al., 2017). Pareek (2012) contended that sensitivity analysis is a common method used by analysts to analyse the impact of changes in key assumptions in cash flow projection and growth rates on the project's net present value. Additionally, scenario analysis has been identified as a useful tool to evaluate the risk profiles and uncertainties associated with valuation projects (Joos et al., 2016). Furthermore, a study by Chen et al. (2018) found that incorporating scenario analysis and Monte Carlo simulation into the valuation process can help investors make better-informed decisions by providing them with a range of possible outcomes based on different scenarios.

The use of a judgmental approach in analysing components during the valuation process is suggested, as it allows for a more comprehensive assessment. This approach involves incorporating qualitative factors alongside the financial numerical assessment to gain a better

understanding of the valuations' challenges and potential risks. As noted in the study, some participants such as RH-DE, GU-DE, DJ-DE, and AE-DE used judgmental evaluation processes that involved discussions with professionals, advisors, and senior managers, where gut feelings and emotional experiences were also considered. Additionally, the "what-if discussion" technique was suggested to approach findings with qualitative characteristics that cannot be evaluated numerically in traditional valuation models. This technique elaborates discussing different scenarios to assess potential issues found or may happen in the future process, such as political, economic, technological or management problems, with consideration given to risk mitigation cases. Ultimately, employing a judgmental approach in component analysis can provide a more accurate and complete assessment of the ICT value. Valuation processes are closely related to due diligence, as valuation results form the basis for the decision-making process. Findings in the study the detail evaluation of ICT components, with judgmental assessments and the importance of considering qualitative factors, as well as the financial numerical assessment.

This study also found that the most popular risk mitigation measures in the ICT firms include sensitivity and scenario analysis, as well as Monte Carlo simulation, internal and external due diligence, operational and management risk reduction, systematic risk consideration, and standardisation of procedures. The choice of measures varied based on the characteristics of the firm, with significant differences observed between valuation advisors. Political consideration observed in the use of weighting to the probability of events and sensitivity analysis. German practitioners frequently utilised sensitivity and scenario analysis, as well as Monte Carlo simulation in the valuation of ICT firms. However, the usage of sensitivity and scenario analysis was often superficial in Iran. While Monte Carlo simulations are commonly used in Germany, Iranian practitioners never used this in their valuation process, as depicted in Figure 5-15. In the ICT valuation value at risk method was rarely applied. Additionally, only a small percentage of participants considered possible added value of opportunities and synergies in their ICT valuation.

Figure 5-15. Triangulating current study and empirical results for managing volatility in the valuation process



The current literature and empirical study in Germany highly suggest the detailed analysis of sensitivity, scenario, and Monte Carlo simulations, so it is suggested that Iranian practitioners incorporate these valuable tools into their valuation process when assessing an ICT firm.

5.3.11 Growth rate consideration

The valuing process requires considering various factors at different levels of the analysis, including the use of historical financial data and judgmental approaches to calculate growth rates. Rotkowski and Clough (2013) and Yousefi (2021) both noted that historical financial data could be a useful tool in predicting future growth rates, particularly when used in conjunction with judgmental approaches that account for qualitative factors such as industry trends and management quality. Additionally, according to Allee et al. (2020), that incorporating judgmental approaches in the valuation process can lead to a more accurate estimate of a company's value, particularly when dealing with companies operating in rapidly changing industries. Petropoulos et al. (2022) emphasised the importance of considering both historical data and judgmental approaches when valuing businesses in emerging markets like Iran, where financial information may be limited and difficult to obtain.

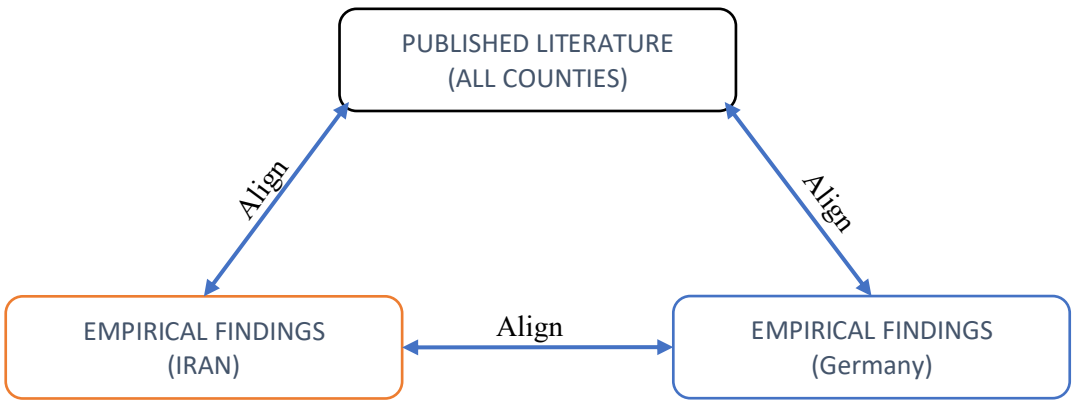
Table 5-3 displays a variety of applicable techniques to consider the growth rate, sourced from both academic references and insights gathered from participants in this study.

Table 5-3. The applicable growth rate techniques

Applicable growth rate techniques		
Historical financial growth rate	(T/P)	Berk and DeMarzo (2020), Brealey et al. (2020), Allee et al. (2020), Petropoulos et al., (2022)
ICT industry or peer group growth rate	(T/P)	
judgmental growth rate	(T/P)	
Inflation and interest rate base	(T/P)	

The application of growth rate calculation within the DCF model revealed several techniques. These include the use of three to five years of historical financial data and the integration of judgmental methods to assess challenging-to-measure variables. The judgmental approaches were used in conjunction with historical methods where possible. The pertinent internal and external factors that influence the judgmental approach, such as due diligence, service, or the nature of the business, technological, management, financial structure, and synergies, despite not being explicitly incorporated in the valuation process, have an indirect effect on valuation methods (Berk & DeMarzo, 2020; Brealey et al., 2020). Furthermore, the growth rate in the terminal value level was determined based on the inflation rate and economic growth rate in Germany and solely the inflation rate in Iran, as Iran's GDP had a negative rate in recent years and cannot be applied.

Figure 5-16. Triangulating current study and empirical results for applied growth rate methods within the valuation process



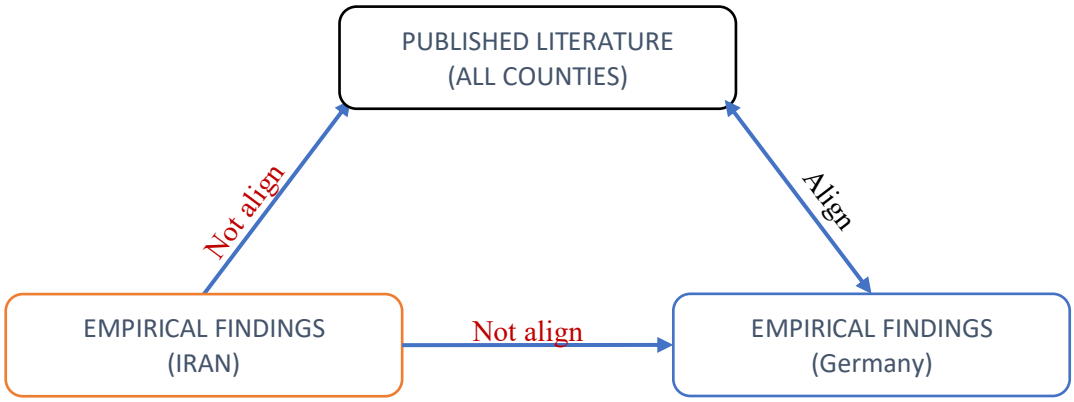
As showed in Figure 5-16, the growth rate methods employed by Iranian practitioners were consistent with both the prevailing literature and the methods adopted by the German counterparts.

5.3.12 Addressing Final Valuation Conclusion

The final valuation conclusion also presented a challenge during the Iranian study. In Iran, there was no standardised approach. Some Iranian practitioners mentioned the practice of taking the average of values, while one participant proposed presenting a range of values. Another approach mentioned was the weighted average, applied judgmentally across different methods as the final valuation conclusion. In contrast, the German practitioners in this study predominantly favoured a single method, with the Discounted Cash Flow (DCF) method being the primary choice. German practitioners introduced the market approach mainly for plausibility checks to ensure that values fell within an acceptable range.

Theoretical insights suggest that arriving at a conclusive valuation for ICT firms is a nuanced process. Iranian practitioners should rely on their informed judgment rather than a rigid formula when it comes to selecting and weighing appraisal methods (BVS, 2018). In Iran, practitioners must consider deciding whether to assess indications of value qualitatively or mathematically, while providing a clear rationale for their choices. Factors such as data quality in the valuation process, the valuation's purpose, the specific ICT entity being appraised, and other relevant considerations should guide analysts in evaluating the significance of each method's results.

Figure 5-17. Triangulating current study and empirical results for final valuation conclusion



This evaluation helps determine whether a single method should take precedence in reaching the final valuation conclusion. Given that different valuation methodologies vary in their nature and assumptions, it is crucial to present the final valuation conclusion in a standardised manner, ensuring effective communication of findings by analysts.

5.3.13 Limitations and Challenges to Consider

The process of valuing ICT presents several intricate challenges. First and foremost, uncertainties regarding the future, customer dependencies, revenue estimation, and the acquisition of accurate information can significantly impede the valuation process. Collecting pertinent and precise data from industry peers can also be difficult. Managing the workload of team members and ensuring the accuracy of information for prospective buyers are additional time-consuming challenges. Accounting for high inflation and fluctuating variables, particularly on a macro level, is crucial. Moreover, considering industry-specific factors and formulating reasonable assumptions for cash flow forecasts are vital when applying discounted cash flow analysis. Valuing ICTs with limited information is compounded by uncertainties stemming from industry dynamics and structural changes. Predicting the future proves to be complicated, with disagreements between sellers and buyers concerning income and cost projections. Gathering data is often problematic, especially in the case of start-ups or companies with untested business models. Interpretation of the gathered numbers and aligning them with qualitative aspects to evaluate the ambition, realism, or conservatism of a business plan also present noteworthy challenges.

5.4 The implications of Iranian advisors using Germany as a learning model

When evaluating Iran's development strategy, the question arises: Is it appropriate for Iran to use Germany as a model, or would it be more beneficial to consider alternative reference points?

While it is common for countries to look to others as models for development, it may not always be appropriate for Iran to directly emulate Germany. Although Iranian advisors can gather several important lessons from German valuation process, such as detailed DCF

analysis, comprehensive risk consideration and mitigation through detailed scenario and sensitivity analysis, and the application of Monte Carlo simulations at various stages of the valuation process, but there are several points to consider:

Iran and Germany have distinct economic, social, and political contexts. What works well for Germany may not necessarily be applicable or effective in the Iranian context. Iran faces unique challenges and opportunities that require tailored solutions. Relying solely on the German model may overlook Iran's specific needs and strengths. Cultural and institutional differences between Iran and Germany can significantly impact the effectiveness of policies and strategies. It's essential to consider these variances when adopting foreign models.

Instead of direct emulation, Iran may benefit from adapting and localising successful strategies from various developed countries, including Germany, to suit its context and priorities. While Germany may offer valuable insights into many aspects of valuations, Iran can also learn from the experiences of other countries facing similar challenges or pursuing comparable goals. Iran should foster an environment of innovation and experimentation to develop solutions tailored to its unique circumstances, rather than solely relying on external models. Eventually, while there may be lessons to learn from Germany, Iran should approach development with a critical and context-sensitive perspective, considering local needs, challenges, and opportunities.

5.5 Chapter Summary

This Chapter has focused on result analysis in the context of valuing ICT companies in Iran and triangulate them with current studies and investigations in Germany. The Chapter has highlighted the applicable valuation methods, such as discounted cash flow (DCF), the market approach, and option-based models for valuing ICT companies. The replacement cost approach was considered less suitable due to the unique characteristics of the ICT sector and the difficulty in valuing intangible assets. The Chapter has also discussed the discount rate and risk profile, emphasising the use of the weighted average cost of capital (WACC) and the capital asset pricing model (CAPM). This study also discussed the difference between cash flow levels when valuing entities or equity is significant and can be confusing even for experienced valuation professionals. The focus for valuing ICTs using the free cash flow to firm (FCFF) method is on the entity approach. The WACC approach could be suitable for

ICT valuations due to the standing for debt and equity side. Furthermore, it is essential to consider both systematic and unsystematic risks in ICT valuation, as they impact the overall risk level of the company and affect the expected rate of return. During this study, several interconnected themes concerning valuation methods were identified in academic theories and classified under the first main theme. These themes had a significant impact on the valuation process and are crucial for accurately valuing an ICT. This chapter compared and contrasted the collected results with current literature and presented the suggestions for better application of the ICT valuation process.

Chapter Six
Conclusion

6.1 Introduction

Following from the presentation of the results and the discussion of the findings, as set out in Chapter Four and Chapter Five, this Chapter present a critical review and summary of the contribution of the research from an academic and business practice perspectives. This chapter begins with presenting the research's aim and objectives. It is followed by an overview of the study, and a summary of the findings, how the research has achieved its objectives. Next, it discusses the contributions to academic knowledge, followed by its practical contributions. This chapter also proceeds with a consideration of the study's limitations and suggests areas for future research. Finally, it concludes with a reflection of the research journey.

6.2 The aim of the research

The study was based on critically evaluating how Iranian information, communication, and technology (ICT) SMEs are valuated in Iran, compared and contrasted to how this sector is assessed in Germany.

To achieve this, the study addressed the following research objectives:

Objective One: To critically evaluate the models, effectiveness, and justifications of valuation strategies used for ICT firms, assessing valuation practices in Germany compared to other developed countries as derived from the existing literature.

Objective Two: To critically analyse how these models have been used in the ICT valuation process in Iran, and contrasting the practices observed in Germany, especially given the differences between the two countries.

Objective Three: From the findings generated, provide a new academic insight as to how Iranian ICT companies are valuated.

In achieving these research objectives and ultimately the aim, the intention of the study was to provide a new critical insight into how the Iranian financial sector assesses and valuates ICT SMEs, and determine what strategies are used. In achieving this, the study focused on determining which valuation strategies and methods were used in published literature of developed countries, and whether these practices could be informed by comparing these approaches with an established European methodology, using Germany as an exemplar. To accomplish this, the study adopted a social constructivist approach to generate a critical insight firstly as to the established valuation practices adopted and used in Germany and compare them with other developed countries, which then informed the main study based on conducting semi-structured interviews in Iran. Rather than simply proving or falsifying a pre-determined hypothesis the study has generated a new insight in an under researched area. The rationale for this decision is presented in the next section.

6.3 Overview of the study

To be able to critically evaluate and understand how the ICT SMEs are valuated in Iran, the study adopted a social constructivist approach using an interpretivist strategy to interpret the findings, which was generated firstly from the existing literature practices and approaches adopted in an established economy, the European powerhouse, Germany, which has been extensively research before then deep diving into the approaches and strategies adopted in Iran, an emerging economy, which has been relatively under-researched. As set out in Chapter Two, the first stage of the study was devised to inform the researcher as to what is seen as best practice which could be aligned to the current academic debate, before embarking on the central focus of the study, how Iranian financial valuators assess the financial position of an ICT SME. This theme was informed by Dastkhan (2022), who highlighted the need for further research to enhance existing valuation methods for new technologies in Iran.

Throughout the first stage of the research project, this study referred to the current academic debate and to the various financial models and methodologies as presented in Chapter Two (2.3, 2.4 and 2.5). This study adopted a qualitative methodology to gather the data, which was captured using a constructivist perspective, using semi-structured interviews for both the German and Iranian financial valuators. Subsequently, the findings were categorised and

analysed. Through following this strategy, the approach enabled the researcher to engage with the participant's perspectives and approaches through providing context and meaning to understand their strategies adopted (Creswell, 2016). Using this inductive strategy, the interviews were recorded, transcribed, coded and analysed in English and in Persian, depending on the participant's profile, using a thematic analysis approach as prescribed by Braun and Clarke (2013). The findings were evaluated against existing knowledge and then as the research progressed, a comparison was conducted as the research developed, which enabled informed data outcomes to be generated. By using this strategy, the intention was to evaluate the findings to develop a set of suggestions as to how Iran could use the valuation strategies more effectively, but also from an academic perspective provide a new critical insight into an underdeveloped area of understanding.

6.4 Summary of the findings

This section outlines how the research objectives were achieved and how the overall aim of the research—critically evaluating the valuation of Iranian information, communication, and technology (ICT) SMEs compared to existing literature and the assessment practices in Germany—was achieved.

Before moving to the **first research objective:** first needed to identify and critically evaluate the main theoretical valuation models used to value ICT firms in other developed countries and specifically in Iran, a series of key findings were identified and presented in the Chapter Two. In addressing this research question, the study found various valuation theories suitable for ICTs through conducting an extensive review of current literature. The study has highlighted the importance of valuation theories in determining the value of ICT companies, particularly in Western countries and reviewed those methods has been applied and suggested, resulting the identification of various valuation methods such as discounted cash flow (DCF), market approach, option pricing models, replacement approach, and venture capital have been used to assess the value of ICT firms including start-ups.

The wide range of valuation methods discussed in recent studies such as Hekmat et al. (2023) and Thorne (2021) has contributed to the complexity and uncertainty surrounding the valuation process, therefore, it is crucial to refine existing valuation theories applied in Iran and develop new approaches that account for these unique challenges for emerging

economies like in Iran. The existing regulations provided by the Iranian Privatisation Organisation (IPO) offered a broad and diverse array of valuation methods without specific guidelines or standardised criteria. Instead, the IPO suggested that financial institutions performing valuations in Iran can use valuation methods such as the market approach, replacement value, net recoverable value, discounted-based models of DDM and DCF, and net current value. The IPO's suggested valuation methods tend to fail due to the specific application to identified industries while neglecting to provide detailed guidance on the valuation process. The absence of specific valuation guidelines for ICT companies in Iran can lead to that determining the ICT value to be more complex and subjective. The lack of specific guidelines leaves each practitioner to independently decide which methods to use and determine the extent to which ICT firms should be analysed. This can result in an inaccurate valuation process and the application of different valuation methods, making communication between practitioners and managers challenging (Berk & DeMarzo, 2020; Brealey et al., 2020). Applying a wide range of valuation methods and involving financial institutions emphasised the importance of knowhow and careful analysis when valuing companies in Iran. The challenging economic conditions and inflation further can add to the difficulty and introduce additional risks and uncertainties that must be considered in the Iranian ICT valuation process. Therefore, the establishment of standardised framework for approaches and valuation process is vitally important to facilitate effective collaboration amongst Iranian valuation advisors. By adopting a common set of valuation guidelines, Iranian advisors can navigate the challenging conditions more efficiently and to address these with greater clarity and regularity.

From the empirical study to achieving the **first research objective:** To critically evaluate the models, effectiveness, and justifications of valuation strategies used for ICT firms, assessing valuation practices in Germany compared to other developed countries as derived from the existing literature, the study found that in Germany, which is recognised as a well-established economy, found that two primary valuation methods used, the DCF and the market approach, were commonly used for valuing German ICTs. Another valuation method identified in current studies was the venture capital approach, which was only used for assessing the value of ICT start-ups, despite being rarely employed by German practitioners. However, it is important to note that the venture capital method has certain limitations compared to the DCF method. Consequently, it was only used in very few cases for valuing technology-focused

start-up companies in Germany. The study in Germany demonstrated that the DCF method was the primary model, with German practitioners paying more attention to detail and carefully examined different aspects of these companies to gain better accurate results. To analyse the ICT companies, the German advisors used Monte Carlo simulation, and examined different scenarios and the probabilities at different level of the valuation process, such as cash flow projections, growth rate and discount rate calculations designed to ensure that the analysis was thorough. In addition to the DCF method, the advisors also used the market approach and studied the detail financial ratios and market multiples of German ICT companies and observed how the market determined the value of these companies. German advisors used the market approach to ensure the reliability of their conclusions. This involved comparing previous comparable transactions and peer group financial ratios, enabling them to analyse and validate their findings.

Part of the reason why German valuation advisors applied the DCF, and market approaches was that the DCF method is considered the standard in Germany and widely accepted by valuation institutions. The German practitioners emphasised that the DCF method is easy to understand, transparent, and can effectively communicate the valuation process with other practitioners and management. Similarly, the market approach facilitated a shared understanding of outcomes by comparing them to market benchmarks and seeing how the market perceives ICTs. Both the DCF and market approaches consider input parameters derived from the company's information, business plan, and market perspective, which give a comprehensive assessment and allows for a holistic evaluation of value

The study in Germany revealed that German advisors did not use option pricing models (OPMs), one of the market-focused methods suggested by current literature from other developed countries. When investigating why OPMs are not commonly used in Germany, the participants were unable to provide fully satisfactory answers. They mentioned several reasons, including the lack of standard guidelines for OPMs in Germany and the preference for Discounted Cash Flow (DCF) as the standard method. German participants also expressed concerns about the complexity of implementing OPMs in practice, noting that clients often find OPMs too complex to understand and effectively present. Additionally, OPM methodology is perceived as not aligning well with DCF and market approaches, which are viewed as complementary and robust methods. As a result, OPMs are only considered in specific cases, such as for early-stage and start-up company phases or not used.

Compared to Germany, the study conducted in Iran, found that Iranian financial advisors used various valuation methods, such as DCF, DDM, and the market approach, along with the replacement method, to assess ICT companies in Iran. The Iranian advisors did not apply option pricing models (OPMs) during the valuation process due to limitations in knowledge and regulatory constraints. Specifically, components of the OPMs, such as the risk-free rate, need modification to fit the Iranian context, which requires further detailed study. The rationale why the Iranian valuation advisors applied DCF and DDM approaches was to ensure that the internal financial aspects of the ICT companies is accurately valuated, and to predict the future cash flows that ICT company can generate. The DDM methodology was employed in Iran due to the commonality of cash dividends among profitable Iranian ICTs. In contrast the valuation was influenced by several determinants, including macroeconomic policies, inflation, and exchange rate fluctuations. Therefore, the Iranian practitioners evaluated the market perspective on the ICTs by examining then comparing the financial multiples of the existing ICT companies in the market. This was illustrated by the use of the replacement valuation approach due to the economic uncertainty, with high inflation, and the fluctuation in foreign currencies.

To further achieve the other aspect of the primary research objective: to critically evaluate the models, effectiveness, and justifications of valuation strategies employed in Iran for valuing Iranian-based ICT companies, and to contrast these approaches with those used in Germany and current literature. This study found that having a thorough understanding of a company's business plan in both countries is crucial for accurately estimating ICT valuation. Valuation analysts in Iran faced several challenges when valuing ICT companies due to the high rate of inflation and the fluctuation in foreign currency. These facets are primarily at a macro-level, but have potentially a significantly influence and bearing on ICT earnings. However, these facets were impacted by high inflation and currency fluctuations which lead to significant effects on ICT company's profitability, because it increases costs of operation, creating pricing challenges, the financial reporting becomes complex, and create more uncertainty in investment decisions. Both countries in market approach analysis, reviewed historical transactions and considered various financial metrics such as revenue, cash flows, profitability ratios, and enterprise value multiples, to compare and evaluate companies in the ICT industry. By analysing comparable firms and considering financial metrics, valuation advisors in both countries gained invaluable insights into various aspects of ICT valuation.

This included relative performance, value, financial health, profitability, and enterprise value multiples. For instance, if an ICT company's financial metrics outperformed its peer group, it indicated a potential for higher value. Conversely, if the financial metrics were weaker compared to the peer group, adjustments to lower the value were necessary.

Furthermore, in achieving the **second research objective:** To critically analyse how these models have been used in the ICT valuation process in Iran, and contrasting the practices observed in Germany, especially given the differences between the two countries. This study found that Iranian practitioners evaluating ICT companies in Iran did not give sufficient attention to the DCF analysis. Iranian advisors failed to properly use the existing analysing tools to consider critical aspects such as assessing company components, predicting future cash flows, evaluating potential risks, and determining growth rates. Instead, the study found that the review of market research, scenario and sensitivity analyses were superficial, while the Monte Carlo simulations were completely absent from the current Iranian valuation process. This lack of emphasis from Iranian advisors on these valuable tools raises concerns regarding the accuracy and comprehensiveness of ICT valuations. These tools play a crucial role in providing deeper insights and addressing uncertainties in valuation process. Neglecting these aspects in Iran's valuation process could result to less robust assessments, potentially affecting the overall accuracy of evaluating ICT companies. It is crucial for practitioners to conduct a thorough and detailed analysis of each component in order to arrive at a value that they are confident in and can comprehensively explain and communicate. This ensures transparency and clarity in how they reached the specific value and the rationale behind it.

In contrast, German practitioners frequently employed detailed scenarios, sensitivity analysis, and Monte Carlo simulations to evaluate the volatility of business cash flows and risk profiles. Through comprehensive analysis and simulation-based studies, German practitioners were able to identify the key drivers and determine the significance of individual components in determining the value of ICT company. Notably, German valuation professionals stressed the importance of employing Monte Carlo simulation to test different parameters derived from historical data. This approach helped in capturing potential volatilities and facilitated a thorough comparison of the business plan component with peer groups. As a result, adjustments could be made to accurately reflect the value of the ICT company. The detailed analysis methodology adopted by German advisors allowed for a more comprehensive

understanding of the risks and uncertainties associated with the valuation process, ultimately leading to more robust and reliable assessments. This approach could serve as a valuable learning model for Iranian advisors.

Both Iran and Germany used historical data and business plan analysis in their DCF valuation and modelling for ICT companies. However, notable differences were observed, for example in Iran, the financial planning, and cash flow projections, which form the foundation of the DCF model, but was limited due to a shorter timeframe of two to three years. According to Iranian advisors, shorter projections were necessary due to the volatility of valuation-related variables such as the country's high inflation rate. However, the act of shortening the cash flow projections did not support by existing literature and the evidence from a German study. The business plan analysis in Iran also lacked any depth and detailed reasoning when examining existing assumptions. Iranian advisors primarily employed simple scenario analysis for realistic and pessimistic views during the development of future cash flow projections in the DCF. In contrast, German practitioners extended the evaluation period for cash flow projections to five years, aligning with theoretical DCF models and other developed countries. The German practitioners tended to dedicate more time to evaluating the business plan, conducting interviews, and performing comprehensive analyses using different scenarios, sensitivity analysis, and Monte Carlo simulation to assess existing assumptions from management and potential future cash flows. Understanding the detail of financial planning and recognising the impact of different perceptions and the importance of thorough business analysis can significantly enhance the accuracy and effectiveness of DCF valuations for ICT companies.

In the context of determining the discount rate in the DCF valuation of an ICT company, Iranian advisors recognised the suitability of the WACC and CAPM approach but also acknowledged the influence of inflation. However, Iranian valuation practitioners simplified the CAPM method by only adding the risk-free rate to the ICT industry risk premium, incorporating the impact of inflation. Some Iranian participants noted that small variations in the discount rate and underlying assumptions, such as Beta, had limited impact on the final discount rate. However, neglecting the Beta factor may result in the exclusion of market risk effect or insufficient attention to market risk, which can affect the accuracy of discount rate calculation. In contrast, in Germany, the standard WACC and CAPM method was employed, with German advisors considering the risk-free rate, Beta, and risk premium to calculate the

CAPM. German advisors conducted detailed analyses, including Monte Carlo simulations and peer group analysis, to determine the appropriate Beta and calculate a more accurate discount rate for ICT companies.

There were other notable differences in the approaches used to determine growth rates in DCF analysis between Iran and Germany. This study found that the Iranian advisors take a more conservative approach and look in shorter future periods, by reviewing KPIs such as company performance, business plan, industry potential and peer group comparisons. However, economic growth rates are ignored due to recent negative trends. In contrast, Germany adopted a comprehensive approach and longer vision in future align with theory and other developed countries and considered all the Iranian KPIs plus economic growth rates. The German practitioners used detailed analyses of scenario, sensitivity, and Monte Carlo simulations to determine an appropriate growth rate. The differences in considering the economic growth and inflation rates between Iran and Germany are influenced by specific macro factors and conditions present in each country. The Iranian advisors take a cautious approach, which can be attributed to the instability in macro factors within Iran.

During the valuation process, to cover different aspects of valuation, both sets of financial advisors examined the business model's characteristics, technology, management, competitors, owner's risk, technical support, customers, and revenue generation costs. This qualitative analysis was complemented by a review of the company's historical financial data, including income statements, balance sheets, and cash flow statements. From the findings, the Iranian advisors mainly relied on existing data provided by existing managements. In Germany, the practitioners conducted the analyse with greater care, especially when it comes to existing management assumptions, by engaging in discussions with management and employees of the ICT company to understand the assumptions and growth rates. German practitioners compared these assumptions against results derived from detail analysis, to assess the relevance of estimations for various components.

Finally, in achieving the **third research objective:** From the findings generated, provide a new academic insight as to how Iranian ICT companies are valuated. This study found that when assessing ICT companies, there were different challenges for Iranian and German advisors. For the Iranian advisors encountered difficulties arising from the high variability of macro-level alongside with ICT company's value drivers, whereas Germans faced challenges specific to the ICT companies themselves. Both groups of advisors suggest employing a

combination of valuation methods to achieve reliable outcomes and establish multiple reference points. When these advisors used various valuation methods that provide different reference points, comparing the ICT values can help practitioners ensure that the outcomes fall within a similar range or not. If the values are very different, this comparison helps identify why and allows practitioners for a careful review of the valuation process.

When valuing companies, advisors from both countries suggested using two main methods: the DCF approach and the market approach. The DCF approach for a detailed internal analysis of the company and the market approach to compare ICT multiples with peer group. The application of both the DCF and the market approach potentially could enhance the accuracy and reliability of the valuation process by incorporating diverse perspectives. It is advisable to apply option pricing models (OPMs) for ICT companies in Iran, given the sector's reliance on intangible assets and the high level of uncertainty. OPMs could provide valuable insights and improve the accuracy of valuations. When advisors consider multiple sources of analysis and use different methods, advisors gain greater confidence in their final valuation conclusions. This comprehensive approach allows for a more robust assessment, leveraging the strengths of each method and providing a more detail aspects on the value of the ICT being evaluated.

In presenting this finding, the study contends that it is essential to emphasise how the values obtained from different valuation methods should be presented. In Iran, valuation practitioners typically used the average values approach, which involves taking the average of different values derived from different valuation methods. Some Iranian valuation practitioners assigned a range of values and engage in team discussions to determine the final value. In contrast, Germany follows a more standardised approach by presenting the value derived from the DCF analysis as the primary method. The market approach is used for validation purposes to confirm the absence of significant estimation errors, and ensure plausibility. However, German practitioners did not use the method of averaging these values because they believe it is not the right way to do it.

6.5 Contributions to academic knowledge

In this section, the study's contributions to academic knowledge are outlined, particularly in the context of effectively valuating ICT SMEs from an Iranian perspective. The initial

contribution addresses the call for more research in this domain, as highlighted by Ghazinoory and Khorasani (2016) and Dastkhan (2022), emphasising the potential positive influence on trade exchange activities and the confidence of the Tehran Stock Exchange. Additionally, the study responds to the need for standardised guidance in conducting valuations, recognising the broad framework provided by the Iranian Privatization Organization (IPO) but lacking explicit guidelines. This aligns with recommendations from Kraus et al. (2022), Berk and DeMarzo (2020), and Brealey et al. (2020).

Another significant contribution is the filling of a gap in research by providing detailed insights into the strategies and processes of ICT valuation, particularly in the Iranian context. The study conducts a triangulating analysis with Germany, and other developed countries focusing on the practice of discounted cash flow (DCF) models in conjunction with the market approach for ICT valuation as well as the option pricing models (OPMs). The empirical findings indicate the prevalent use of the DCF approach, particularly the free cash flow to firm (FCFF) methodology, among German advisors. Notably, German practitioners overlooked option pricing models (OPMs), which are considered market-focused valuation methods, instead adhering to standards recommended by the Institute of Public Auditors in Germany (IDW) for DCF-FCFF methods.

However, the Iranian application of valuation methods diverges from the German context, and other developed countries as Iranian practitioners do not adopt the DCF-FCFF method and project a shorter two to three-year future period and did not use the option pricing models (OPMs). Additionally, while other developed countries and German advisors employ robust analysis tools such as Monte Carlo simulations, sensitivity analysis, and scenario analysis, their Iranian counterparts use superficial modelling of the DCF and market approach. Iranian practitioners also simultaneously apply outdated models like the replacement model and dividend discount model (DDM), the latter facing limitations for non-profitable ICTs and high margin of errors in estimations. The rationale for the replacement model in Iran is driven by the high inflationary environment and fluctuating foreign currencies, seeking to determine the estimated cost of establishing a new ICT company in USD or EUR.

Another contribution to academic knowledge was that there was the recognition that there was a need for standardised and more detailed guidance from official sources to assist analysts in conducting valuations. While the Iranian Privatisation Organisation (IPO) provided a framework, there are currently no explicit guidelines or techniques to follow. This

concept has been discussed in various publications by Berk and DeMarzo (2020) and Brealey et al. (2020). From an academic perspective, institutions should prioritise the establishment of comprehensive guidelines that outline proper company valuation practices and define acceptable valuation models (Kraus et al., 2022).

Further disparities emerge in the relative (market) approach, where German advisors employ more detail financial statement analysis and metrics such as EV to EBITDA and EBIT multiples, financial ratios, and market multiples. In contrast, Iranian practitioners focus on a narrower range of metrics, with predominant attention to P/E and profitability multiples. Notably, the emphasis on EV metrics is relatively less pronounced in the Iranian valuation process. Another gap addressed is the modification of the Capital Asset Pricing Model (CAPM) in Iran, wherein Beta is eliminated, contrary to the detailed Beta calculations in Germany. The omission of Beta introduces potential inaccuracies in discount rate estimations, as emphasised by Damodaran (2016), Berk and DeMarzo (2020), and Brealey et al. (2020). Finally, this study contributes into the final valuation conclusion methods practices in Iran, which was not align in comparison with Germany and in existing research.

6.6 Contribution to practice

Building on above, this section is dedicated to presenting the contribution to business practice in Iran as to valuating ICT SMEs. It outlines how the valuation process in Iran could be changed to provide a more robust solution in the subject area.

This study asserts that in Iran, valuation advisors employed four different methods of valuation, yet the analysis was potentially superficial. To enhance the valuation process, this study suggests a more detailed analysis, emphasising the two most effective methods for valuing ICT companies: the Discounted Cash Flow (DCF) and market approach along with the option pricing models. The DCF analysis is considered suitable for evaluating financial performance and forecasting future cash flows, considering the company's risk profile and growth potential comprehensively. Simultaneously, the market approach provides a benchmark valuation reflecting market perceptions crucial in the dynamic ICT sector (Berk & DeMarzo, 2020; Brealey et al., 2020; Damodaran, 2016). This study underscores the importance of combining DCF and market-based methods for enhanced accuracy in valuating

ICT SMEs. Combining these methods allows decision-makers to compare results and gain a more comprehensive perspective on ICT investment decisions.

This study rejecting the use of the Dividend Discount Model (DDM) for valuing ICT SMEs in Iran due to its significant margin of error and limited applicability in the context of irregular dividend payments common among new ICT SMEs. Similarly, the replacement cost approach is discouraged as it tends to yield the lowest value. This model should only be used when evaluating the cost of ICTs, not their potential.

This study contends that in Iran, valuation advisors should pay more attention to the DCF analysis and utilisation tools, including the usage of the Monte Carlo simulation, while conducting sensitivity and scenario analysis at various stages of the valuation process. Additionally, extending the projection period beyond two years, aligning with the other developed countries and German practice of five years, is suggested. Emphasising the consideration of risk profiles rather than relying solely on simplified formulas or generic guidelines is crucial.

Another business practice suggestion is associated to the final valuation conclusion. Instead of presenting an average of results obtained from multiple models, this study suggests prioritising the usage of DCF, the market approach and OPMs. By placing greater emphasis on DCF results followed by the market approach and OPMs, more reliable outcomes can be achieved, offering a clearer understanding of ICT valuation processes in Iran, and giving greater confidence in internal and external investors.

Implications for German and Iranian ICT Valuations Due to the Lack of OPMs: The absence of option pricing models in German ICT valuations suggests potential limitations in accurately capturing the value of intangible assets and growth opportunities. Without these models, German companies may struggle to account for the flexibility and uncertainty inherent in ICT investments, potentially leading to conservative valuations that underestimate the true potential of their projects. This could hinder innovation and strategic decision-making, as firms may be less inclined to pursue high-risk, high-reward opportunities.

For Iran, the implications of not adopting option pricing models could be even more significant, particularly as the country seeks to develop its ICT sector in a rapidly evolving global market. Without these advanced valuation techniques, Iranian firms may face challenges in attracting foreign investment, as their valuations might not fully reflect the

potential growth and innovation within their projects. In the future, the adoption of option pricing models could enhance the competitiveness of Iran's ICT sector by enabling more accurate and dynamic investment appraisals, thereby fostering greater innovation and economic growth.

6.7 Limitations of the study

There were several limitations associated with this social constructivist study. The first limitation is the potential bias of the researcher, as a social constructivist research project is subjective in nature. To address this potential bias, as a social constructivist project, the study was designed to conduct a series of semi-structured interviews with practitioners from Germany and Iran, from which the data was analysed using an interpretivist approach, which meant that the researcher needed to ensure that the subjective bias of interpretation was minimised. To address this potential bias, the researcher needed to confirm that the interview data was captured and transcribed accurately to achieve trustworthiness, dependability, and authenticity. To accomplish this, the researcher then checked the transcripts several times during the analysis stage to ensure that the participants' voices were appropriately portrayed. This was achieved also by keeping the interview data in the native language of the interviewees.

The next limitation is associated with the sample size. In this research, an interpretivist approach was followed, employing a social constructivist method throughout three phases of the study. Due to the subjective nature of the study and the limited number of practitioners in the field of interest, a small sample size was applied. It is important to acknowledge this limitation, and therefore, the study aimed to provide a comprehensive understanding of the experiences of these practitioners rather than generating generalised outcomes. Additionally, the study did not intend to draw generalised inferences, but rather aimed to generate data that would offer new critical insights. This study also recognises that collecting the data through interviewing the practitioners on a one-to-one basis has its own limitation. With one-to-one interviews, while the voices of participants are captured accurately, the viewpoint is singular (Bryman et al., 2019). To overcome this, each participant was asked open questions, but then follow-up questions were used and ask to probe further their perspective.

6.8 Areas for further research

The main suggestion for future research would be to conduct a qualitative study which is focused on the valuation process of ICT firms across a series of Middle Eastern countries. The study to be robust and relevant need to have countries which share similarities such as their risk profiles, the valuation guidelines followed and how valuation methods are used to assess ICT companies. This comparative analysis study would contribute to a better understanding of ICT valuations and increase academic understanding from an emerging and often under researched region. Another suggestion is to conduct a comparative analysis of ICT valuation practices between Iran and other Middle Eastern countries. This suggestion could explore the similarities, differences, and facets which could influence ICT valuation methodologies, approaches, and outcomes across the region. By comparing various countries, future studies could identify best practices and potential areas for improvement. Also, suggested would be to investigate the policy and regulatory frameworks related to ICT valuation in Iran and Middle Eastern countries. To achieve this, this study suggests the examination as to how government policies, regulations, and incentives impact the valuation process, investment decisions, and the overall ICT industry. This could be achieved by providing a critical insight into the effectiveness of existing policies and suggestions for policy enhancements to foster ICT development and innovation.

Finally, it is suggested that future research could examine the valuation challenges and opportunities associated with emerging technologies in Iran and Middle Eastern countries. To accomplish this, there could be a focus on areas such as artificial intelligence, blockchain, Internet of Things (IoT), and cloud computing. This might be explored as to how these technologies impact the valuation of ICT assets and the implications for investment and innovation in the region. By pursuing these research suggestions, future studies could contribute to expanding the knowledge base, addressing limitations, and providing valuable insights into ICT valuation in Iran and Middle Eastern countries and inform decision-making, policy development, and foster sustainable growth and innovation in the ICT sector.

6.9 Concluding reflection about research journey

Writing this PhD thesis was a long road, but I interested in exploring the theory the rationale behind the practiced valuation of ICTs in Iran and Germany, I studied these countries because

I am Iranian born but live and work in Germany for several years. Initially, I aimed to develop a revised theory based on a numerical approach but realised that qualitative factors were more important in the process. So, I then decided to evaluate the knowledge and experience of valuation professionals to learn from them and develop a comprehensive valuation model that includes judgmental considerations.

As a finance lecturer at a German business school, this journey has helped me improve my knowledge and transfer more detailed academic learning theory and practice to my students. Although the thesis was a long learning journey involving both academic and practical work, my aim was to create a piece of academic work that can be useful for practitioners in the future. Based on my thesis topic, I wrote a paper on modern software valuation in the US to gain academic insight into the valuation of high-tech companies. After completing the paper, I contacted journal editors and successfully published it in a British business and finance journal in 2021. Throughout this PhD process, I also participated in action learning circles, doctoral seminars, and collaborated with other academic mentors, researchers and candidates, which allowed me to engage in peer debriefing and collect valuable academic inputs. In September 2022, I had the chance to present and exchange my research progress at a conference in Tehran focused on investments and valuations. During the conference, I presented my thoughts on the assessment and valuation of ICTs in Iran, which also covered the German ICT valuation process. The discussion was engaging for attendees, as it provided insights into the future implementation of valuation of ICTs in Iran.

My next step will involve continuing to teach and build a strong publication record in corporate finance journals, as well as developing and emerging finance journals and finance conferences. Additionally, this serves as a manual to guide users on the correct valuation approach. Another interesting part of the challenging research journey was the importance of remaining open to unexpected findings. They discuss the importance of time management, self-reflection, and balancing a full-time job with pursuing a Ph.D. The experience of finding a suitable research approach and the importance of self-motivation and flexibility were different areas that I needed to be careful about. Despite the challenges, I found the research journey fulfilling and suggests it to those willing to take up the challenge of contributing to the current state of knowledge and practice.

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Appendix:

8.1 Literature review appendix

8.1.1 Valuation theories and their concepts

This section outlined the detailed process of valuation theories and their concepts, including the calculation and application of these methods. Several valuation theories have been analysed in the context of ICT companies. These theories differ in their underlying assumptions, inputs, and methodologies. Some of the prominent valuation theories include:

Income approach: Dividend Discount Model (DDM)

The Dividend Discount Model (DDM) is a valuation approach used to estimate a company's worth based on its future dividend pay-outs. The process involves several key steps. Firstly, future dividends are projected by considering historical dividend growth rates, industry trends, and the company's financial outlook. Next, a suitable discount rate, often known as the required rate of return or cost of equity, is determined. This rate reflects the company's risk and is derived from factors like market and company-specific risks. The present value of each projected dividend is then calculated by applying the discount rate, involving division by (1 + discount rate) raised to the relevant time period. The present values of all projected dividends are summed to establish the total present value of future dividends. Additionally, a terminal value is computed to capture the value of future dividends beyond the projection period. This can be achieved using methods like the perpetuity growth model or an industry-standard exit multiple. The terminal value is then discounted back to present value. By adding the present value of projected dividends and the discounted terminal value, the estimated total equity value of the company is determined. It's worth noting that the accuracy of DDM relies on the quality of dividend forecasts, the choice of discount rate, and assumptions regarding future growth (Payne & Finch, 1999). DDM is particularly suitable for mature companies with consistent dividend patterns, while companies lacking dividends or stability may benefit from other valuation methods such as the Discounted Cash Flow (DCF) model (Berk & DeMarzo, 2020; Brealey et al., 2020; Ross et al., 2020).

The standard formula for computing the present value of an asset through the DDM technique is as follows:

DDM:

$$V_0 = \sum_{n=1}^{t=\infty} \frac{Div_N}{(1+r_E)^N} + \frac{V_N}{(1+r_E)^N}$$

DDM Equation 8-1

where:

V_0 = the total current value of the asset

Div = the dividend expected to be paid by company

r_E = the required rate of return

N = periods

V_N = the value in period N

Income approach: Discounted Cash Flow (DCF) Model

The DCF model is one of the fundamental valuations approaches widely used to assess ICT companies. It estimates the present value of expected future cash flows, considering the time value of money. By discounting the projected cash flows to the present, this model provides an intrinsic value estimate. The DCF model's concept lies in the principle that the true value of an ICT company is the present value of its future cash-generating capabilities.

When applying DCF model, close attention must be given to four critical parameters: ICT's expected earnings, income generation timeline, present value of future income, and the risk and discount rate associated with realising future income (Tkachenko et al., 2018). The estimation of cash flows is a pivotal step in determining the intrinsic value of an ICT company using the DCF model. Analysts should meticulously identify relevant cash flow components and ensure accurate estimation. The process of calculating free cash flows for an ICT company involves several steps, including estimating historical revenue, determining earnings and expenses, calculating tax costs, deducting expenses and taxes to find earnings before interest and taxes (EBIT), subtracting depreciation and amortization costs to get earnings before interest, taxes, depreciation, and amortisation (EBIDA), further subtracting capital expenditures (CAPEX) from EBIDA for unlevered free cash flow (FCFFirm) (Fernandez, 2019).

Different formulas can be used to calculate FCFF, but some of the most used ones include the following:

FCFF: $EBIT \times (1 - \tau_c) + D\&A - \text{CapEx} - \Delta\text{NWC}$ FCFF Equation 8-2

Or

$OCF + Interest \times (1 - \tau_c) - \text{CapEx}$

where:

EBIT = earnings before interest and tax

τ_c = corporate tax rate

D&A = depreciation and amortization

CapEx = capital expenditure

ΔNWC = change in net working capital

OCF = cash flow from operations

In the context of calculating free cash flow, the inclusion of current asset management holds significant importance. To thoroughly assess current assets, it is imperative to analyse the net working capital in DCF model. This analysis is facilitated through the use of the following pair of formulas for calculating net working capital:

NWC: $NWC = Current\ Assets - Current\ Liabilities$ NWC Equation 2-3

$= Cash + Inventory + Receivables - Payables$

The discounted cash flow formula, as outlined in recent academic literature (Berk & DeMarzo, 2020; Brealey et al., 2020), is utilised to determine the value of an ICT asset. However, to calculate the current value, analysts must first ascertain the terminal value. The following model is employed to assess the current value of the ICT asset.

DCF Model: $$V_0 = \sum_{n=1}^{t=\infty} \frac{FCF_N}{(1 + r_{wacc})^N} + \frac{V_N}{(1 + r_{wacc})^N}$$ DCF Equation 8-4

where:

V_0 = the total current value

FCF = free cash flow

r_{wacc} = weighted average cost of capital

N = periods

V_N = terminal value

Due to the complexity and sensitivity of the discount rate in the valuation process, the determination of the weighted average cost of capital (WACC) has been extensively studied in past few years, as a result a separate section allocated to it. The section on risk and discount rate provides a more detailed discussion of various methods, including the calculation of the WACC.

Before calculating the current value of the ICT firm in a discounted cash flow (DCF) analysis, an important step is to calculate the terminal value. In this analysis, one commonly employed method is the perpetual growth method. This method assumes that the cash flows generated by the ICT asset will persist indefinitely at a constant growth rate beyond the explicit forecast period.

Academics propose the following formula to calculate the terminal value using the perpetual growth method:

Terminal Value: $$V_N = \frac{FCF_{N+1}}{r_{wacc} - g_{FCF}} = \left(\frac{1 + g_{FCF}}{r_{wacc} - g_{FCF}}\right) \times FCF_N$$ Terminal Value Equation 8-5.

where:

V_N = terminal value

FCF = free cash flow

r_{wacc} = weighted average cost of capital

g = growth rate

Determining an appropriate discount rate based on the company's risk profile and financing structure, estimating the company's growth rate, discounting the free cash flows, calculating the present value, and deriving the enterprise value by incorporating the present value of free cash flows and net debt are crucial steps.

In DCF formula, the final cash flow represents the expected cash flow in the last year of the explicit forecast period, the r_{wacc} is used to discount future cash flows, and the g_{FCF} signifies the estimated long-term growth rate of the cash flows, assuming that the long-term growth rate (g_{FCF}) of free cash flows after year N is constant. To discount the free cash flows the weighted average cost of capital is used in ICT valuation. The formula to calculate the WACC, as presented by Berk and DeMarzo (2020) and Hartwig (2012) is as follow:

Unlevered WACC: $$r_{wacc(U)} = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D$$ WACC Equation 2-6

where:
E = market value of the firm's equity
D = market value of the firm's debt
r_E = cost of equity
r_D = cost of debt

To compute r_E, both academic research and practical application affirm the predominant use of the Capital Asset Pricing Model (CAPM). The CAPM model's formula encompasses key factors including the risk-free interest rate, investment beta, and anticipated market return, as depicted in the following equation:

CAPM: $$r_I = r_f + \beta_I \times (E[R_M] - r_f)$$ CAPM Equation 8-7

where:
r_I = cost of capital of an investment
r_f = risk-free interest rate
β_I = beta of an investment
$E[R_M]$ = expected market return

Regarding the beta (β) factor within the CAPM framework, academics have introduced various methods, while only a limited number are typically used by practitioners in practice. One of the most employed formulas to calculate beta (β) is illustrated as follows:

Beta (β): $$\beta_i = \frac{\sigma_i \times \rho_{i,M}}{\sigma_M}$$ Beta (β) Equation 8-8

where: β_i = beta of ICT
σ_i = volatility of ICT
$\rho_{i,M}$ = Correlation of ICT with market
σ_M = volatility of market

Market approach or Comparable Company Analysis (CCA):

CCA involves comparing the financial metrics and valuation multiples of the target ICT company with those of its peers or competitors in the industry. The concept behind CCA is that similar companies should have similar valuations, providing a relative valuation estimate. The CCA valuation method encompasses numerous financial ratios, with the primary focus on three widely used valuation multiples: the price-earnings ratio, Enterprise Value (EV) to EBITDA, and Enterprise Value (EV) to Sales ratio. The subsequent sections elucidate the calculation procedures for these three methods.

Market approach: P/E method

The Price-to-Earnings (P/E) method assesses a company's value in relation to its earnings by comparing the current price ($Price_0$) to projected earnings ($Earnings_1$), typically for the next fiscal year. A higher P/E ratio signifies investors' willingness to pay more for potential growth or elevated market expectations. The P/E ratio aids in comparing a company's valuation within ICT industry or market, yet its interpretation should consider financial performance, growth outlook, and industry standards, as a higher P/E ratio doesn't necessarily indicate a superior investment opportunity, necessitating a holistic evaluation (Pettit, 2012; Ross, 2015). The P/E method formula:

P/E Method: $$ForwardP/E = \frac{Price_0}{EPS_1} = \frac{Div_1/Earnings_1}{r_E - g}$$ P/E Equation 8-9

where:

$Price_0$ = current price

$Earnings_1$ = forward earnings

P/E = forward price-earnings

Div_1 = forward dividend

r_E = cost of capital

g = growth rate

Market approach: EV/EBITDA method

The Enterprise Value to EBITDA multiple is a valuation metric that gauges an ICT company's value by considering its financial performance and structure. Calculated by dividing the enterprise value (EV) by EBITDA, it offers insights into the amount investors are willing to pay for each unit of EBITDA generated. This metric offers comprehensive valuation by factoring in operating performance and capital structure, considering debt and providing a clearer view of core profitability. It allows for comparative analysis, aids in acquisition decisions, and assesses a company's debt capacity. Nevertheless, it should be used alongside other methods, as it doesn't account for growth disparities, industry nuances, and earnings quality (Berk & DeMarzo, 2020). The EV/EBITDA multiple formula calculated as the following:

EV/EBITDA: $$\frac{V_0}{EBITDA_1} = \frac{FCF_0/EBITDA_1}{r_{wacc} - g_{FCF}}$$ EV/EBITDA Equation 8-10

$$V_0 = EBITDA \times comparable\ average\ EBITDA\ multiple$$

where:

V_0 = current enterprise value

EBITDA = earnings before interest, taxes, depreciation, and amortisation

FCF = free cash flow

r_{wacc} = weighted average cost of capital

g_{FCF} = growth rate

Market approach: EV/Sales method

The Enterprise Value to Sales (EV/Sales) multiple is another valuation approach that measures an ICT company's worth based on its total revenue. This multiple compares the company's enterprise value (EV) to its revenue, offering insights into investors' willingness to pay for each dollar of revenue generated. It serves as a benchmark to assess a company's valuation relative to its revenue generation capacity, with a higher EV/Sales multiple potentially indicating anticipated strong growth or premium value for revenue. Noteworthy considerations include its sensitivity to revenue changes, its utility for industry comparisons and early-stage companies, and its limitations in excluding profitability-related factors. Contextual interpretation, along with integration into a broader valuation analysis, is crucial, especially for companies with varying profitability levels or emphasising revenue-driven growth (Berk & DeMarzo, 2020; Brealey et al., 2020; Pike & Neale, 2009). Enterprise value to sales multiple valuation formula:

EV/Sales: $$EV/Sales = \frac{MC + D - CC}{Annual\ Sales}$$ EV/Sales Equation 8-11

where:

MC = market capitalization

D = debt

CC = cash and cash equivalents

The Black-Scholes option pricing model

As the Black-Scholes option pricing model is used to determine the value of intangible assets such as ICTs, its application to valuing an intangible asset would proceed as follows for the Black-Scholes formula for the price of a call option:

Black-Scholes: $C = S \times N(d_1) - K \times e^{-rT} \times N(d_2)$ Black-Scholes Equation 8-12

where:

S: Current Price of the Underlying Asset

K: Strike Price

N(d1) and N(d2): Are values from the cumulative distribution function of a standard normal distribution.

T: Time to expiration

r: Risk-free interest rate

e: Euler's number

Replacement Cost Method

The Replacement Cost Method is a valuation strategy that determines a company's value by approximating the expense of replacing its tangible assets with equivalent ones at present market rates. This approach is particularly beneficial for evaluating businesses with substantial physical assets, like manufacturing or real estate firms. The process entails steps such as identifying assets, estimating replacement costs, considering depreciation, totalling costs, factoring in liabilities, and adjusting for intangibles. This method sheds light on a company's value grounded in its physical assets, accounting for costs a purchaser would incur to recreate the entity using current market conditions. While suitable for asset-intensive industries, it may not fully encompass intangible asset value, necessitating its use alongside other valuation methods for a comprehensive assessment (IVS, 2020). Replacement cost method formula is calculated as follow:

Replacement method:	$V = MVA + G_c + LBE + RP$	Replacement Equation 8-13

where:

V = value of existing business

MVA = Market value of tangible and identifiable intangible assets (net assets) defined under the cost approach

G_c = Adjusted cost of developing business network and market recognition (promotion costs).

LBE = Lost benefit equivalent, a kind of opportunity cost that occurs during the start-up stage of a new business: benefits that the investor does not receive having decided to start a business from scratch rather than acquire a company already generating returns.

RP = Value of eliminated start-up risk (excess of budgeted expenses, high probability of losing a part of invested capital or its total amount).

Venture Capital (VC) method:

The Venture Capital (VC) method is a valuable approach to assess the value of startups or early-stage companies, especially when conventional valuation techniques are unsuitable due to limited operating history or unique attributes. Commonly used by venture capitalists and angel investors, this method involves estimating the future exit valuation based on industry trends and investor expectations, factoring in the target return rate linked to investment risk. By calculating the necessary ownership stake for the desired return, the method derives the company's valuation. Sensitivity analysis aids in understanding different valuation scenarios, and the resulting valuation informs negotiations between investors and founders. While beneficial for nascent companies, careful consideration of risk appetite, industry dynamics, and exit strategies is crucial, and combining the VC method with other approaches and thorough due diligence ensures informed investment choices (Isaksson & Fredriksen, 2020; Shin, 2020; Suwarni et al., 2020). The VC can be calculated in the following formula:

Expected RoI:

$$\text{Expected RoI} = \frac{\text{Exit Value (EV)}}{\text{Post money Valuation (PMV)}}$$

Expected RoI
Equation 8-14

$$\text{PMV} = \frac{\text{Exit Value (EV)}}{\text{Expected RoI}}$$

where:

RoI = expected return on investment

EV = estimated value at which the firm will be sold

PMV = post money valuation

8.2 Methodology appendix

8.2.1 Comparative analysis of research paradigms and methodologies for research method selection

To arrive at the ultimate selection of the most suitable research method, the researcher designed and developed matrix to compare different research paradigms. The matrix analysis

helped the researcher to a comprehensive description and comparison of various research paradigms, encompassing aspects such as reasoning, ontology, epistemology, axiology, research strategy, method, data collection, ethics, languages, skills, outcomes, pros, cons, and limitations. Ultimately, this analysis helped the researcher to understand which approach best aligns with the objectives of this research.

As the interpretivist has been chosen for this study its stance in research demands a profound understanding of the experiences from the practitioners. Opting for this position in the context of ICT valuation in Iran and Germany offers several significant advantages. It facilitates improved relationships with the public, enables the formulation of research questions and methodologies to unearth fresh insights into ICT valuation cultures, and allowed researcher for the translation of these insights into educational curricula. In assessing the valuation of ICT companies, adopting an interpretivist perspective within the research process helped interpret practitioners' viewpoints and contributes to the evolution of contemporary theories. The researcher considered this approach was possess fluency in foreign languages and cultures, along with a robust background in computer, valuation knowledge, and data analysis. Before fully committing to this position, the researcher thoroughly explored existing literature within the field to grasp the scope of work involved and the role to play in this research. By embracing the interpretivist position, the researcher could document participants' experiences and findings during this research journey, thereby contributing novel knowledge that could be shared with fellow researchers, advancing the field further.

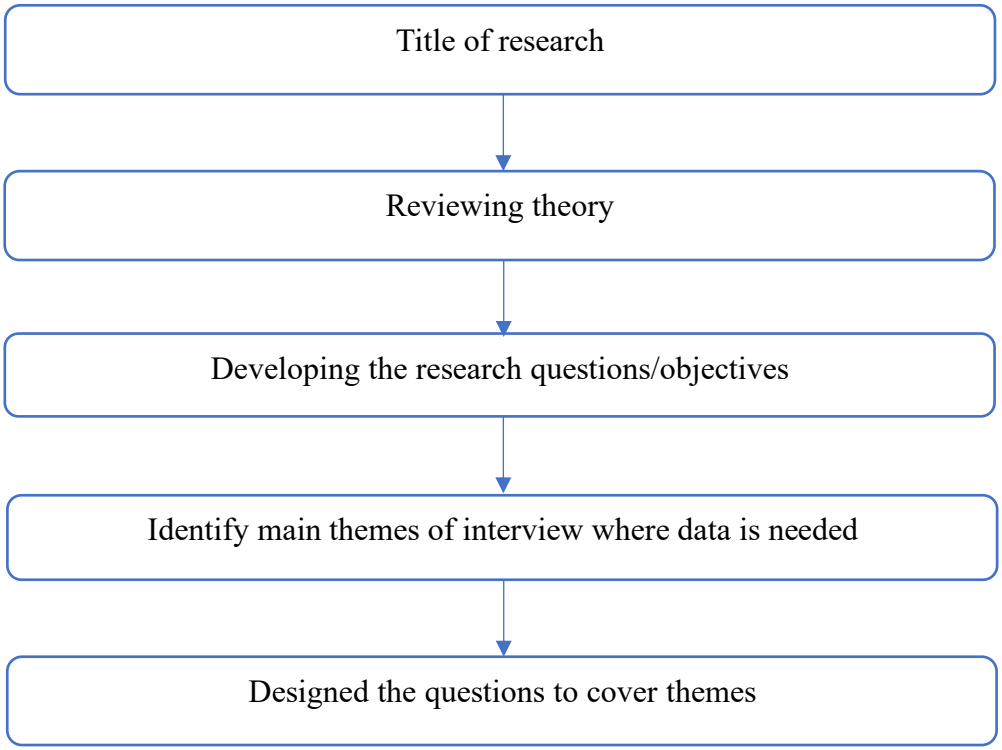
8.2.2 Designing the interview questions

The study used a semi-structured interview method to gather primary data and obtain in-depth knowledge and understanding of the different perspectives of the participants on this topic. Semi-structured interviews were designed as open- and semi-closed-ended questions to identify further data collection and provide feedback on the research questions (Blaikie, 2009). The qualitative (semi-structured) interviews helped explore the evidence used by the organisations to evaluate ICTs.

The study was designed to devise interview questions based on research themes identified in the literature (Kvale, 2008). Semi-structured interviews were chosen because they provide

flexibility in engaging participants, collecting open-ended data, and exploring personal and sensitive issues (Galletta, 2013). The questions were finalised with supervisors' help to ensure they covered the themes. The researcher carefully designed and amended questions with supervisors to ensure they were error-free, and no unexpected issues arose during the primary data collection phase. The diagram 8-2 illustrates how interview questions developed.

Figure 8-1. Deriving questions for interviews



Source: Prowle (2020)

Some of the challenges in conducting interviews in Germany and Iran included: Contacting and asking the knowledgeable individuals or managerial level was challenging without having the right connections to connect the researcher to the participants. Another challenge was that the abovementioned potential participants were overwhelmed and have time incapacity. Covid-19 and the pandemic have changed people's access and made it more difficult to recruit new volunteers. Also, the researchers have made several requests, and some (participants) have stated that they are unable to join since they have previously collaborated with others.

The interviews' detailed valuation methods and processes provided key insights while discussing practical cases. This part was actively and even enthusiastically performed by all participants because they presumably felt highly confident in performing this task, similar to performing evaluations at work.

The follow-up questions in the interview cover the inadequate information in the valuations provided valuable insights into the additional data and information that are crucial in performing a valuation of ICT firms. All participants provided detailed interview questions and information leaflets to make them feel comfortable about the interview.

As the evidence demonstrates, this is not a comparative study because of the differences in nations. In the initial phase, the researcher sought to comprehend the nature and methodology of the valuation process in an established economy like Germany. Therefore, the first two pilot interviews of German practitioners were performed in English (the first two were English native living in Germany), and the language was kept thereafter because the practitioners were satisfied with it. After conducting the first phase of interviews and understanding the concept, the researcher moved on to the Iran interview phase and performed ten interviews with Iranian practitioners, reaching saturation at number eight. The interviews were conducted in Persian, and then translated them into English. The researcher wanted to gain a deeper understanding of what the Iranian was saying, so he performed five more interviews with new German participants and completed the data collection. Prior to conducting the main study in Iran, the researcher is required a comprehensive understanding of an established economy and its perspective. Due to Iran's embryonic valuation environment and very niche topic, the researcher could only address a small population at once. So, in order to ensure that sufficient data were collected, the researcher decided to return to Germany and conduct another five interviews in order to collect substantial data from there.

The three phases of the data collection interviews had the same methodology but different aims. In the first phase, German practitioner interviews were conducted to understand the concept and investigate the valuation process thoroughly. After data collection, they were transcribed and analysed. In the second phase, interviews with Iranian specialists were conducted to collect the data for the main study, use the developed knowledge to investigate the ICT valuation process, and uncover interesting aspects. The data were then transcribed, translated, and analysed. In the last phase, the additional data collection using the same

procedure assisted in the clarification of the investigated topic and helped to develop more substantial data to strengthen the study.

8.2.3 Conducting interviews and transcription

The interviews took place between July 2021 and Sep 2022, intending to ensure that ethical commitments and specified procedures were considered. The researcher accomplished all the interviews with the selected participants (methodology chapter, sampling section). Based on the sampling technique and participant qualifications, the interviews with German specialists were done first, followed by interviews with the Iranian practitioner.

The following are some criteria for conducting the interviews: As the research topic is extremely complex and niche (ICT sector), so only a few people engage in this sector and have the experience to respond to the interview questions. Since the lower level that were not involved in the whole valuation process, they could not answer the interview questions, then the following criteria were used to select the target participants:

- Being highly professional in the valuation of ICT companies
- Having sufficient experience (more than seven years)
- Being in major cities in Germany and Iran

The same criterial applied for choosing the Iranian practitioners. After reviewing the Iranian valuation literature, the researcher has asked almost the same interview questions. In the second part of the data collection, the researcher has applied ten interviews. In Iran the collected data reached to the saturation in eight interviews, and in the latest part of the interview phase the answers were very much similar and there was not new knowledge produced. But further interviews were undertaken to guarantee that the saturation level was met.

The interviews primarily conducted as a form of audio and video communication in online format. Telephone interviews were conducted with a few German participants. Because of Covid-19, long distance and the inflexibility of participants scheduling, many respondents prefer distance contact and only accept online and telephone interviews (Gläser and Laudel, 2010). As a result, doing an in-person interview was impossible.

The pilot study in the initial phase of the interviews with German practitioners was conducted in English since they were English natives working in Germany. However, when the interviews continued and the researcher asked the candidates if they were in German or English, they suggested continuing the interviews in English. Conversely, the Iranian interviews have been conducted in Persian. After the interviews were conducted, the researcher used transcription software (f4x.audiotranskription) to achieve a high-quality standard for the transcription of the German interviews.

As for the Iranian interviews, the researcher transcribed the audio interviews in Persian. After that the researcher hired an official translation institute to translate the interviews, when received the transcriptions, then the transcriptions were checked and edited with a finance professor (did his PhD in the UK) in Iran to make sure that the transcribed data meet the proper academic meaning, without mistranslation or change in the meaning of the statements.

8.3 Findings appendix

8.3.1 Information leaflet

The University of Gloucestershire

Hossein Yousefi PhD candidate in Financial Management

Tel: +49…

Email: [redacted]

Further information (Q&A) about:

Research topic: How Iranian information communication and technology (ICT) companies are valued.

What is the aim of this research?

The purpose of this study is to gain insights into valuation practice of ICT firms in Germany. The study will focus to identify the effectiveness of valuation methods used for valuing such companies.

Who is conducting the research and who is it for?

Hossein Yousefi (PhD candidate in University of Gloucestershire) is carrying out this research. This research is the dissertation for the degree of Doctor of Philosophy in Financial Management from University of Gloucestershire. Professor Dr Malcolm Prowle (Supervisor).

Why am I being invited to participate in this research?

You have been identified as a suitable enterprise and valuation specialist for this study. For this reason, we would like to invite you to participate in our research.

If I take part in this research, what will be involved?

The researcher will be conducting interviews during the period July 2021 to Sep 2022. The interview will take approximately between 40 minutes to one hours and would be conducted

online, at a date and time that is convenient to you. Also, intended that the research process will be of benefit to you as well as us, by identifying areas where valuation of ICT may contribute to knowledge, practice, and the effectiveness of the methods.

What will the interview be like?

The interviewer will use a semi-structured qualitative question which contains valuation questions intended to act as a catalyst for free conversation. It is hoped that the interviews recorded, and the narrative subsequently transcribed into written form which will be stored electronically.

What will we be talking about? Or What will you be observing?

The researcher will be asking you about:
The applied valuation methods and, where particular techniques are/not employed, attempting to ascertain the reasons why.

Is it confidential?

Your participation will be treated in **strict confidence** in accordance with the Data Protection Act. No personal information will be passed to anyone outside the researcher. The researcher will write a report of the findings from this study, but no individual will be identifiable in published results of the research.

What happens now?

Over the next few days, the researcher may contact you by telephone to ask if you would like to take part and, if so, ask you a few questions about yourself. We need to make sure that a cross-section of people with different experiences are included in the study and for this reason we cannot guarantee that we will see everyone who volunteers to take part, although we would hope to include most. If you would prefer not to be contacted about this research, please send your answer to above contact information to let us know and we will not contact you again. Your participation is entirely voluntary.

What if I have other questions?

If you have any other questions about the study, we would be very happy to answer them.
Please contact Mr Yousefi by email to [redacted]
Professor Dr Malcolm Prowle: [redacted]

8.3.2 Interview guide and questions

Note: this interview guide was used as a reference during my interviews. The participants were provided with the information leaflet and questions in advance, and this guide was presented to them. All questions were asked and answered verbally. Although all themes and topics were discussed in each interview, the order and phrasing of the questions varied. If any additional relevant topics or questions came up during the interviews (which occurred particularly in the early interviews), the interview guide was updated accordingly.

Introduction & first question: [Prior to commencing the interview, I provided an overview of my background and research methodology to the participant. I obtained their consent for the recording of the interview and requested them to sign the consent form. Additionally, I inquired if the participant had any queries before we proceeded with the interview].

This interview is done as part of a research project for a doctorate in financial management. It designed to gain your perspective and opinions to understand better how German technology managers/advisors manage decision making about the valuation and market value of such firms. This interview will take about 40 minutes.

Indeed, all answers you provide will be kept strictly confidential and will not be passed on to third parties and used solely for the agreed purpose. The review results will only be used for academic research purposes. Moreover, the participant's identifications and companies' names will not be in any publications.

If you have any questions or uncertainties, please do not hesitate to contact
[redacted]

The abbreviation ICT is used for information communication and technology.

Tell me about yourself -male/female -age -education -type of your organisation and experience and position. And made sure about their role in valuation process is relevant to the research study.

1- Have your company already invested/involved in ICT firms' transaction (valuation)? How?

2- What method(s) your company (you) apply when valuing ICT companies and how is the effectiveness of the method(s)? Why?

3- What technique(s) your company (you) apply to estimate the cost of capital and discount rate and how is the effectiveness of the techniques/approaches? Why?

4- What can be improved in setting discount rates and in valuation processes in general and specifically?

5- Have your company (you) modified any models or techniques to get a better result? How?

6- How does your company (you) consider the systematic and unsystematic risk in valuation processes?

7- How does your company (you) determine growth rate, in different level?

8- How your company consider the different risk profile and risk mitigations of an ICT firm in the valuation process?

9- What data and financial information must be prepared and presented for the final investment decision?

10- Are there any other important influencing factors and essential points to be considered in the valuation process and decision-making?

11- Could you provide a detailed explanation of the challenges encountered in the valuation process, specifying the particular aspects affected, and describe how these challenges were addressed?

12- How does your organisation consider the presentation of par values derived from various valuation methods?

13- Which methods would your company (you) suggest for future valuation of such a company?

14- Would you like to provide any further information?

Thank you very much.
May I come/get back to you to discuss further if there's anything that remains unclear?

German translation of interview questions:

Dieses Interview wird im Rahmen eines Forschungsprojekts für eine Promotion im Bereich Finanzmanagement durchgeführt. Es dient dazu, Ihre Sichtweise und Meinungen zu erfahren, um besser zu verstehen, wie deutsche Technologiemanager/-berater Entscheidungen über die Bewertung und den Marktwert solcher Unternehmen treffen. Dieses Gespräch wird etwa 40 Minuten dauern.

Alle von Ihnen gegebenen Antworten werden streng vertraulich behandelt und nicht an Dritte weitergegeben und ausschließlich für den vereinbarten Zweck verwendet. Die Ergebnisse der Befragung werden ausschließlich für akademische Forschungszwecke verwendet. Außerdem werden die Namen der Teilnehmer und der Unternehmen in keiner Veröffentlichung genannt.

Bei Fragen oder Unklarheiten können Sie sich gerne an s4001134@glos.ac.uk wenden.

Die Abkürzung ICT steht für Information, Kommunikation und Technologie.

Erzählen Sie mir von sich selbst - männlich/weiblich - Alter - Ausbildung - Art Ihrer Organisation und Erfahrung und Position. Und vergewissern Sie sich, dass ihre Rolle im Bewertungsprozess für die Forschungsstudie relevant ist.

1- Hat Ihr Unternehmen bereits in Transaktionen von IKT-Firmen investiert/beteiligt (Bewertung)? Wie?

2- Welche Methode(n) wendet Ihr Unternehmen (Sie) bei der Bewertung von IKT-Firmen an und wie effektiv ist die Methode(n)? Warum?

3- Welche Technik(en) wendet Ihr Unternehmen (Sie) an, um die Kapitalkosten und den Diskontsatz zu schätzen, und wie wirksam sind diese Techniken/Ansätze? Warum?

4- Was kann bei der Festlegung von Abzinsungssätzen und bei Bewertungsprozessen im Allgemeinen und im Besonderen verbessert werden?

5- Hat Ihr Unternehmen (Sie) irgendwelche Modelle oder Techniken geändert, um ein besseres Ergebnis zu erzielen? Wie?

6- Wie berücksichtigt Ihr Unternehmen (Sie) das systematische und unsystematische Risiko bei den Bewertungsverfahren?

7- Wie bestimmt Ihr Unternehmen (Sie) die Wachstumsrate auf verschiedenen Ebenen?

8- Wie berücksichtigt Ihr Unternehmen das unterschiedliche Risikoprofil und die Risikominderungsmaßnahmen eines IKT-Unternehmens im Bewertungsprozess?

9- Welche Daten und Finanzinformationen müssen für die endgültige Investitionsentscheidung vorbereitet und vorgelegt werden?

10- Gibt es weitere wichtige Einflussfaktoren und wesentliche Punkte, die im Bewertungsprozess und bei der Entscheidungsfindung zu berücksichtigen sind?

11- Könnten Sie die Herausforderungen, die im Rahmen des Bewertungsprozesses aufgetreten sind, detailliert erläutern, wobei Sie die betroffenen Aspekte angeben, und beschreiben, wie diese Herausforderungen angegangen wurden?

12- Wie sieht Ihr Unternehmen die Darstellung der aus verschiedenen Bewertungsmethoden abgeleiteten Nennwerte?

13- Welche Methoden würde Ihr Unternehmen (Sie) für die zukünftige Bewertung eines solchen Unternehmens vorschlagen?

14- Möchten Sie weitere Informationen zur Verfügung stellen?

Ich danke Ihnen vielmals.

Darf ich mich mit Ihnen in Verbindung setzen, um weitere Fragen zu besprechen, wenn noch etwas unklar ist?

Persian translation of interview questions:

این مصاحبه به عنوان بخشی از یک پروژه تحقیقاتی برای دکتری مدیریت مالی انجام شده است. این برنامه برای به دست آوردن دیدگاه و نظرات شما طراحی شده است تا درک بهتری از نحوه مدیریت تصمیم گیری مدیران/مشاوران فناوری ایرانی در مورد ارزش گذاری و ارزش بازار چنین شرکت هایی داشته باشد. این مصاحبه حدود 40 دقیقه طول خواهد کشید.

در واقع، تمام پاسخ‌هایی که ارائه می‌کنید کاملاً محرمانه خواهند بود و به اشخاص ثالث منتقل نمی‌شوند و صرفاً برای هدف مورد توافق استفاده می‌شوند. نتایج بررسی فقط برای اهداف تحقیقاتی دانشگاهی مورد استفاده قرار خواهد گرفت. ضمناً هویت شرکت‌کننده و نام شرکت‌ها در هیچ نشریه‌ای وجود نخواهد داشت.

اگر سوال یا ابهامی دارید، لطفا با ایمیل تماس بگیرید

ICT مخفف برای ارتباطات و فناوری اطلاعات استفاده می شود

در مورد خودتان - مرد/زن - سن - تحصیلات - نوع سازمان و تجربه و موقعیت خود بگویید. و مطمئن شد که نقش آنها در فرآیند ارزشیابی با مطالعه تحقیق مرتبط است.

آیا شرکت شما قبلاً در معاملات (ارزیابی) شرکت های ارتباطات و فناوری اطلاعات سرمایه گذاری یا مشارکت داشته است؟ چگونه؟

شرکت شما (شما) از چه روشی برای ارزش گذاری شرکت های فناوری اطلاعات و ارتباطات استفاده می کنید و اثربخشی روش(ها) چگونه است؟ چرا؟

شرکت شما (شما) از چه تکنیکی برای برآورد هزینه سرمایه و نرخ تنزیل استفاده می کنید و اثربخشی تکنیک ها/رویکردها چگونه است؟ چرا؟

در تعیین نرخ های تنزیل و در فرآیندهای ارزش گذاری به طور کلی و خاص چه چیزی را می توان بهبود بخشید؟

آیا شرکت شما (شما) مدل یا تکنیکی را برای به دست آوردن نتیجه بهتر تغییر داده است؟ چگونه؟

شرکت شما (شما) ریسک سیستماتیک و غیر سیستماتیک را در فرآیندهای ارزش گذاری چگونه در نظر می گیرد؟

شرکت شما (شما) چگونه نرخ رشد را در سطوح مختلف تعیین می کند؟

شرکت شما در فرآیند ارزش گذاری، مشخصات ریسک و کاهش ریسک یک شرکت فناوری اطلاعات و ارتباطات را چگونه در نظر می گیرد؟

چه داده ها و اطلاعات مالی برای تصمیم گیری نهایی سرمایه گذاری باید تهیه و ارائه شود؟

آیا عوامل تاثیرگذار مهم و نکات ضروری دیگری وجود دارد که در فرآیند ارزش گذاری و تصمیم گیری مورد توجه قرار گیرد؟

آیا می توانید توضیح مفصلی در مورد چالش های پیش آمده در فرآیند ارزش گذاری، با مشخص کردن جنبه های خاص تحت تاثیر قرار دهید و نحوه رسیدگی به این چالش ها را توضیح دهید؟

سازمان شما ارائه ارزش اسمی حاصل از روش های مختلف ارزش گذاری را چگونه در نظر می گیرد؟

شرکت شما (شما) چه روش هایی را برای ارزیابی آتی چنین شرکتی پیشنهاد می کنید؟

آیا می خواهید اطلاعات بیشتری ارائه دهید؟

بسیار از شما سپاسگذارم

آیا می توانم برای بحث بیشتر در صورت وجود چیزی که مبهم باقی مانده است، بیایم/با شما تماس بگیرم؟

8.3.3 Initial contacting interviewees

Dear Mr/Ms. …

Thanks for ....

My name is H. Yousefi, and I am a PhD candidate in financial management in the UK.

For the empirical chapter of the research, which is the valuation of ICT companies in Iran and Germany, I am applying interviews with professionals in valuation.

Based on your experience and skills; you seem to be the right person to interview.

Please reply here if you would like to take part, or over the next few days, I can contact you by telephone or email to ask if you would like to take part.

There are interesting questions regarding the valuation of ICT, which I believe both will learn during the interview. Therefore, after your confirmation, I will attach the interview's information to clarify the research and interview details.

I would be grateful to further talk to you and hopefully coordinate an interview.

Thanks, and I am looking forward to hearing from you.

8.3.4 Coding example

Figure 8-2 displays a coding sample extracted from the collected data.

Figure 8-2. A coding sample