MBA Innovation, Digitalization & Entrepreneurship

ACADEMY FOR CONTINUING EDUCATION

Alternative criteria for centralization of accounting subledger for financial products

A Master's Thesis submitted for the degree of
“Master of Business Administration”

supervised by
Mag. Dr. Helmut Aigner

Viktoriia Rakova

01460774

Vienna, 10.02.2023

Affidavit

I, **VIKTORIIA RAKOVA**, hereby declare

1. that I am the sole author of the present Master's Thesis, "ALTERNATIVE CRITERIA FOR CENTRALIZATION OF ACCOUNTING SUBLEDGER FOR FINANCIAL PRODUCTS", 113 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
2. that I have not prior to this date submitted this Master's Thesis as an examination paper in any form in Austria or abroad.

Vienna, 10.02.2023

_____
Signature

Abstract

This thesis aimed to identify, categorize and evaluate the decision-making factors and approaches for the centralization of subledger for financial products utilized by financial service companies in Europe. The central research question was to find the common alternative decision-making criteria when it comes to the centralization of subledger for financial products. The master thesis based the research on qualitative methods, namely context analysis of data collected with a non-probability sampling strategy. In order to reach the aims of this master thesis, the data collected from various literature sources, including academic literature, interviews with industry experts, and IT software vendor websites was synthesized to build a general framework regarding alternative criteria for the centralization of subledger for financial products. The results indicate that there are two alternatives to the centralization of financial product subledger. The data suggests that in the financial area, multiple important criteria and aspects are influencing the decision to centralize the subledger for financial products. Using context analysis the criteria could be categorized into five thematic groups, namely strategic and economic factors, business and technical functionality, and vendor criteria. The data indicates that the strategic criteria group holds the highest importance and weight, where the financial institutions are mapping the strategic targets and goals of the company to the functionalities and capabilities of the subledger for financial products. The other criteria groups are commonly considered within the process of deciding about the centralization of financial subledger after the majority of strategic indicators are met. The criteria catalog created within the research and weighting of the importance of different factors for centralization of a subledger for financial products can be applied in practice by financial institutions in the form of guidance or a benchmark, supporting senior management decision referring to centralization of a subledger for financial products. Future research might be focused on other alternatives to the centralized subledger. The research can be also expanded with additional sampling and the implementation aspects of subledger for financial products in other regions like Asia, Africa, North and South America, and the Middle East. Their regional aspects might be further analyzed and discovered.

Table of contents

Chapter 1: Introduction

High regulatory pressure in the finance industry combined with rapid technological advancements are opening doors to start-ups, and creating a tough environment for traditional banks and insurance companies forcing them into reorganization, simplification, and optimization of internal processes, change of their business models, and corresponding IT landscapes. An accounting subledger for financial products is a core component of a finance digital transformation aimed to provide on-time information needed for managerial decisions in a fast-paced environment and comply with expanding external reporting requirements (Werner 2019). However, there are conflicting views and an overall lack of research regarding how best to define the alternative criteria for the centralization of an accounting subledger in the finance industry, where subject knowledge is continuously evolving as a reaction to new experiences from implementation examples.

This research aims to identify, categorize and evaluate the alternative decision criteria for the centralization of accounting subledger for financial products in the industry undergoing digital transformation where subject knowledge is continuously evolving.

This chapter will provide an introduction to the master thesis by first discussing the background and context, followed by the research problem, the research aims, objectives and questions, the significance, and finally, the limitations.

1.1 Background to the thesis

The demand for a subledger for financial products grew throughout the history of accounting, accounting standards and principles, globalization, the history of banking, numerous financial crises and increase of regulatory pressure as well as the technological revolution, and, last but not least, the rise of Fintechs (OECD 2018).

The evolution of the topic is so widespread that its roots come from thousands of years of human civilization. There is evidence confirming the theory that the art and practice of accounting existed in Vedic times, where the details of matters recorded, registered, and examined of accounts are described (Adukia 2011). However, generally, the origin of accounting can be traced to the Babylonian Empire around 3500 B.C. For thousands of years, people were keeping account of commerce deals, goods, and services, and coding those transactions (Adukia 2011). With the evolution

of currency and money, accounting has spread all over the globe and required more and more details. Taxes imposed on people required a thorough examination of those accounting records, thus the invention of generic principles of record keeping. Ancient Greece, China, India, Roman empire, Medieval times – throughout those different stages of human evolution accounting principles and requirements for financial statements were evolving too, during these times people started using annual budgets and hiring auditors to account for profits and losses of newly created business forms in rising trade and commerce (Adukia 2011).

In the early 14th century the first cities started reporting in the double entry form. By the 16th century double entry accounting principle went global following the history of empires and their colonies and the increase in education brought by religion (Adukia 2011). In the 17th century country by country, the national authorities require financial reporting according to country-specific accounting principles as a response to the creation of the first big corporations and the opening of stock markets. This was the time of the creation of the first bank regulating institutions on a country level, here is when the first national banks emerged (Canals&Jordi 2011).

The 18-19 century were the rise of free-market banking. Under the views of a self-regulated economy, bankers managed to limit state involvement in the sector and gain significant financial and political power (The Economist 2022). Free-market capitalism and competitive banking found perfect ground in the United States of America and then spread around the globe. The banking industry was flooded with small private banks, and this business was incredibly profitable, bringing more and more players onto the market. In the mid-19th century, the situation started turning around for small banks, which were creating partnerships and making big acquisitions to occupy more market share and impact pricing (The Economist 2022). With the chain of mergers and acquisitions, the markets all over the globe by end of the century were primarily occupied by megabanks holding over 75% of the market, posing a systemic risk to the economy. The business transactions became global, thus bringing risks of far-reaching economic impacts of the crisis, namely distributing profits of corporations between different countries and also bringing losses from abroad. The first global crisis blew up in 1857 spreading panic, unemployment, and devastation. Bankruptcies of businesses were followed by the closing of respective banks providing loans to those businesses (The Economist 2022). This is when regulatory pressure became necessary to normalize the situation.

The First World War gave the economies several more years with the need to finance war and rebuilding of countries. But the real turning point for imposing accounting standards was the Great Depression of 1929-1933 (Adukia 2011). The biggest economic crises in history had far-reaching outcomes around the world. Bank failures came in waves, business bankruptcies, unemployment rose to 25%. With the massive state reforms, capital injections, and extreme regulations the situation was able to stabilize but gave raise to new government bodies regulating customer money and almost all banking operations (The Economist 2022). Countries were changing laws, imposing stricter rules and enforcing accounting standards, and providing academic justification for the standardization of accounting (Adukia 2011).

In order for financial statements to make sense to users who rely on them for their decision-making purposes, there has to be consistency in the way items are treated in the financial statements. Limited liability companies have a statutory duty to comply with these rules, and it is the job of the auditor to check this compliance. Partnerships and sole proprietorships are also often bound by these rules because of professional or trade association standards or because of the conditions attached to loans. The rules govern two aspects of accounting: 1. The accounting treatments are permissible for any individual event or transaction. 2. Disclosure requirements which tell us permissible formats for the balance sheet and profit and loss account items (Adukia 2011). These rules are called Accounting Standards.

Until 1972 the accounting standards still differ between countries and even states or regions, the comparison between financial statements was complicated for investors and customers, who wanted to evaluate a company's stability and profit opportunity (Adukia 2011). In 1973 an International Accounting Standards Board was created to cover the increasing need for standardization of accounting principles, globalization, and the rise of mega-corporations, to provide transparency of financial information and comparability between the years and regions. IASC was founded in June 1973 after an agreement by accountancy bodies in Australia, Canada, France, Germany, Japan, Mexico, the Netherlands, the United Kingdom, Ireland, and the United States, and these countries constituted the Board of IASC at that time (IFRS.ORG 2022). The intention was that it would set up new international standards, which must 'be capable of rapid acceptance and implementation worldwide'. In 1981, it was agreed that IASC would have complete autonomy in setting international accounting standards and in publishing discussion documents on international accounting issues (Adukia 2011).

At the same time regulations towards banks are expanding (Quaglia & Lucia 2004). The Banking Supervision authorities are formed, including international ones like Basel Committee. In the 1980s first strict regulatory requirements are imposed to prevent further financial crises and keep track of credit risk, risk-weighted assets, and capital requirements. Basel I is coming into force in 1988 (Putnis et al. 2022).

Between 1973 and 2001 the International Accounting Standards Committee (IASC) released International Accounting Standards (IFRS.ORG 2022). The International Accounting Standards Board (IASB) replaced the International Accounting Standards Committee (IASC), in 2001. On its formation, in April 2001 the IASB announced that the IASC Foundation Trustees agreed that accounting standards issued by IASB would be designated "International Financial Reporting Standards" (Adukia 2011). This was an important milestone in the history of Europe when several countries agreed to enforce one set of accounting standards for their internal as well as international reporting. In 2002 Europe adopts a law requiring listed companies on regulated securities markets, including banks and insurance companies, to prepare their consolidated financial statements in accordance with IFRS Accounting Standards (Adukia 2011). From that point onwards the number of countries and industries following these regulations just grew. It is important to note that US GAAP and some other local GAAP stayed for local purposes, but in the following years, agreements were signed to bring the accounting standards closer together with local GAAPs (IFRS.ORG 2022).

Yet another crisis beginning of the 21st century brought new challenges to the economy and new stricter regulations followed. The biggest impact in Europe brought the adoption of the following regulations in 2004: Basel II demanded even higher capital requirements, Financial Groups Directive required additional supervision of financial conglomerates, the Market in Financial Instruments Directive (MiFID) provided regulations of the financial services market, regulating activities of market players which provide investment services, etc. (Putnis et al.2022).

On the other hand, technological evolution caught up and started impacting such traditional areas of business as banking already at the beginning of the 21st century. This is the time when start-ups were starting to enter the market of financial services. The first step in creating Financial Technological Start-ups (FinTechs) was made in 2004, when the very first screen scraping and data use was made (England 2022), enabling bank customers to grant service providers permission to access their banking information. This breakthrough allowed the service provider to access the

account, if they were the customer. This advancement allowed new companies to enter the banking sector focused on providing payment services to the customers, replacing traditional banking transaction services and sparing the time of customers at banks' branch offices. The era of FinTechs and open banking has begun (England 2022).

The regulation of this new type of business was published in 2007 called the Payment Services Directive or PSD1 (Putnis et al. 2022). The aim was to stimulate competition in the financial industry, enhance the quality of services provided and protect the end user. The move led to a new industry category – namely, payment services, which featured new regulations enabling non-banks to carry out transactions and grow in the sector.

The 2007-2009 financial crisis developed gradually, early 2007 showed signs of increased bankruptcy, hedge funds followed, and investments started to fail, but the most prominent mark of that time was the collapse of Lehman Brothers as the biggest fall in US history (The Economist 2022). When the bubble burst, financial institutions were left holding trillions of dollars worth of near-worthless investments in subprime mortgages. It was a domino effect on the US and other biggest world economies, followed by less developed countries. The losses were close to the times of the Great Recession (The Economist 2022). As in similar cases in history all countries reacted with numerous reforms and even more rules and regulations. So countries equip themselves with regulations of Central Banks, Financial Market authorities, Supervisory authorities as well as international committees on a regional and global level. All efforts hoping to prevent another financial crisis like that in the future (The Economist 2022).

In the years to follow Basel III is published in 2010 raising capital requirements and reporting needs, MiFID II in 2014 added regulation to trading strategies, banning certain products and activities for banks, PSD2 in 2015 complemented previous regulations with new security measures for banks and FinTechs (Feyen et al. 2021), and finally, AnaCredit announced by ECD in 2016 brought the collection of credit data on deal and transaction level (Putnis et al. 2022).

In the meantime, FinTechs continue expanding their activities and from 2011 customers were allowed to download and use their transaction data in online tools, which increased banking switch and brought the era of digital banking to life. This scheme was backed by credit card producers and rolled out in 2015 aiming to change personal banking (England 2022).

From 2015 FinTech companies become established business models of modern economies, taking over more activities from traditional banking, growing transactional volumes and customer base exponentially (England 2022). With customer expectations changing rapidly towards online banking, Fintechs are not occupying niche markets anymore, but actively competing with the biggest financial groups around the world, forcing them into digital transformation and rethinking their core business processes.

To sum up, through the history of mankind and especially in the 20th and 21st centuries multiple economic, political, and technological aspects forced banking institutions and IT software providers to work together on the solution allowing banks and Fintechs to comply with numerous regulatory requirements and accounting standards on a local and international scale (OECD 2018). The latest changes in those requirements (Putnis et al. 2022) represent the tendency of supervisory authorities to track not only high-level indicators of financial performance and stability of banks but rather to go into details on customer, deal, and even transaction levels in the hope to prevent or foresee upcoming financial crises. On this wave multiple IT providers have seen the business opportunity from new reporting needs, teamed up with partners, and created subledger solutions (O'Malley 2022), enabling multiple-level accounting with details of deals, customers, and attributes required for internal and external reporting.

In accounting terms, a subsidiary ledger, or "a subledger is a ledger containing all of a detailed sub-set of transactions" (Riahi-Belkaoui 2001). A summary of subledger transactions is periodically recorded in the general ledger. There are different types of accounting subledgers depending on the nature of transactions recorded in them or the categorization of data subsets included. The subledger is usually made for areas with a high transaction volume (O'Malley 2022). Examples of the subsidiary ledger are not limited to an accounts receivable ledger, an accounts payable ledger, a ledger of fixed assets, etc.

In IT terminology a subsidiary ledger is "an accounting tool that tracks the details of specific types of transactions and what happens in specific categories within a business's chart of accounts" (O'Malley 2022). A subledger is an integral part of an accounting software package, thus, it is a database rather than a manually-maintained book.

For this thesis, a subledger is meant as an accounting software component or a standalone IT software tool combining the sub-set of data with similar nature of transactions (Mitic 2020:3).

For small to medium-sized businesses, the general ledger is usually enough for day-to-day financial recording and reporting needs. Detailed subledger becomes a crucial component of a finance architecture for large businesses and multi-national corporations in order to provide accurate accounting and meet external and internal reporting requirements. Subledger helps to slice and segment the data and transactions into data sets, which can be analyzed separately on a detailed level (Fariz Al Hafiz et al. 2022: 1).

A subledger for financial products is a new concept, which came out of technological advancements and the growing need for collecting core deal-level business information in the financial industry. A subledger for financial products is a comprehensive software for banks, insurance, and Fintechs (viz. start-ups in the finance industry), which is designed to account for main business transactions and comply with national and international regulatory requirements (Mitic 2020: 3).

Centralization in the scope of accounting normally means consolidation of accounting functions in one location, usually the administrative center of a group of companies. The centralization here means that operational accounting is performed as a head-office function rather than a responsibility of a subsidiary or a representation office (Mitic 2020: 6).

Centralization when applied to the meaning of an accounting subledger for financial products, for this thesis, is a process of collecting all relevant transactional data about financial products and services in one software tool, which is a centerpiece of IT architecture in the finance area of the company. By central subledger is meant a single database, where all the data about financial products is collected, and from where deal-level reporting can be drawn (Werner 2019).

High regulatory pressure from national financial market authorities, and national banks as well as ever-changing international accounting standards have created a new challenge for traditional large financial service companies in collecting and structuring deal-level data (Gortsos 2021).

In many industries, technical knowledge is constantly and rapidly evolving, and traditional banks struggle to keep up with the new pace of technologies and exponentially growing customer expectations. However, modern technology provided

the opportunity to obtain decision-making data faster to react to growing competition and customer expectations in the finance sector.

Important concepts relevant to this thesis are but not limited to financial accounting, the role of a general ledger and subsidiary ledgers in the company's financial reporting, purpose and types of financial products and services, subsidiary ledger functions, and centralized accounting.

1.2 Research problem

Defining criteria for the centralization of accounting subledger for financial products is critically important for companies' management to support decision basis in pursuit of maintaining market position and compliance with regulatory requirements (Putnis et al. 2022).

Numerous studies have investigated the advantages and disadvantages of centralized accounting (Kassander 1986) and applications of subledger and general ledger (Fariz Al Hafiz et al. 2022) within organizations in different industries.

However, these studies have traditionally focused on high-paced industries with open market entry, rather than the highly regulated sector as finance occupied by big international corporations. This body of theory presents a problem for industries that face a digital transformation and the need of customers for fast and quality service, while required to comply with regulatory reporting deadlines and level of detail. Moreover, the existing studies do not cover the concept of subledger for financial products as it emerged out of a combined impact of technological advancements, structural changes on the financial market, and increasing pressure from regulatory requirements.

As a result, the existing research is inadequate for industries, such as the finance sector, in which essential knowledge and technology are constantly evolving. Senior management in such industries finds themselves ill-equipped in terms of decision-making criteria and approaches to react to a dynamically changing environment.

The analysis of complex movements and impacts external to the company environment, consideration and compliance to ever-expanding regulatory demands, and growing pressure on the market from the competition are the main complexity factors of daily decision-making of senior management in the banking industry. A lack

of sophisticated supportive research on the ways to decide how to stay profitable and compliant is the question, which is addressed in this thesis.

1.3 Research aims, objectives, and questions

The main scope of the master thesis is the aspects around accounting subledger as a software solution in the finance industry, the subledger for financial products, in particular, as the centerpiece of financial data repository in the complex IT landscape.

Other industries except the financial service industry consisting primarily of banks, insurance companies, leasing companies, special payment service organizations, FinTechs, and collection companies are out of scope for this master thesis.

Given the lack of research regarding the decision-making criteria for the centralization of accounting subledger for financial products as a way to comply with growing customer demands and regulatory requirements, this master thesis will aim to identify, categorize and evaluate the decision-making factors and approaches utilized by financial service companies in the EU.

The purpose of the research is further described and detailed within the following research objectives:

Research objective #1 is to identify alternatives for the implementation of subledger functions in financial services companies in Europe.

Research objective #2 is to evaluate the strengths and weaknesses of different approaches for the implementation of subledger for financial products.

Research objective #3 is to identify, categorize and prioritize most common decision-making criteria for the centralization of accounting subledger for financial products.

The research objectives stated above will be achieved by answering several detailed research questions in the course of this thesis:

Research question #1 is "What are the alternatives to the centralization of an accounting subledger for financial products currently being used by financial service companies in the EU? What are the advantages and disadvantages of different approaches? "

Research question #2 is "What are the common alternative decision-making criteria, when it comes to the centralization of this product?"

Research question #3 is "How important are those criteria for the decision-making process of senior management?

1.4 The significance of the research

This master thesis will contribute to the body of knowledge on accounting software solutions by surfacing and evaluating the alternative criteria for the centralization of accounting subledger for financial products in the finance industry, in which knowledge, skills, and environment are rapidly and constantly changing.

This research will complement the available academic knowledge with the definition of accounting subledger scope in the finance industry, identify alternatives and approaches for its implementation, as well as evaluate the importance of the different alternative criteria on decision-making at the senior management level.

This will help address the current shortage of research in this area and provide real-world value to organizations operating in such dynamic environments.

The most benefit from the research is expected in its practical value to the senior management in the financial service industry by supporting them in the day-to-day decision-making process to centralize a core business subledger, and evaluate its short-term impacts and long-term outcomes on company profitability, compliance and ability to satisfy customer demand.

1.5 The limitations of the research

There are several limitations to this research connected to various subjective and objective factors, which would be important to point out.

This master thesis is primarily focused on one industry, namely the financial service industry. Most information in the industry is available for banking institutions as the biggest players in this market. Therefore, the thesis has a narrow scope for one industry to provide the most specific outcomes and most benefits for the industry itself and contribute to the body of knowledge in this area. In addition, the thesis focuses on a very narrow scope of new accounting software solutions like subledger for financial products, while keeping the other subledger types or other accounting software out-of-scope.

The research is based on industry examples, interviews, available case studies, and public discussions about the criteria for centralization of the accounting subledger and its priority for the company. The statements from different management representatives and consultants can be subjective. This research is based on interviews and discussions with IT experts, Architects, Banking business, Accounting, and Procurement experts, who provided their subjective views and opinions on the matter. On the other hand, the master thesis is not focusing on detailed technical or business implementation criteria for subledger for financial products, but rather presents on a high level the common view of the available data, which can be seen as too simplified from the perspective of technical or business experts in the field.

One of the biggest limitations is the availability of data about the topic in the industry due to the highly regulated environment, high standards for security and data protection, and knowledge of different players on the market about new software solutions. In a lot of cases due to high-security standards, the data within the use cases can be artificial or strictly confidential.

The master thesis is generalizing the research results on the level of Europe, namely a region, rather than a particular country. For the data from various sources and origins are analyzed, but not all country differences within Europe can be considered.

The other limitation is connected to technical aspects of variability and complexity of IT landscapes in different companies and in different countries. The companies in the industry are not at the same technology levels, not the same complexity or advancement, thus, only common technical impacts and criteria are considered.

Another limitation regards to prioritization of alternative criteria for centralization. Different companies within the same industry have a different customer focus and competitive strategies, meaning the priority for a bank aiming for high-tech advancement will be higher for technical criteria of centralization, when the bank purely focused on maintaining the current customer base would prioritize business criteria instead of technical. This master thesis will define common trends, but the results can be adjusted to company strategy for practical use.

1.6 The structural outline

In Chapter one, the context of the master thesis has been introduced. The research objectives and questions have been identified, and the value of such research argued. The limitation of the thesis has also been discussed.

In Chapter two existing literature and bodies of knowledge of practical examples will be reviewed to identify key alternative decision-making criteria for the centralization of accounting subledger for financial products within the context of a fast-changing industry, especially the finance industry undergoing digital transformation.

In Chapter three, the theoretical framework will be presented. The methodical approach will be justified, and a broader research design will be discussed, including the limitations.

In Chapter four, the results of the research will be presented. The data generated during the research will be categorized and summarized.

In Chapter five, the information collected on the topic will be analyzed, and discussed from different perspectives and aspects. The research impacts and different considerations on the finance industry will be elaborated.

In Chapter six, the conclusions from the research will be made. The research questions will be discussed and answered, taking into account the research aim.

In the Bibliography the reference list representing the most prominent body of knowledge currently available and used in this thesis will be outlined.

The Appendixes will include the list of figures/charts/diagrams and tables as well as other documents relevant to the topic of this master thesis and used within this thesis.

Chapter 2: State of the art

2.1 Introduction

In the previous chapter, different aspects of the history of accounting, banking regulation, financial crises, impacts of digitalization, and macroeconomic environment have been analyzed based on academic and expert literature. This overview provided insights into the situation in which the senior management of the financial institution is when considering decisions about the implementation of accounting software, in particular, a subledger for financial products.

The purpose of this chapter is to analyze, evaluate and synthesize existing literature concerning the research aims, objectives, and questions. The chapter will present the results of the literature research, identify the gaps and build a foundation for the framework used in the result chapter.

The topic of this literature review is a definition of criteria for the centralization of subledger for financial products. In order to understand the issue from different perspectives, several subtopics are considered, and the main terms are clarified.

The scope of the literature review combines definitions and discussions of academic literature, expert opinions, experience studies, use cases, and surveys about centralized management, in particular centralization of accounting, criteria for selection of accounting software, and, last but not least, subledger for financial products, its role, and key functions.

The information sources concerning other subledgers, rather than subledger for financial products, and different aspects of centralization outside the accounting domain, are out of scope for this review.

The core content of the literature review is divided thematically. First, the discussion concerning centralized management in accounting will be presented, including the definitions of centralization and its understanding in different sources. Second, different discussions will be analyzed considering the variety of criteria for the selection of accounting software in different industries. Third, the definitions of subledger for financial products in banking and insurance will be discussed, highlighting key features and a role of a subledger in the finance industry. Last but not least, several theories will be discussed concerning the future outlook of accounting software as a whole and, potentially, a subledger.

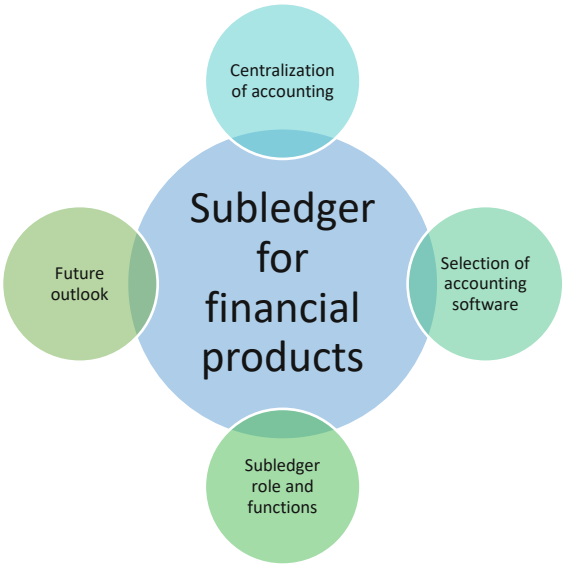


Figure 1: The Chapter Outline and topics in scope of the literature review

2.2 Thematic literature review

2.2.1 Centralization of accounting

The topic of centralized accounting has been discussed in the literature for several decades, namely from the transition from paper and pencil accounting to computer software. During the span of the last 30 years, several definitions of centralized and decentralized accounting have been proposed. According to Kassander (1986:138), centralized accounting is an approach to managing the financial reporting of an international company on the group level rather than individual accounting of the branches. Kassander also mentions that centralized accounting became important with the rise of international companies, corporations, and export/import transactions. From Kassander's point of view, the company shall consider the factors as size of units, relationships between HO and branches, the authority of the branches, and their need for the information as input aspects to decide if the accounting shall be centralized on group level or be managed separately on a unit level.

By 2011, when Campbell et al. published their article, the view on the definition of centralized accounting changed. According to Campbell et al. in "McKinsey Quarterly" centralized accounting is not only an organizational aspect, but also connected to group-wide software system launch. For Campbell et al. (2011), centralization means both serving separate units from the center, providing accounting services to branches from Head-office, and also providing central software tools where financial

reporting can be made. From their perspective, the philosophy of decentralization was trendy in the 1820s, before most companies went to a global scale. In their article, Campbell et al. defined three questions which should give guidance to senior management if the accounting should be centralized. The authors claim that senior management should centralize if at least one of these questions is answered yes.

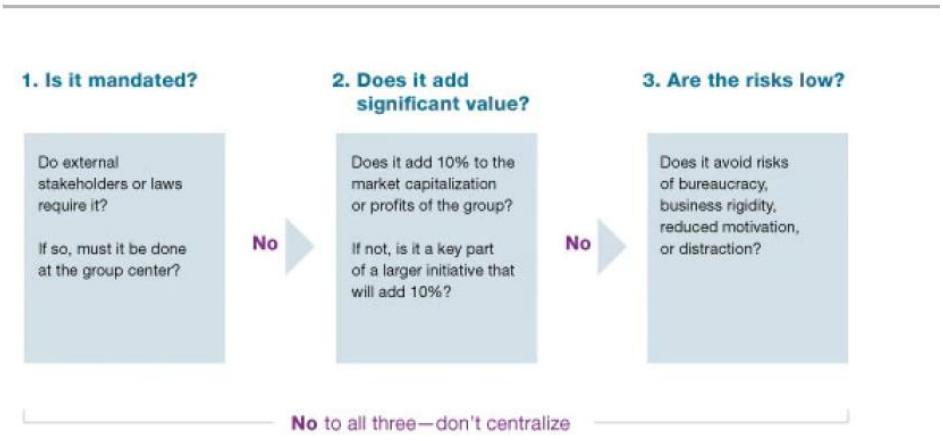


Figure 2: Three questions to consider before centralization according to Campbell et al. (2011)

M. Barret (2014) has discussed centralized and decentralized management. In his article, centralized and decentralized management approaches are explained, and he clarifies the advantages and disadvantages of each of the approaches.

Another research was published in 2014 by Li Guanyue, where the impact of centralized accounting on the corporate financial audit was reviewed. According to this research, centralized accounting can have a significant influence on audit procedures, namely, it can reduce their complexity and time since all the records are booked in the head office rather than in separate branches.

Another group of researchers dived deeper into the centralization and decentralization management principles in 2015. According to Pidun et al. (2015) from Boston Consulting Group, there should be a balance between centralization and decentralization. In order to decide about centralization, the company's senior management shall consider and evaluate the value the centralization can bring, not looking only at the profit aspect but also strategy. Pidun et al. (2015) suggest emphasizing future company strategy over the organizational structure, defining six parenting strategy archetypes. The research suggests senior management let the business drive the center, be self-critical about center capabilities, and properly assess if all centralization functions are possible from the head office.

For the purpose of this thesis, the definition of Campbell et al. (2011) of centralized accounting is used, which combines both the definitions of the centralized management system as an organizational aspect of centralization, but also as centralization of software tools and solutions in order to provide an accounting service platform to other units and branches in an international environment.

2.2.2 Selection of accounting software

There are several academic research papers and experience studies available on the topic of selecting accounting software.

The first studies on the topic appeared in the 1990s when most companies were still considering whether they should have stayed with the pen-and-pencil approach in accounting or invested in computerized accounting software. Collins (1999: 67) stresses the importance of the decision of computerized accounting software and provides an overview to the senior management of its key features bringing the most value or “must haves” at the end of the 20th century. The key features of accounting software defined by Collins (1999: 69) are the connection to the Internet, the possibility to publish web reports, real-time information about prices and orders entered into the system, automatic import of predefined orders and printouts of reports from a web page, as well as email triggered emails with reports.

Mattingly (2001: 48-53) discusses and proposes guiding principles on how to select accounting software. He stresses that accounting software decisions shall not be viewed only from the perspective of functions that an accountant would like to have, but should be viewed from the business need perspective. Accounting software shall have functions to cover current business needs but also the future strategy/scaling of the company. He also suggests mapping system features to business and customer requirements. Mattingly recommends choosing the features based on the industry trends, outlook, and company size, thus deciding for small, low-end, or high-end software. Other aspects Mattingly (2001) suggests to consider are the need for group collaboration in the system, the number of users, the company’s budget, and anticipated system outcomes. The article also says to evaluate the cost structure of software implementation and future maintenance costs, then compare it with features and business needs to decide which package suits better. Mattingly also mentions technical factors to be considered in the decision like a type of database, testing by

users, and batch processing. He suggests evaluating the accounting software options by reviewing the feedback of external and internal users and the value it brings them.

In 2004 A.A.Musa published an article where he defines a theoretical framework for the criteria for selecting accounting software. Musa (2004) agrees with the idea of Mattingly (2001), saying that when selecting accounting software, the company shall assess beyond its short-term needs, not only bookkeeping needs, but all finance staff providing input for the daily decision-making process. Musa quotes Morey (1999), defining the steps to follow in evaluating and selecting alternatives for accounting software. He also quotes Collins (1999), stating the key questions to be asked when assessing accounting software features. The author stresses the importance of customizing, the availability of accounting software in order to fit the business needs in different industries, vendor reliability, and vendor resources to implement and maintain the software. Musa is defining the main criteria for selecting accounting software as end-user requirements, software features, vendor reliability, and IT infrastructure. Each of the criteria is then dropped down into subcategories and further described.

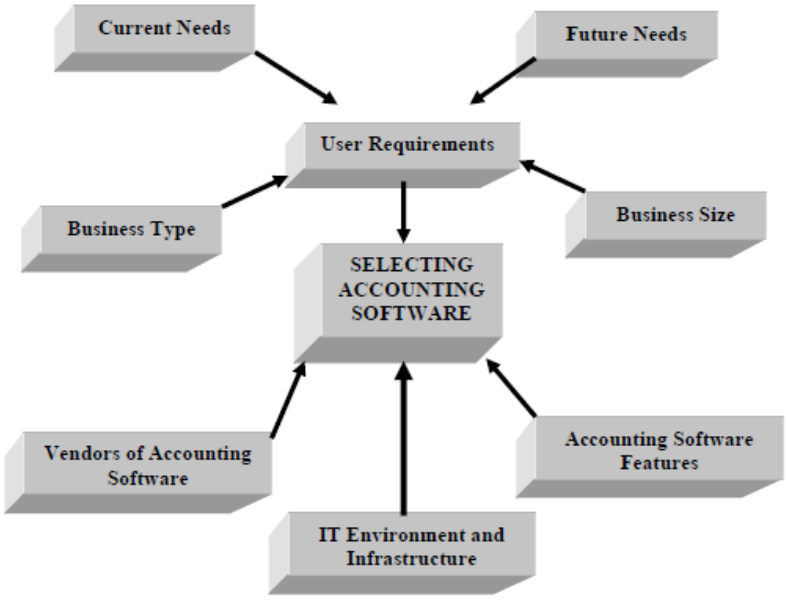


Figure 3: Criteria for selecting accounting software according to A.A. Musa (2004)

In 2005 in a follow-up article, Musa (2005: 85-110) complemented his research from 2004 with a mathematical approach to the evaluation of the defined factors. Musa has created a model for determinants for selecting accounting software by introducing a system of points the company needs to assign to each factor based on their relevance

to the company and future needs. In the end, he also suggested the procedure to implement the model, stressing the presentation of the significance of different factors.

Keeping into consideration the models of Mattingly (2001) and Musa (2004), Bishop (2016) addresses the challenge of strategic alignment during the selection of accounting software packages. As Mattingly and Bishop were stressing, the need to map business needs to software functionalities before purchasing or implementing accounting packages. Bishop (2016) introduces the concept of business assumptions and business imperatives, namely strategic objectives and pain points, which should be aligned with the accounting software planned to be implemented.

Around the same time in 2004, Adhikari et al. were discussing additional characteristics for selecting accounting software. Their focus was on international companies and their needs. Adhikari et al. stated that the company size and degree of internationalization have a significant impact on selecting accounting software packages. Companies with a high degree of internationalization would require additional features like multicurrency, international reporting, multi-ledger capability, and multilingual interface. Moreover, the security and flexibility of the software became of more importance for international companies.

In the research of Ghasemi et al. (2011: 112-116), the advantages and significance of IT and digitalization on modern accounting systems have been discussed. The research shows that the implementation of computerized accounting software has reduced the time to prepare and present financial information and increased the efficiency of accountants and the accuracy of information. Moreover, in the long term perspective, computerized accounting software is tailored to industries, even cost assumptions, and business needs providing the best value for money for companies.

The research of Wickramsainghe et al. (2017) compliments the points of Ghasemi et al. (2011) regarding the advantages of computerized accounting software (CAS) for business performance. The research shows that CAS facilitates decision-making. The results of the research from Hashimy and Yusuf (2021) confirmed that the implementation of accounting software indeed has a positive effect on a company's performance, while environmental external factors have a negative effect on the decision to adopt computerized accounting software.

In 2019 Paul and Sadath re-evaluate the criteria for selecting accounting software in modern times, stress the importance of accounting software implementation as an

error-free and efficient regulation in the finance area of the company, discuss the risk reduction and manual work in accounting departments, help with cost control after implementation of accounting software. Paul and Sadath (2019) highlight the importance of user participation, user training, and education in the success and performance of accounting software. Their research also discusses the trend to choose standalone best-of-breed software rather than central ERP. They also add to Musa's (2004) and Mattingly's (2001) models the modern factors for the selection of accounting software, namely its navigation and control capability, regular updates and integration to other software and IT architecture, as well as different deployment options.

Almgrashi (2020) adds to the previous research on the topic also the important role of governmental factors in the implementation of accounting software, including environmental factors external to the organization.

The empirical study from Hamad et al. (2021) assessed the point of user involvement and user education in selecting accounting software as raised by Paul and Sadath in 2019. The study showed that the management age, education of accountants, and their number had a positive impact on the likeliness for the adoption of accounting software, while the users' view on its security and online access had a negative impact.

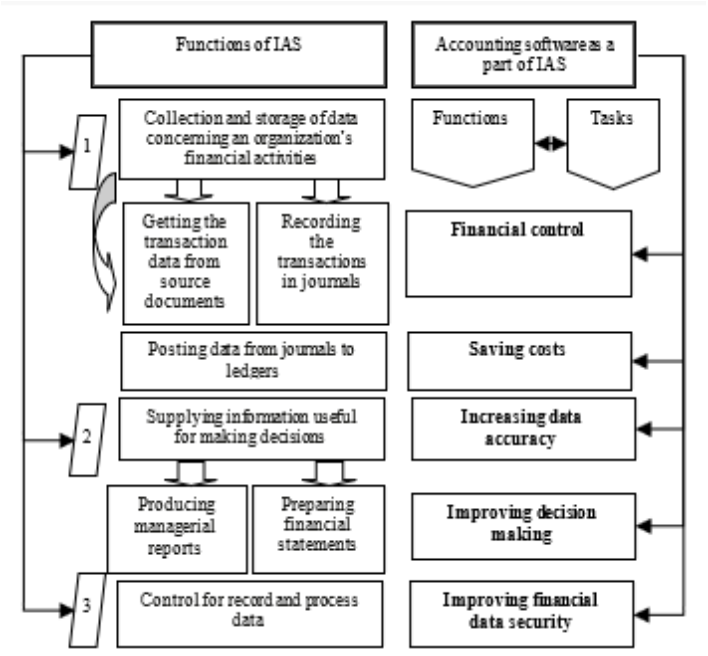


Figure 4: Managerial functions and tasks of accounting software in IAS according to Marushchak et al. (2021)

The research of Marushchak et al. (2021:862-870) summed up the body of knowledge on the topic from different models stated before and updated it according to the practical experience of modern business. The research defines the functions of accounting software relevant to international accounting standards (IAS).

The defined functions and tasks are then mapped to different types of software packages, satisfying those tasks and dividing them into spreadsheets, commercial, enterprise, and custom software. The software is further categorized based on the features it can cover and the costs they bear in implementation. The model was complemented by different examples of software providers and their relevance for company size. Namely, the research of Marushchak et al. proposes to base the accounting software decision not only on features available in the software and their mapping to company needs but also on company size. The research from Marushchak et al. (2021) introduces the concept of self-developed customized software options and, moreover, presents different deployment options seeing the future in the cloud.

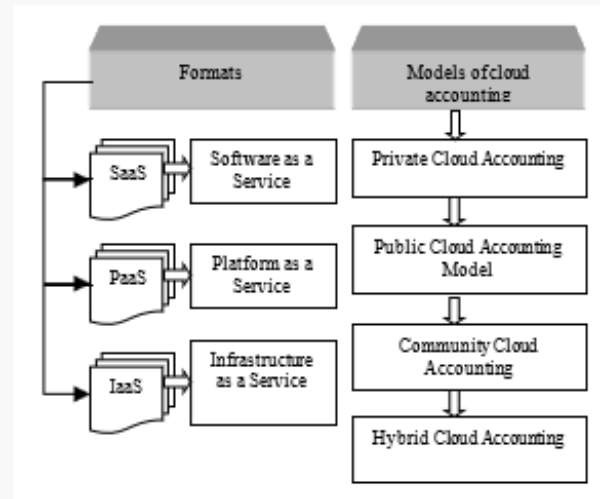


Figure 5: Models of Cloud accounting according to Marushchak et al. (2021)

The literature discussed above provided a solid background and input for the conceptual framework of this master thesis. For this thesis, the different alternative criteria for selecting accounting software were consolidated from the literature review as stated above in order to assess the significance of defined factors in the selection of subledger for financial products and complement the current body of knowledge with current expert opinion from IT, consulting, procurement and banking.

2.2.3 Subledger role and key functions

From the early 2000s, the topic of computerized accounting software was becoming more important in different industries as well as becoming more visible in academic books and articles. In subchapter 2.2.2, the importance of the implementation of accounting software was reviewed and analyzed in different research papers, as well as the criteria for selection of that software was elaborated upon. In this subchapter, the literature referring to the definition, role, and functions of a subsidiary ledger are synthesized, in particular, the subledger for financial products.

According to Riahi-Belkaoui (2001) in accounting terms, “a subsidiary ledger, or a subledger, is a ledger containing all of a detailed sub-set of transactions”. A summary of subledger transactions is periodically recorded in the general ledger. His book divides the subledgers into accounts receivable, accounts payable, or fixed asset transactions. Riahi-Belkauoui (2001) views the advantage of the subledger in the year-end audit procedures, where auditors may trace the transactions from a subledger to the general ledger and from there to the financial statements.

The other view on the subledger was presented by O’Malley (2022). Her article presents the subledger from an IT perspective. According to O’Malley (2022): “a subsidiary ledger, or a subledger, is an accounting tool that tracks details of specific types of transactions, and what happens in specific categories within a business’s chart of accounts”. The paper states that the subledger is primarily useful as a tool for high transaction volumes, dividing information into categories that can be individually analyzed. In addition to the already mentioned by Riahi-Belkaoui (2001) types of subsidiary ledgers, O’Malley also adds Inventory, Payroll, and Research & Development subledgers. According to O’Malley, the subsidiary ledgers allow detailed transactions to be recorded separately from the general ledger, thus, taking away the burden from it while keeping a full history of individual business events.

Al Hafiz et al. (2022) in their paper stress out that subledgers are important for big-size companies and international corporations, especially stock-listed ones, due to regulatory requirements to provide financial statements with a high level of detail to the auditors and shareholders. Those consolidated financial statements should be able to provide high-level financial information to the internal and external users (like the stock exchange) as well as drill down to each transaction. When there are high volumes of transactional data, this drill-down is possible in the subledger. Moreover, Al-Hafiz et al. provide a table for a visual illustration of the difference between the

main and subsidiary ledger. The authors also highlight the importance of alignment between the chart of account balances in the main and subsidiary ledger.

Table 1: Differences between Main Ledger and Subsidiary Ledger (Al Hafiz et al. 2022)

Differences	Main Ledger	Subsidiary Ledger
Recording Source	From special and general journals	From a collection of transaction evidence
Post Time	Generally it is done at the end of every month and is done collectively	Done every day or every time a transaction occurs
Listing Date	End of every month	On the transaction date

Starting with 2019 several IT outsourcing firms and consulting companies become increasingly interested in the new software built in the market for the finance industry. Throughout the 2010s, several biggest software providers like Oracle, SAP, Walter Kluwers, and others have developed specialized accounting software for banks and insurance companies, seeing the demand to comply with new IFRS requirements. A particularly interesting product for this master thesis is a subsidiary ledger for financial products. As there is no academic research yet available on this particular type of subledger, there are several articles from known consulting companies describing the functions, relevance, advantages, and disadvantages of implementing this type of subledger.

During the course of 2019, Sarah Werner published a series of articles dedicated to the topic of subledger for financial products. In her paper, Werner (2019a) states that the key reason for the implementation of subledger for financial products is to follow new IFRS and regulatory requirements for insurers and banks. According to Werner, this is the best time for “subledgers to shine” as regulatory requirements are pushing companies for even more calculations and disclosures, which traditional general ledger systems cannot provide. Werner claims that in these circumstances, this is the best time to consider the implementation of a central subledger for financial products, which will support all units group-wide to comply with those new requirements, as well as allow more focused decisions based on detailed data analysis. Key functions of a subledger for financial products are a calculation of cash-flows, allocations for Multi-GAAP accounting, generation of bookings and reports, as well as standardization of business processes. Werner (2019a) says that the subledger provides a single view of finance, real-time access to granular data, simulation of scenarios, and an efficient and future-ready finance department. Werner's (2019b) series of articles were complemented with a clarification of the benefits of having a subledger for financial products. According to Werner, senior management shall expect from the accounting subledger a solid financial foundation for consolidation and efficiency, finance-

certified control, centralized accounting policy, and insights into the business and compliance. In the last article of the series Werner (2019c) clarifies the coexistence of a subledger and a general ledger. Werner discusses the benefits of having a subledger and a general ledger separately. Subledger allows following a thin general ledger approach, when the main ledger holds the data on an aggregated level, while the subledger provides all the details needed for disclosures for core finance products. Werner in his article 2019a, also compares the IT architectures between decentralized and centralized finance, visualizing the benefits of a centralized approach for internal control and reporting.

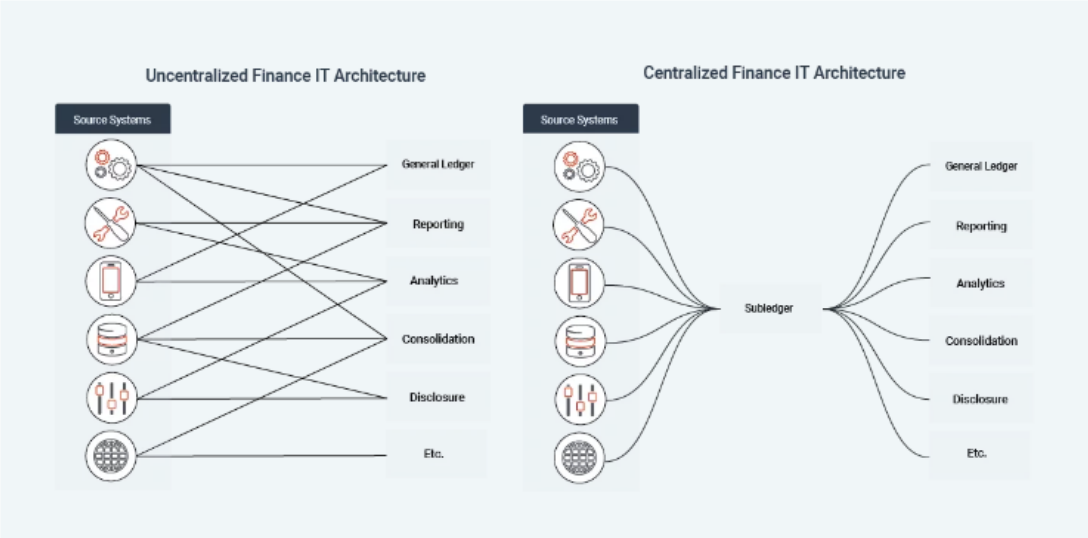


Figure 6: Centralized vs uncentralized Finance IT Architecture (Werner 2015)

In 2020 an experience study published by MSG Global (Mitic 2020), the impacts of creating a central subledger for finance transformation have been discussed. The experience study adds to the features stated by Werner (2019a), also the data repository functionality, accounting engine rule, and capability of drill-through. Mitic (2020) says that subledger for financial products has become one source of truth for accounting and reporting. The study confirmed that subledger challenges group-wide definitions harmonize data sources and IT architectures, accelerated financial close cycles, help to see data as an asset, and support future company growth. Mitic calls subledger for financial products a “disruptive innovation”, which helps companies to comply with regulatory changes, expand the use for strategic purposes, and look into the data available on a detailed level for decision-making purposes.

The literature reviewed and discussed in subchapter 2.2.3 provides a foundation for the topic of this thesis since it clarifies the definition of subledger in general, subledger

for financial products in particular, its functions and features, and its significance and relevance at present time in the finance service industry.

2.2.4 Future outlook of accounting software and subledgers

According to E.Feyen et al. (2021), Fintech companies appearing all over the globe bring disruption to the financial service industry as we know it. FinTechs are targeting standard services, which can be easily and quickly substituted by online analogs and do not require a banking license. Thus, in the next years, according to E.Feyen et al. (2021), more start-ups will try to slice the classic banking services to occupy a share of the financial service market, thus pushing traditional banks to digital transformation and faster change into the evolving market environment.

Both Werner (2019) and Mitic (2020) saw the future in implementing the subledger for financial products in international banks, where regulatory pressure and high transaction volumes are driving the companies into finance transformation.

Werner (2019c) suggests the move of subledgers and general ledgers to the Cloud as the technology of the future, which supports cost optimization targets of companies and simplification of business processes through standardization. She also mentioned the importance and trend for consolidation of multiple general ledgers and subledger into one centrally controlled tool, which supports the reduction of transformation efforts and helps companies adapt to changes in the market faster.

According to Marushchak et al. (2021), the entire topic of accounting software implementation is moving in the direction of the cloud. More and more companies consider Cloud options as their key “selling points” for upgrading current accounting software or choosing a new one. Moreover, this paper also shows current trends and alternatives for the implementation of accounting software as Platform as a Service (PaaS), Software as a Service (SAS), and Infrastructure as a Service (IaaS).

The deployment options of accounting in the Cloud have been also discussed by Brandasa et al. (2015), where different forms were discussed, along with the factors impacting the decision about the technology. According to Brandasa et al. (2015), there is a set of technological, risk, and security factors, which shall be considered while deciding on Cloud accounting and deployment options together with business strategy and existing accounting processes.

Table 2: SWOT Analysis of cloud computing and mobile technologies impact on accounting software system. (Brandasa et al. 2015: 92)

Technologies	Impact on AIS			
	Strengths	**Weaknesses**	**Opportunities**	**Threats**
Cloud computing and Mobile Applications	Scalability Costs reduction Collaborative environment (with customers, employees) Global approach (without borders) Data back-up and recovery	Service Agreement (Contract) Internet connection A lack of standards between cloud providers (inter-operability) [12] Integration with existing architecture [12] Data migration [15]; [16]	ERP-SaaS Mobile automated Accounting (documents) data gathering Mobility Security Improvement	Accounting and financial data loss Privacy breaches Systems Availability Dissatisfaction with offerings/ performance/ pricing from vendors Legal and regulatory

The topic of moving accounting into the Cloud has been discussed by Prichici (2015) as a new paradigm of accounting policies. Prichici (2015) mentions the following impacts of moving accounting into the Cloud as data mobility, data virtualization, and regulation of cloud applications.

The paper from Wenfeng Li (2022) brings a ground-breaking idea and perspective on the future of accounting software. In his thesis, he proposed a design for a distributed ledger based on main-sub-ledger architecture. This idea is using the current technological advancements of blockchain and proposes its use in accounting. The paper also discusses the advantages of moving accounting to the blockchain architecture, providing the possibility of access from any location and embedded protocols for recording accounting data, which will reduce the time for the audit of a global company to a matter of days or even hours.

This section is important for this thesis since it provides an outlook into the potential alternative future of accounting software and subledger in particular, helping define not only the alternative criteria for selecting the subledger for financial products now but with a forward-looking perspective fitting future business needs and requirements.

2.3 Conclusion

First and foremost, the main takeaway of the literature review is the discussion and clarification of different definitions important to this thesis. The literature found has helped to define a subledger (O'Malley 2022), subledger for financial products in particular (Werner 2019), centralization and decentralization as alternative approaches for the implementation of accounting software (Campbell 2011), and, last

but not least, cloud accounting with its varieties of deployment options (Marushchak et al. 2021).

During the literature review, it has been identified that the decision for centralization or decentralization is very important for the strategic objectives and performance of the company. This decision shall be closely considered and analyzed by senior management taking into account the value and impact of the centralized approach (Campbell 2011). But it is also important to review if there is enough capacity in the head office or the center to maintain this function (Pidun et al. 2015). Centralized and decentralized management approaches represent the input for the thesis research question about alternatives for software implementation. These alternatives are defined in generic terms, the thesis within the answer to research question # 1 will validate if these approaches are the only alternatives for the implementation of subledger for financial products in the finance service industry.

The next takeaway from the literature review was a detailed analysis and case examples of the strengths and weaknesses of different approaches for the implementation of accounting software (Barret 2014). The importance and significance of this decision have been mentioned by all authors in the literature review. Multiple case studies were showing the impact of the implementation of accounting software as a whole and centralized management of accounting in particular on a company's performance (Campbell 2011), audit procedures (Li Guanyue 2014), and decisions on company strategy (Pidun et al. 2015). The research so far does not cover the special aspects of different implementation alternatives in accounting software in the financial service industry, nor consider the subledger for financial products, which will be covered in research question #1 of this thesis.

The literature review has provided a significant foundation within academic literature and experience studies about selection criteria for accounting software for companies of different sizes. In order to answer research question #2, considering the decision-making criteria for selecting the accounting software package, the following key factors have been found in the literature as identifying business needs (Mattingly 2001), modern technological advancements (Ghasemi et al. 2011), scalability and bringing most value, connectivity via the Internet and standardized reporting (Collins 1999), user requirements, customizing possibility, IT infrastructure (Musa 2004), internationalization aspects (Adhikari et al. 2004), governmental and external control factors (Almgrashi 2020) as well as mapping actual accounting tasks to software functions and choosing proper deployment options (Marushchak et al.. 2021). The

criteria mentioned before were defined for a selection of accounting software packages, and in this thesis, the criteria are checked for relevance to the subledger for financial products and special aspects relevant to the finance industry.

In the paper from Musa (2005), there is a suggested model to define the importance of each function of the accounting software, based on the business requirements of the company. Answering research question #3, this thesis will consider the proposed model in order to suggest the framework and how the alternative criteria for the selection of subledger for financial products can be evaluated and graded based on the company's priorities and relevance.

The literature has provided an extensive view of the subledger and a subledger for financial products in particular. For this thesis, it was important to define the subledger and understand their functions (O'Malley 2022), find specific features and functions of subledger for financial products (Werner 2019), and identify the importance and relevance of implementation of this subledger in the financial service industry (Mitic 2020).

Moreover, the papers review opened up the window of outlook into the current trends, like the impacts of Fintechs (E.Feyen et al. 2021) and the potential future of accounting software (Brandasa et al. 2015), digitalization shifts into the Cloud (Princhici 2015), and the ground-breaking ideas of building subledgers on the blockchain (Wenfeng Li 2022).

However, the literature review has shown that the studies have traditionally focused on high-paced industries with open market entry rather than the highly regulated sector as finance occupied by big international corporations. As a result, the existing research is inadequate for industries such as the finance sector, in which essential knowledge and technology are constantly evolving. Moreover, the existing studies do not cover the concept of subledger for financial products as it emerged out of a combined impact of technological advancements, structural changes on the financial market, and increasing pressure from regulatory requirements. This master thesis will focus on adding to the current body of knowledge the specifics of the finance service industry and evaluating alternative selection criteria for subledger for financial products as a new product of the accounting software market.

Chapter 3: Description of the methodical approach

3.1 Introduction

In this chapter, the methods and strategy of the research are described. The key research aims of this thesis are to find alternative options for the implementation of subledger for financial products and to identify common decision-making criteria for the centralization of the subledger functions.

This chapter aims to align the research design, methods, and strategy with the research aims in order to answer the stated research questions. In this chapter, the research philosophy, type, methods, time horizon, sampling strategy, data collection methods, and analysis methods for this thesis are described and justified by referring to the research aims. At the end of the chapter, the research limitations are stated and clarified, finishing with the concluding summary.

3.2 Research design

The research design choices start with the research philosophy. Due to the work experience and participation of a researcher in the topic and building the concept based on the data collected, including subjective expert opinions as well as the opinion of the researcher herself, the research philosophy for this thesis can be described as interpretivism (Dudovskiy 2022a). The research does not exist in a separate reality from the researcher, which can be observed objectively. In this thesis, different participants of the research contribute, thus subjective views on the data collected as well as expert opinions obtained in the interviews. Nevertheless, the researcher's role is insignificant within this reality, referring to decision-making in the area and industry of the thesis, thus providing enough grounds for an objective review of the collected data, as well as own subjective professional opinion on the matter.

In order to reach the aims of this master thesis, the data collected from various literature sources, including academic literature, interviews with industry experts, and IT software vendor websites, was synthesized to build a general framework regarding alternative criteria for the centralization of subledger for financial products. This approach follows the interpretivism philosophy, namely the inductive research type rather than positivism since the concept of hypothesis for centralization criteria of a subledger is built on collected data rather than the other way around. This research approach allows not limit the data collection to only some theories, which would

disapprove or confirm the hypothesis, but rather present a wider opportunity to analyze the data from different sources to find commonalities and sum up a general concept. The inductive or observatory research type goes hand in hand with interpretivism philosophy allowing the researcher to analyze objectively the information collected and contribute to the results with a subjective view of the data (Dudovskiy 2022a).

The master thesis based the research on qualitative methods. The topic of alternative criteria for centralization of subledger for financial products observes and analyses qualitative data on different factors impacting the decision-making processes supporting senior management in defining that criteria catalog and the priorities for each of the alternatives. Since this thesis is focused on the question of what alternatives can that be rather than their impact on company performance, the research is using qualitative methods. Moreover, the research aims to create a common criteria catalog considering technical, business, strategic, and forward-looking factors in the first stage, where qualitative methods are more suitable to collect as much information on the subject as possible. In the next phase/follow-up research, the actual impacts of those factors can be evaluated, analyzed, and quantified for different company types and industries.

The research will cover data collected within a defined period of time, namely with results available on the cut-off date of thesis submission. The research does not aim for comparing chronological data within numerous time points/years but to focus on and categorize available information at one point in time. This approach defines the cross-sectional time horizon of the master thesis. The change of data within the aspect of time is not important for research aims, as the thesis targets the identification and analysis of different alternatives for the centralization of a subledger for financial products at the current state of the economy rather than the progress of the situation in time.

The choice of a sampling strategy is very important for the master thesis to ensure the importance and usefulness of the research results (Dudovskiy 2022b). For this research, the non-probability strategy has been chosen to cover all research aims and answer research questions. The sampling of the data has taken into consideration the case studies, interview results, and expert opinions from representatives in Europe, namely Austria, Germany, Netherlands, Ireland, and the United Kingdom. In order to ensure the most coverage in the finance industry, the data has been collected from senior managers and enterprise experts in their fields from a global group of

companies, both international bank groups, and insurance companies. By interviewing senior experts and management in big international groups the experiences throughout Europe could be collected, thus providing a representative sample for the banking industry based on information from Europe's biggest market players. In order to make the sample even more representative, the feedback from the best experts in the IT industry, namely IT architects and vendor/procurement services have been collected and included in the research, providing even higher assurance for a representative sample. This approach was chosen due to its practicality, the convenience of data collection, and significant resource and data constraints. Banking secrecy laws, as well as regulatory requirements in the EU, prevent financial service companies from sharing much of internal data for research purposes, thus, the sampling was done with anonymous data and based on available case studies and interviews. In addition, the literature review covers information from sources around the globe, thus, widening the perspectives on the topic to geographical areas outside of Europe.

In order to find all available alternatives for the centralization of subledger for financial products, and identify known advantages and disadvantages of various approaches, a thorough literature review has been conducted as a key data collection method. This enabled us to build a framework based on existing research and identify the discussion points and gaps to focus on. Moreover, the literature review as a data collection method has been complemented with additional words-based methods, namely structured and unstructured interviews, as well as participant observations within the scope of the research.

The structured interviews were conducted within the span of 6 months in 2022, considering the feedback of senior management representatives of big international banking and insurance groups with Head-Offices in Austria, Germany, Netherlands, Ireland, and the UK. The interviews were anonymous and based on the discussions lasting about 1 hour each, covering their experiences in the implementation of subledger for financial services, advantages and hurdles during implementation, as well as the stabilization phase. Additional questions covered the factors impacting the choice of the software and framework. All interviews were held 1:1 and anonymous in order to obtain the most trustworthy and relevant feedback. On top of structured interviews with senior management, unstructured interviews with industry experts and consultants have been conducted. The interview questions varied depending on the expertise and focus of the discussion. The unstructured interviews were anonymous

and can be categorized based on the area of participant expertise as IT Architecture interviews, vendor management/procurement, management consultant interviews, and software provider interviews/demo sessions. The scope of questions covered within the interviews shall ensure broad input into the topic of centralization criteria, subledger implementation as well as bottom-up aspects together with management's view on the decision for or against the centralization of subledger for financial products.

The data collected in the literature and interviews have been analyzed with content analysis methods and techniques. The information received has been grouped thematically, answering the research questions about centralization, different approaches and their advantages, subledger functionalities, and factors impacting the decision for centralization of subledger for financial products. The groups defined have been further detailed into categories to clarify the topic and provide a deeper understanding of the factors for decision-making. The discourse found during the literature review and interviews was approached using discourse analysis methods, reviewing all available discussion points and highlighting the different views on topics in order to answer research questions keeping in mind different perspectives.

Last but not least, it is important to state the limitations of the research methodology that this master thesis faces. The key limitations of the research methods are connected to the sampling strategy and data collection methods. As mentioned above, the research in the banking industry does limit the sampling size for qualitative research, since only limited information is available. Thus, the sampling size is limited to the information which could be obtained during the dedicated research time from the sources/participants, who agreed voluntarily to provide their feedback via anonymous interviews. This research could not use probability sampling methods (Dudovskiy 2022b) due to the nature of the data required and the industry where it had to be collected. Nevertheless, numerous mitigation measures have been adopted in order to make the sampling choice representative to the financial service industry in Europe, namely a profound selection of interviewees from the biggest banking groups in Austria, Germany, etc., which operate around Europe and beyond, thus providing experiences from different markets and geographical areas. Another limitation worth mentioning is the subjectiveness of opinions provided by interviewees. The subjective opinions, nevertheless, are based on numerous years of experience of industry experts, different projects they worked on, and impacts on their organizations.

Considering the abovementioned measures taken to provide the most representative sample with an objective view of the industry's state-of-the-art solutions, the research is providing significant value to the senior management in Europe preparing or considering the centralization of subledger for financial products despite stated limits.

3.3 Conclusion

In order to achieve the research aims for this master thesis, an inductive research type following interpretivism research philosophy was chosen. Since the research focuses on defining alternative criteria for the centralization of subledger for financial products, qualitative methods were selected, considering the cross-sectional time horizon of the current state of the industry.

The data collection has been organized via literature study and interviews with key industry representatives, thus following the non-probability sampling strategy. The analysis of the data collected was performed via content, thematic, and discourse analysis of different sources. The limitations of the non-probability sampling strategy have been mitigated, with the choice of interviewees coming from top companies in the financial service industry in Europe, operating in the EU and globally. The structured interviews have been complemented with key industry expert opinions in IT architecture, vendor/management, and consulting to ensure the quality of the research results. The main research design choices and methods used in this thesis are visualized in Figure 7 below.

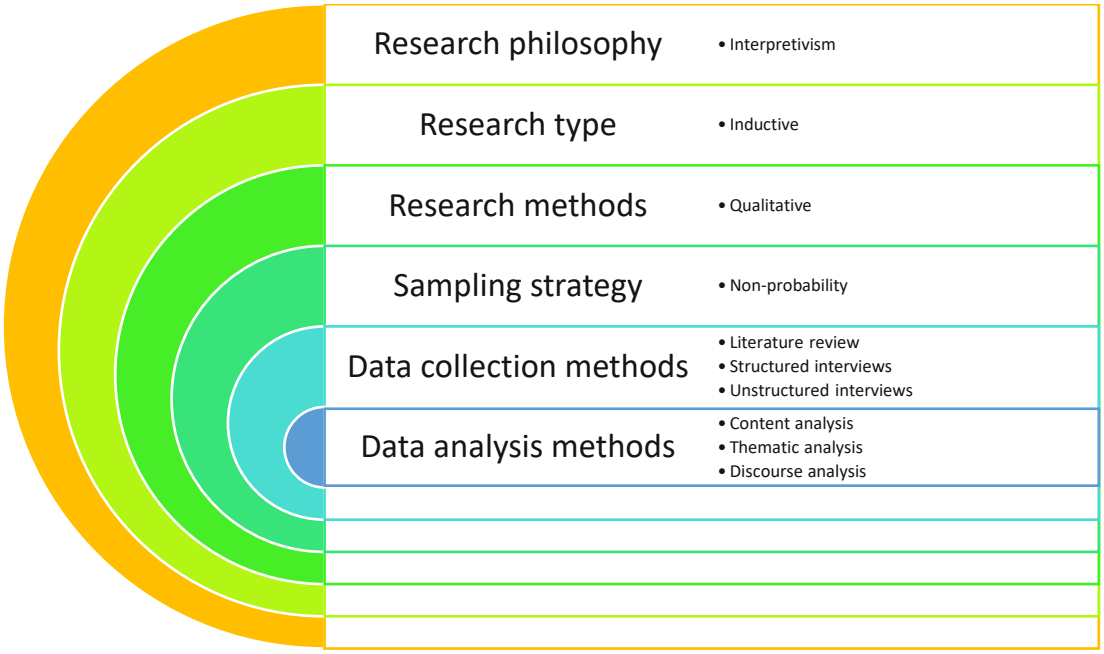


Figure 7: Visualization of research design choices for this thesis

Chapter 4: Presentation of result data

4.1 Introduction

In this chapter, the data collected during the research is presented and described. The data about subledger for financial products, their functions, and functionalities, alternative options for the solution implementation, as well as criteria for deciding for centralization of subledger has been gathered from literature review, interviews, and presentations of consultants and conferences. The collected data was then structured, grouped, and analyzed by relevance to the research questions. This chapter will present a summary of relevant quotes gathered in the literature review section and documentation in appendixes.

The chapter will be structured thematically using context analysis methods. First, the data referring definition of subledger for financial products and its functions will be shown. The information about the alternative options for the implementation of a subledger for financial products will be presented, including but not limited to centralization and its advantages and disadvantages. After that, the decision criteria for the centralization of subledger for financial products will be stated. The chapter will finish with relevant data gathered about the significance and importance of those decision criteria.

4.2 Key findings

4.2.1 The subledger for financial products definition and value

During the research, several data sources provided different definitions of subledger for financial products. Here are some of those statements providing the overview of key definitions and clarity on the value of the solution:

Sarah Werner states: “A subledger is a core component of a finance digital transformation for many multi-national companies. A subledger is, essentially, a database used to store a detailed subset of double entry accounting transactions with a focus on required controls throughout.” (Werner 2019b:2)

A. Mitic in her experience study, talks about the financial subledger as “A repository of detailed transactions for the general ledger, a centralized repository of accounting

rules, a means of detailed drill-through for reporting and analytics and one source of truth for accounting, actuaries and financial reporting". (Mitic 2020: 3)

R. Bucha in his article, gives the following definition: "financial product sub-ledger is a solution to support various financial services organizations to manage finance products as separate sub-ledger and enable acquiring instant financial insight at any level of detail for analytics and reporting."(Bucha 2021:1)

Several studies describe the potential value in the implementation of subledger for financial products for banks and insurance companies:

S. Werner states: "Upcoming regulatory changes in the insurance industry, such as IFRS 17 and LDTI, are leading to increased conversations about subledger benefits. " (Werner 2019b: 2)

Then the author also says: "subledger technology can enhance and replace manual accounting processes, consolidate disparate data sources and relieve overburdened General Ledgers. A subledger is the foundation for an efficient Finance Architecture and a solid control environment" (Werner 2019c: 5)

A. Mitic mentions that "Regardless of the goal enabling analytical insights or ensuring compliance with regulatory requirements — setting up a centralized financial subledger can be the crucial starting point. " (Mitic 2020: 3)

"A financial subledger as a data gatekeeper for business-critical processes will accelerate the financial close cycles, relieve the immediate pain points, and enable a staggered approach to its further utilization." (Mitic 2020: 3)

In her article S.Werner constitutes that "a subledger along with being able to handle the complex regulatory requirements can also provide a single-view finance, real-time access to granular data, simulation of what-if scenarios and an efficient future-ready finance department, with the willingness to easily address changes like M&A and future regulatory challenges" (Werner 2019a: 3)

The subledger for financial products definition is linked to its functions. The topic of business and technical functions of the subledger will be covered later in this chapter in the section where decision-making criteria for centralization of a subledger are covered, namely points 4.2.3.3 and 4.2.3.4.

4.2.2 Implementation options of a subledger for financial products

4.2.2.1 Decentralized implementation options of a subledger for financial products

Decentralized and centralized management systems have been researched in the literature. For example, M. Barret (2014) in his article defines the decentralized management system as: “the upper levels of management transfers some of the decision-making processes onto lower levels, and even to individual employees. The overall authority is still maintained by top-level managers, who make policies that influence the major decisions of the company, but most decision-making responsibility is delegated to the lower levels.” (Barret 2014)

S.Werner (2019c: 3) illustrates the decentralized IT architecture the following way:

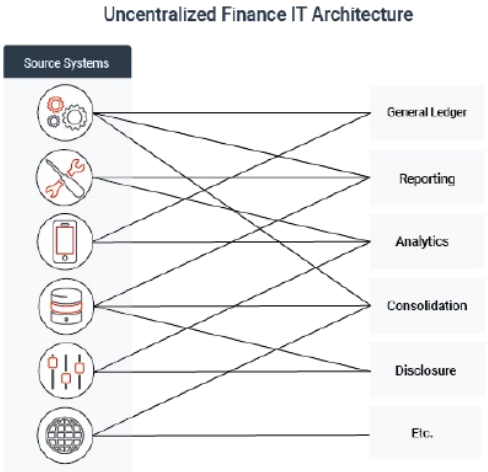


Figure 8: Uncentralized Finance IT architecture (Werner 2019c:3)

She comments: “Data flowing directly from various source systems into the GL. Data streams coming from these systems likely differ in the level of granularity and the regularity with which they are sent to the various target systems. Accounting is happening in multiple locations, which creates reconciling and reporting challenges.” (Werner 2019c: 3)

During the research several interviews have been conducted with the industry experts. Below is a table representing the key dates of interviews, the roles and employers of the participants.

Table 3: List of Interviews and interviewees taking part in this research (see Interviews 1-10 in Appendix)

Interview No	Date	Interviewee Role / Position	Industry / Employer	Country of Employer
Interview 1	15.11.2022	Senior Finance Consultant	Top 10 German Bank	Germany
Interview 2	31.03.2022	IT Lead Finance and Procurement	Local Banking Market Leader	Netherlands
Interview 3	03.05.2022	Head of Finance Change & Strategy	Global banking group	Singapore
Interview 4	23.03.2022	Head of Finance Transformation	Financial service group	Ireland
Interview 5	11.05.2022	Solution Architect for Finance & External Reporting	Cooperative Bank	Netherlands
Interview 6	01.12.2022	Head of Accounting	Top 3 Bank in Austria	Austria
Interview 7	18.03.2022	Senior IT Architect	Top 3 Bank in Austria	Austria
Interview 8	20.12.2022	Product Owner for Subledger and General Ledger	Top 3 Bank in Austria	Austria
Interview 9	15.03.2022	Enterprise Solution Architect	Top 3 Bank in Austria	Austria
Interview 10	23.04.2022	Procurement Expert & Contract Manager	Top 3 Bank in Austria	Austria

In the interviews with banking experts from different countries, the majority mentions that they had a decentralized finance IT landscape before the implementation of a central subledger. Here are the key quotes from the interviewees:

Interviewee 1 says: “The IT infrastructure of the bank was very complex and heterogeneous, there were multiple core banking systems managing different types of banking products. Each of these core banking systems had features of a subledger, which were relevant for a particular product type.” (Appendix 1 Interview 1)

Interviewee 2 (see Appendix 1 Interview 2) states: “each of the companies in the group was enjoying the feeling of freedom to decide which software solutions they would like to have”.

Interviewee 4 (see Appendix 1 Interview 4) adds: “we had several separate subledgers … We also had several systems, which had integrated subledgers. And we had multiple general ledgers, data from which was then consolidated in a reporting tool. The systems were divided basically in the same way as our organizational structure.”

Interviewee 5 (see Appendix 1 Interview 5) highlights: “we had a very distributed IT landscape with numerous subledgers, general ledgers, risk calculations, and even data warehouses.”

The IT Architecture expert describes in his interview two types of decentralized finance IT landscapes (see Appendix 2 Interview 9):

1. Traditional Integrated Core banking architecture, when subledger and general ledger are standard CBS capabilities.

Figure 9: Illustration of a traditional integrated CBS architecture (Appendix 2 Interview 9)

2. Core accounting solution combined with product subledger, where there are a centralized general ledger, and distributed subledger functions."

Figure 10: Illustration of a distributed subledger and central general ledger architecture (Appendix 2 Interview 9)

4.2.2.2 Centralized subledger for financial products

The topic of centralization management in general and centralization of a subledger for financial products have been researched in several studies and literature.

M. Barret explains that "centralized management is the organizational structure, where a small handful of individuals make most of the decisions in a company" (Barret 2014:2). As he says, the key advantage of a centralized system is that upper management has complete control over training and products, and is more likely to achieve company objectives. "A centralized management style also has the potential to improve the organization as a whole instead of just one smaller branch at a time." (Barret 2014: 2) This statement is also valid for a centralized IT management system.

According to A. Campbell et al. "badly judged centralization can stifle initiative, constrain the ability to tailor products and services locally, and burden business divisions with high costs and poor service. Insufficient centralization can deny business units the economies of scale or coordinated strategies needed to win global customers or outperform rivals." (Campbell et al. 2011: 1)

S.Werner (2019c: 3) in her article illustrates a centralized IT architecture in the following way:

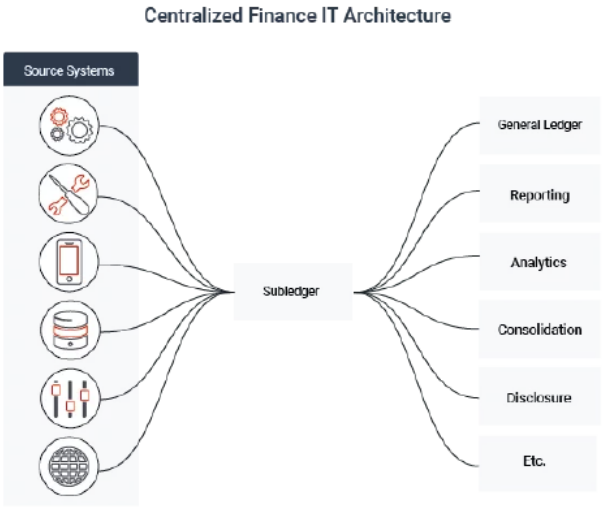


Figure 11: Centralized Finance IT architecture (Werner 2019c:3)

She claims that centralized IT architecture with a subledger for financial products in the core of it "allows an organization to massively reduce reconciliation issues and manual interventions. The company has a centralized, accurate, finance-owned accounting hub." (Werner 2019c: 3) She clarifies that a central subledger can be used to keep a general ledger "thin" without unnecessary details and volumes and that it allows to consolidate of multiple general ledgers and migrate to one central solution, where reporting is built.

In the interview with the IT expert (see Appendix 2 Interview 9), the centralization of a subledger scenario has been described the following way: "Standardized, integrated finance architecture with centralized subledger and general ledger".

Figure 12: Illustration of a central subledger and general ledger architecture (Appendix 2 Interview 9)

One the examples, how this centralized architecture can look like, is available from R.Bucha (2021:2), where he presents and describes the place of a subledger for financial products in the overall data flow and IT landscape:

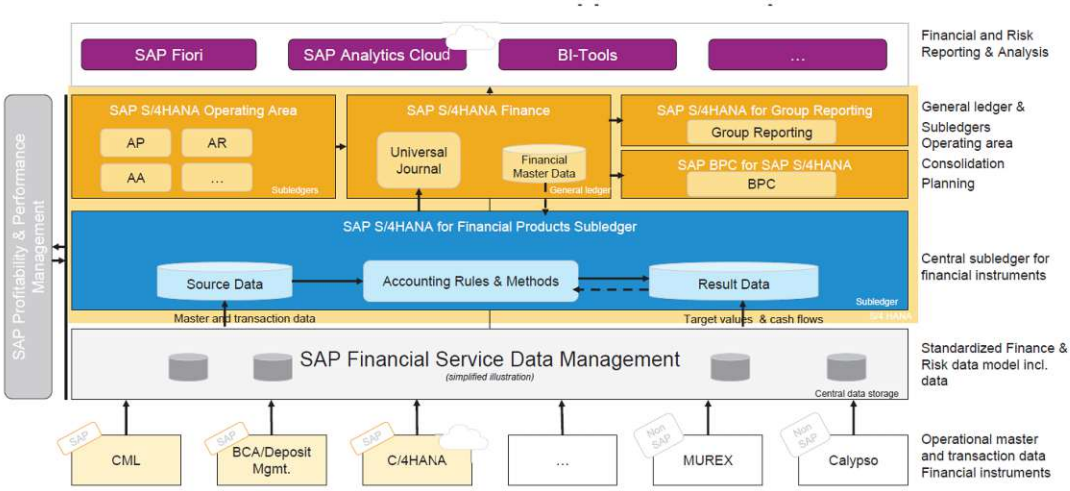


Figure 13: Solution Architecture of SAP Platform with FPSL (Bucha 2021:2)

Interviewees 1-8 (see Appendix 1 Interview 1-8) were describing their transition from mostly decentralized finance architecture to centralized, including the implementation of a central subledger in different software solutions. Here are some quotes:

Interviewee 1 (see Appendix 1 Interview 1) has mentioned that their program "contains an implementation of a centralized subledger, a central general ledger and a new finance data warehouse for reporting"

Interviewee 2 (see Appendix 1 Interview 2) says they are aiming at the "implementation of a centralized subledger for financial products, which could be flexible enough to satisfy the accounting and regulatory requirements of all companies in the group worldwide".

Interviewee 5 summed up the centralization as follows: "with the new strategy of the bank to become one bank, the accounting had to become one too and follow the lead to have one single source of truth for finance data, which meant centralization for us". Other interviewees have followed the same narrative for the centralization of a subledger for financial products.

A lot of the quotes above are linked to the topic of the reasoning, the objective, and expectations from centralization in general and from implementing the subledger for financial products in particular. These reasons will be reviewed in the next subchapter.

4.2.2.3 Buy vs Build vs Frame decision

This part of the section is aiming to clarify different options available on the market, referring to how the central subledger can be built, the options and scenarios are described based on the literature and interviews.

The description of the three scenarios has been given by Interviewee 9, the IT architecture expert. The “buy” option (see Appendix 2 Interview 9) is clarified as “implement a vendor solution available on the market. This solution would require acceptance of standard features and limitations of vendor solution”.

In the literature review, most of the researchers have been describing the “buy” option for the implementation of a subledger for financial products. A.Mitic (2020) in her experience study, is referring to SAP Solution Financial Product Subledger (FPSL) as an example of a centralized subledger provided by the vendor.

Interviewees 1, 3, 5, and 6 (see Appendix 1 Interview 1,3,5,6) have chosen the FPSL as their product of choice for a centralized subledger. This is representing a “buy” scenario for this software.

The other example of a “buy” solution is OneSumX from Walters Kluwer (see reference website in the Bibliography #44)

The alternative scenario to the “buy” option is “build”. The meaning of this scenario is described by Interviewee 9 (see Appendix 2 Interview 9): “Build, meaning develop the software from scratch with internal resources”. This scenario entails the implementation of a subledger for financial products without any vendor solution or frame software in place.

In the article from Marushchak et al., the researchers are describing 4 types of accounting software, namely spreadsheets, commercial, enterprise, and custom. Spreadsheets and commercial and enterprise software are all examples of the “buy” option. The group of researchers are describing them as “software that handles most of business accounting needs and helps in managing complex operations” (Marushchak et al. 2021: 3). While the last scenario is called custom – “computer scientists create their software because there is no commercial accounting software which can meet the company’s needs” (Marushchak et al. 2021: 3). This definition fits the definition of the “build” option in the context of this chapter.

Here is what Interviewee 7 (see Appendix 1 Interview 7) says about the advantages and reasons for choosing this option: “We decided to develop the central subledger on our own. There were resources assigned to develop the solution to fit the bank’s specifics, be maintained in-house, and fit our self-developed general ledger. We were not satisfied with customizing capabilities of solutions on the market and had already a lot of experience with “home-made” products“.

The third scenario, namely the “frame” is described by Interviewee 9 (see Appendix 2 Interview 9): “Frame/Customize – which would mean to buy a platform or a highly customizable software (e.g. PaaS) and build any features and tools required”.

The researchers like Marushchak et al.(2021: 4) were clarifying that the key feature of this kind of scenario would be “flexibility and low risk”. Here are the examples of the formats in which the “frame” scenario can be recognized:

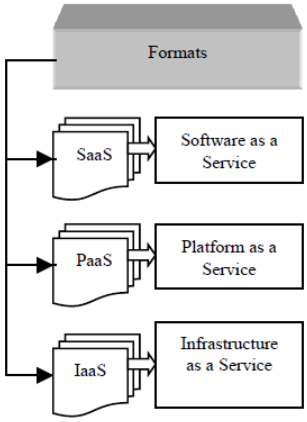


Figure 14: Formats of serviced solutions (Marushchak et al. 2021:6)

S. Werner (2019a, 2019b, 2019c), in her article series, has been presenting a centralized subledger as a vendor solution based on Aptitude Accounting Hub software. This software is an example of a “frame” solution built on the Software as a service concept.

Interviewees 2, 4, and 8 (see Appendix 1 Interview 2,4 &8) have chosen the scenario of a frame software. Here are some quotes referring to their decision:

Interviewee 2 (see Appendix 1 Interview 2) says: “Accounting Hub bought us with its flexibility. This solution can be customized to any need of our units and countries. Other solutions on the market at that time had a lot of limitations and were lacking the features we needed”.

Interviewee 4 (see Appendix 1 Interview 4) adds: “This was the only solution on the market, which would give us that flexibility we wanted and still help us streamline operations”.

The options described above shall provide insights into the opportunities for the implementation of a subledger for financial products on the market. Some of the quotes also give first clarifications, of why the scenarios and solutions were chosen and what was important in the decision-making process. A detailed analysis of the decision criteria for the centralization of subledger for financial products will follow in the next section of this chapter.

4.2.3 Decision criteria for centralization of subledger for financial products

4.2.3.1 Strategic criteria

During the literature review, multiple sources of data have been identified, where researchers focus on companies strategic goals when deciding about selecting accounting software.

Here are some quotes where strategic criteria for centralized software selection have been mentioned.

T.Mattingly, in his article, says: “Software selection is best when based on how the user, in this case, an organization’s financial staff and accountants, wants to organize the information system relative to the business, its financial requirements, its size, and its rate of growth. The answer always begins with determining the needs of the organization.” (Mattingly 2001: 2)

Marushchak et al. claim that accounting software is “a tool that helps to improve control of company’s managers about business performance. It has a positive influence on outcome indicators and productivity. Good accounting software can put a business in efficient control” (Marushchak et al. 2021:2). The researchers also connect accounting software implementation to overall company goals (see Figure 15 below).

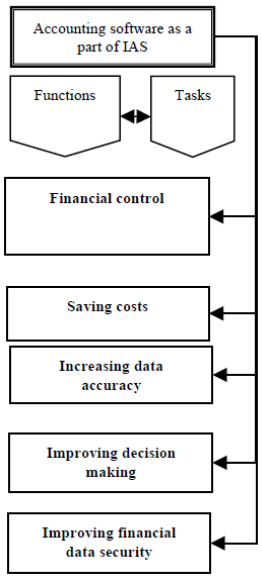


Figure 15: Managerial functions of Information Accounting Systems (Marushchak et al. 2021:3)

W. Bishop has dedicated his entire research to the topic of strategic alignment between selecting the accounting software packages to the strategic business objectives. He states: “In order for a company to select the correct accounting software package, it is important that it invest time and effort in considering the software functionalities provided by the software package and map it against its strategic business imperatives to prevent failure of the package.” (Bishop 2016: 38)

There were 9 business strategies, which are important to be aligned and supported by the IT system of the choice: “pricing, quality product, product differentiation, product diversification, new product, new market, quality service, intensive marketing, and process efficiency” (Bishop 2016: 38).

Paul and Sadath add also the concept of looking at the industry trends: “The choice is generally decided by the nature of the firm & by assessing the existing systems in use in the industry.” (Sadath 2019: 507)

Another topic was the business size and its impact when talking about decision criteria. Paul and Sadath state the following: “Enterprises should consider these features of accounting software along with the needs and size of their businesses while choosing software for their accounting functions.” (Sadath 2019: 510)

Abu-Musa states that “used strategically, technology can be the differentiating factor that separates a company from the competition and provides new growth opportunities. The overriding consideration is finding software compatible with a company’s long-term business goals and the needs of tenants and clients.” (Abu-Musa 2004: 4)

He also adds the point of scalability from a strategic point of view: “One wants an accurate helpmate who grows with him/her (capable of being scaled up).” (Abu-Musa 2004: 2)

Strategy is also important when deciding about centralization. According to BCG Global the company should “emphasize strategy over structure and let the business drive the center”. The suggestion here is “rather than benchmarking corporate functions against those of corporate centers at other companies, management should benchmark them against an objective assessment of what the company’s businesses need and how best to support them.” (Pidun et al. 2015:2)

Strategy as criteria for the selection of a centralized subledger has been mentioned multiple times by the Interviewees. Here are some quotes:

Interviewee 1 (see Appendix 1 Interview 1) mentions the “limitations for future business expansions and planned future business growth”, which the software should be able to support.

Interviewee 5 (see Appendix 1 Interview 5) clarifies: “But with the new strategy of the bank to become one bank, the accounting had to become one too and follow the lead to have one single source of truth for finance data, which meant centralization for us”, describing both the reason for centralization and a choice of a subledger.

The IT expert in interview 9 (see Appendix 2 Interview 9) also states that the options for implementing the subledger for financial products shall be matched to the company strategy: “All of the options above exist in market practice in banking, each organization decides which one of the options fits their strategy and scope better”.

Interviewee 2 (see Appendix 1 Interview 2) touches on an additional aspect of strategic partnerships with vendors: “It was important for us to find a long-term trustworthy vendor/partner, who would be able to develop, implement and grow the solution together with us.” Similar statements also appear during interviews 3, 5, 6, and 8.

Interviewee 1 (see Appendix 1 Interview 1) mentions the industry trends as part of the decision-making criteria for a subledger: “External factors combine advice from multiple international consulting firms and software vendors to try the new solutions on the market and follow the trend in DACH region”.

The strategic criteria for selecting accounting software, especially a centralized subledger for financial products have been highlighted in multiple research papers and also in all of the interviews with industry representatives. But the strategic criteria usually come along with economic criteria for choosing a software package, which is covered in the next section of this chapter.

4.2.3.2 Economic criteria

Economic criteria are one of the first things coming to mind when deciding on a proper software package. Together with strategic company focus, the topic is software value has been touched on by multiple researchers and in the interviews.

Mattingly says: “a company’s budget is, of course, part of the equation when determining which system to buy. To maximize its accuracy, budget preparation should include both a review of various systems and, if possible, an evaluation of comparable systems used by others.” (Mattingly 2001:4)

According to Marushchak et al. (2021: 3), one of the decision-making criteria for software is how much costs are saved, namely, how much “it also can reduce the cost of accounting spending.” An additional point mentioned by the researchers was

connected to the cloud capability of the solution and its effect on “lower operation costs with investment, but maintenance is absent”.

Risk assessment is noted as a part of business case preparation. Paul and Sadath wrote: “Accounting policies, cost-benefit analysis, and assessment of risk are the three most important functions of e-accounting” (Sadath 2019: 510)

Abu-Musa highlights: “One of the important factors that might affect the choice among packages is the cost of acquiring the accounting software. Modern accounting packages are remarkably inexpensive to purchase but deceptively costly to install and operate.” (Abu-Musa 2004: 17)

Hamad et al. (2021) have dedicated their entire research paper to clarifying the influence of accounting software in minimizing business costs. According to their findings, “cost is a significant impediment to companies' use of information technology in accounting”.

BCG Global in their article (Pidun et al. 2015: 1) has stressed the importance to “focus on value”. They said: “In order to ensure that centralization adds value, its potential benefits must be weighed against its likely costs”. They also add the topic of risk asking two key questions during the decision-making for or against centralization: “Is the risk of value destruction from this activity sufficiently small? Is the risk of implementation also limited?” (Pidun et al.2015: 1)

The risk and value point was also mentioned in McKinsey's article (Campbell 2011: 3), where two out of the three key questions about centralization are: “Does the centralization add 10% to the market capitalization or profits of the group? Are the risks low? (Does it avoid risks of bureaucracy, reduced motivation or distraction?)”.

Interviewees supported the topic of a positive business case for a solution decision as a key decision factor and added some extra considerations:

Interviewee 1 (see Appendix 1 Interview 1) says that the project did not start before “The business case calculation for the project was positive and we went for it.” An additional point from him was also the costs of maintenance for the non-centralized subledgers in the core banking systems: “Each of the systems was self-developed by the bank, therefore, fully customized for the needs of the company, but also bearing all maintenance costs and risks coming with it.”

Interviewee 8 (see Appendix 1 Interview 8) also explicitly mentions the business case creation: “The investment into centralized subledger is significant, therefore a positive

business case with expected cost optimization in long-term was important to be developed."

The procurement/vendor relationships expert in her interview (see Appendix 2 Interview 10) has provided even more details on what are the important decision criteria. She states that it is important to get a "flexible pricing model allowing to see different options for licensing costs and maintenance costs over next 5-7 years. The banks expect the presentation of different alternatives and conditions for a fixed price and time-and-material options."

The economic criteria for the selection of accounting software as a subledger for financial products have been researched in different sources. The interviews confirmed the importance of a positive business case calculation in decision-making, together with good commercial offers from vendors. The economic criteria are tightly linked to the business and technical functional coverage, which is summed up in the next section.

4.2.3.3 Business functional criteria

Different data sources were addressing the topic of what functions and features the subledger for financial products are from business perspectives. Here are some of the quotes:

S. Werner (2019a:3), in her article referring to subledger functions, says: "a subledger consolidates, optimizes and standardizes the data from source systems. It enriches the data with modeling and reporting parameters, and it can generate calculations for cash flows. A subledger handles all calculations for Multi-GAAP accounting. A subledger generates bookings and reports."

In one of her next articles, S. Werner (2019c: 4) also adds the following clarifications about the functions: "A subledger contains data at the lowest, most granular level and feeds entries into the general ledger(s). It provides a central point within a finance architecture to retain data, deliver multi-GAAP, multi-entity and/or multi-currency reporting and apply accounting logic."

A.Mitic (2020:3) adds to the functions stated by S.Werner also "detailed drill-through for analytics and a central storage of accounting rules".

In the series of interviews with industry experts around the world, many of them mentioned the functions of a subledger for financial products. Below is a summary of

quotes from the interviews (full text in Appendixes). Each function of a subledger is mentioned in this chapter once to avoid repetition, but the majority of interviewees have seen most of the features of the software solution similar.

Interviewee 1 (see Appendix 1 Interview 1) said: “We are planning to use the subledger to centralize accounting posting logic on deal-level and provide aggregated data to the general ledger and data warehouse.” Interviewee 1 also expects the subledger to be able to cover the entire scope of the banking products portfolio.

Interviewee 2 (see Appendix 1 Interview 2) mentions that the solution shall support customizations, be able to be adopted to different units and countries, and have multi-ledger, multi-currency and multi-language capabilities. In addition, the interviewee states that they plan to use “calculations of effective interest rate, fair value adjustments, and impairments”.

Interview 3 (see Appendix 1 Interview 3) states “we are planning the roll-out to all of our banking portfolios”. The calculations, he says, “are delivered and posted directly into the system”. “The software provides the functionality to revaluate foreign currency” the expert adds.

Interviewee 4 (see Appendix 1 Interview 4) states that the source systems shall “provide the final posting to the solution for consolidation purposes” and that “We needed a system that would be able to combine the features of all those divided subledgers in core banking systems”.

Interviewee 5 (see Appendix 1 Interview 5) says: “we are actually using almost the entire solution feature stack, namely the posting engine, delivery of pre-calculated postings, calculation of effective interest rate, impairments, cash flow projections, etc. All of the bank’s products we could cover in the solution.”

Interviewee 6 (see Appendix 1 Interview 6) mentioned the same features as the previous interviewees with the addition of “we use the subledger as a central data storage for loans (transactions)”.

Interviewee 7 (see Appendix 1 Interview 7) highlights the necessity of flexibility and fitness for all banking products. All the points mentioned by other interviewees.

Interviewee 8 (see Appendix 1 Interview 8) mentions that a set of factors have been considered to be important, including coverage of the entire banking portfolio and providing data to the general ledger and external reporting tools (as also stated by other interviewees).

According to consulting company ADWEKO as SAP partner (M.Rauscher 2020:3), the business functionality of a subledger for financial products can be summed up the following “it offers the functionality to make valuations based on imported business events, target balances or posting documents from product systems. Additionally, it allows manuals postings.”

The business functionality of a software solution has always been a primary factor if the project gets a green light. This is also valid for a subledger for financial products. But in the digital world, business functions are closely connected to the technical capabilities of the system, which we will look at in the next section.

4.2.3.4 Technical criteria

The technical functions were mentioned in multiple sources together with business features as an integral part of the subledger for financial products. Here are some of the quotes from the literature and interviews conducted:

A. Mitic (2020:4), in her experience study, sums up the technical functionality of a centralized subledger as the system that “establish common data definitions throughout the organization”, brings data to a common central platform”, provides real-time reporting capabilities, centralizes “data transformation rules and automate data processing”.

Sarah Werner, in her article series, is also touching the topic of the technical capabilities of a subledger for financial products. In her article (S.Werner 2019c: 1), she says: “the subledger can be made up of multiple components including standardized APIs, a financial data store, configurable posting engine, rich subledger, and a reporting/extract layer. Together they provide a configurable, IP-rich solution.”

The interviewees confirmed the points stated above and also added several technical features they deem important for the subledger to have:

Interviewee 1 (see Appendix 1 Interview 1) mentions that the subledger “requires data to be delivered in a very structured precise way”.

Interviewee 2 (see Appendix 1 Interview 2) says that the “solution can be customized to any need…” and that the “solution had an out-of-the-box interface to (SAP) General ledger”. He also adds that “we are using actively the posting rule engine and all event streaming functionalities”. The expert stresses that the subledger “is flexible, but still has its own data model, which requires specific delivery of data and specific formats.”

The interviewee also says that initially the software was bought on-premise but now "fully migrated into SaaS and managed by the vendor".

Interviewee 3 (see Appendix 1 Interview 3) mentions that the subledger shall support a "Private Cloud, which is serviced by the vendor".

Interviewee 4 (see Appendix 1 Interview 4) says that the subledger should be able to "process millions of data records every day. We needed a solution that would be easily adjustable. We were looking for a system with big integration capacities." The employer of interviewee 4 expects the solution to take over any data gap, which banking systems cannot cover, and be "up-to-date with the technology", thus, they are using the integrated module of data transformation in the system.

Interviewee 5 (see Appendix 1 Interview 5) states that they were "looking for a platform, which would incorporate all the modules we would require, including the subledger, general ledger, and data warehouse". It was important for them to have "new technology, availability of regular upgrades and changes", including "seamless integration" with high-security standards.

Interviewee 6 (see Appendix 1 Interview 6) highlights that they were looking for "a sophisticated business data model and database prepared for all of banking products and volumes. And we considered only modular solutions."

Interviewee 7 (see Appendix 1 Interview 7) mentions the points of the customizable and highly flexible solution, which can be adjusted and maintained internally.

Interviewee 8 (see Appendix 1 Interview 8) adds that they were interested in "future-proof technology, scalability, and modularity, high-security standard, and performance dealing with big data volumes".

The IT expert during Interview 9 (see Appendix 2 Interview 9) suggests, in addition to the abovementioned functions, also "real-time capability, event-driven architecture, API, cloud integration and continuous improvements". These features, from his perspective, constitute a future-proof solution.

The scope of both business and technical functions of a software solution is very big. In this chapter, only the key points expected from the subledger for financial products are covered based on the literature collected and expert opinions.

4.3 Conclusion

In this chapter, the summary of the key data collected during the research was described and presented. From the magnitude of the data available key takeaway is that the topic of a subledger for financial products, its implementation options, and decision-making criteria is very complex. Starting from the different definitions and understanding of a subledger and its main functions, ending with the scope of implementation options and decisions to be made, it has become clear how difficult the decision for or against a central subledger can be for senior management.

The key findings from the chapter are that the key criteria when deciding about a centralized subledger for financial products can be categorized into strategic aspects with long-term arguments, economic considerations and risk evaluations, business and technical functions as well as key vendor relationships.

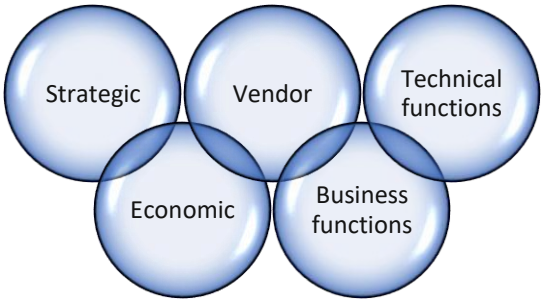


Figure 16: Key groups of decision criteria for centralization of a subledger for financial products

Chapter 5: Analysis and discussion of results

5.1 Introduction

In this chapter, the data collected and presented in the previous chapter will be analyzed, synthesized, and discussed. The discussion will follow the same thematic structure as the results chapter. In this chapter, the research questions will be discussed and answered based on the data collected including the relevant literature found as well as data from interviews conducted.

This master thesis is dedicated to researching, structuring, and assessing the decision-making criteria for the centralization of a subledger for financial products used by financial service providers in the EU.

This master thesis aimed to identify different alternatives to the centralization of this solution, find out common decision-making factors important for senior management, and evaluate the significance of those aspects in making a final decision for the implementation of a centralized subledger for financial products.

The key findings from the previous chapter are that the data collected suggests, rather a range of factors and aspects that are important when deciding the centralization of a subledger for financial products. According to the research information found, the decision-making criteria can be grouped into the following categories: strategic, economic, business, and technical functions and vendor/partner assessment.

The data collected agrees with the academic and professional literature found and discussed in the literature review chapter, as well as adds additional aspects coming out of practice so far not covered in the studies. In the next section, a detailed analysis of the results will be presented.

5.2 Interpretation of results and solution suggestions

In this section, the results of the data collected and the literature review is analyzed, synthesized, and interpreted. The relevance of the data to answering research questions is clarified.

First of all, the analysis of the data collected corresponds to the literature review with regard to the definition and understanding of a subledger for financial products. The data in interviews deepen the knowledge about the subledger as a solution, its current and future use, and the importance of its centralization in the IT landscape of financial service companies.

Multiple sources within the literature review and interviews agreed that subledger for financial products is a tool providing a holistic overview of banking products, their movements, and their impacts on companies' performance. Centralization of a subledger for financial products allows the companies in the finance industry to create a single point of truth for financial (and sometimes risk) data within their organization

5.2.1 Alternatives for implementation of subledger functions in financial services companies

The data suggest that, in high-level terms, there are two different approaches to representing and implementing subledger functions in a financial service company.

One approach would be the decentralization of a subledger solution and functions, while the other one is the centralization of it on the head-office level, primarily in the hands of the unit responsible for accounting and reporting.

The literature found agrees with this statement and provides a high-level understanding of decentralized and centralized management. But, at the same time, literature mostly sees the topic of centralization or decentralization as primarily a function of control from the center toward the units or subsidiaries rather than from an IT perspective. Nevertheless, the series of recent articles coming out from consulting companies show the topic from the IT architecture perspective too. This IT landscape perspective corresponds to the one suggested by collected data.

The sources claim the key advantages of centralization of a software solution are the reduction of long-term maintenance costs, standardization of business processes across various subsidiaries, and general compliance with regulatory and security standards requested by the center. On the other hand, the disadvantages of centralization and the advantage of decentralization are claimed to be the motivational factor in subsidiaries toward reaching their performance and business targets, the opportunity to quickly make decisions keeping in mind local specifics.

From the IT architecture perspective, a decentralized method of implementation of a subledger for financial products keeps the responsibility for data on the source systems where the data is created. It allows the core banking systems to maintain the end-to-end responsibility and overview of their products and performance. Centralization, on the other hand, allows for simplifying and unifying data collection and harmonizing business data model, helps optimize integration and reduce short-term implementation costs for changes, as well as long-term operating expenses.

The data collected during the research contributes to the existing body of knowledge with a clear definition of three implementation options relevant for the subledger for financial products, where the first two are following a decentralized approach and the third one is going on the path of centralized IT management system:

1. Traditional when core banking system includes both subledger functionalities for the relevant products, as well as general ledger summing up the posting

for the part of the financial statements. According to the data in interviews, this was a primary alternative for the companies before going for centralization of a subledger for financial products.

2. “Product system”, is when the core banking system includes all relevant subledger functions for the products it covers, but the general ledger is represented as a separate solution. Data suggests this was the second most used option in the banking industry before centralization.
3. The central platform represents the core banking system as software responsible to provide relevant product data to the central subledger, which would process and store the data and deliver it to the central general ledger. Subledger and general ledger are both separate software solutions and both centralized on the unit level.

The body of knowledge covered in the literature review did not cover the actual implementation options for a centralized subledger. The data collected during the research shall cover this gap.

The analysis identifies that there are three options so far available on the market for use in the financial service industry, namely to “buy” the subledger for financial products, to “build” it, or to “frame” it.

The data defines the “buy” option as the opportunity to select an already developed software solution available on the market. There are different alternatives, and most of them are represented by highly standardized software created by big software providers. The “build” option suggests developing the subledger for financial products based on the internal business requirement within the company and for the company itself. This would require high effort from internal resources and potentially external support for the time of the project, but the solution developed will be fully customized and adjusted to the company’s product specifics and needs. Last but not least, the “frame” option is largely connected to the software solutions on the market available as Software as a Service (SaaS) or Platform as a Service (PaaS) concept in the Cloud. This alternative differs from the previous ones since the solution selected is sold only as a “frame” or “base” with a highly customizable and adjustable software package, meaning the bank can create a customized solution using the available frame and standard functionalities. These are the options combining the standardization to some extent from the “buy” option and customizing opportunities from the “build” one.

The following overview shows a contribution of the thesis results to the field of research relevant to the topic of implementation of a centralized subledger for financial products:

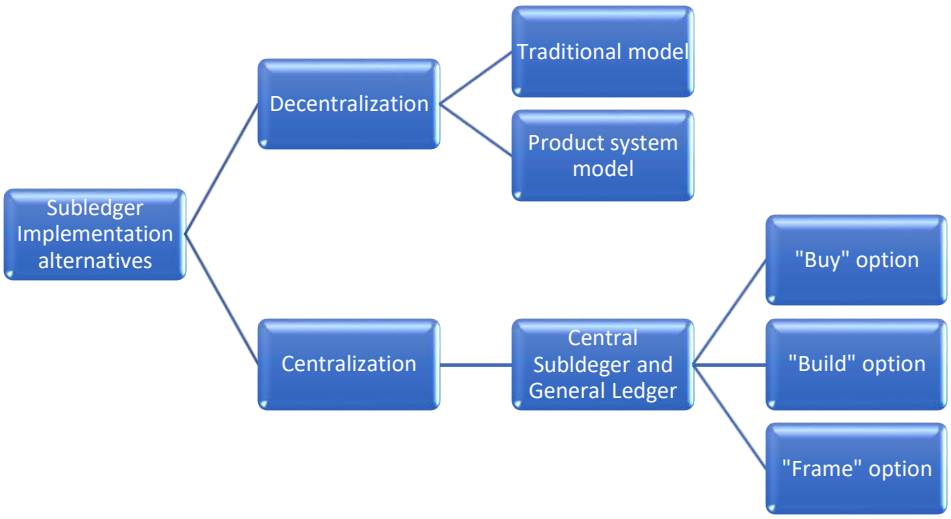


Figure 17: Implementation approaches and options for a subledger for financial products

5.2.2 Alternative criteria for centralization of a subledger for financial products in the finance industry

The literature review in Chapter 2 presents an extensive overview of different books and articles, where researchers covered the topic of criteria for the selection of accounting software in general and a central subledger for financial products in particular.

The data agree with the sources mentioned in the literature review as well as compliments it with additional factors which might impact the choice. The analysis showed that the criteria can be thematically categorized into 5 groups of factors, impacting the decision about a central subledger for financial products: strategic and economic factors, business and technical functionality, and vendor.

5.2.2.1 Strategic criteria

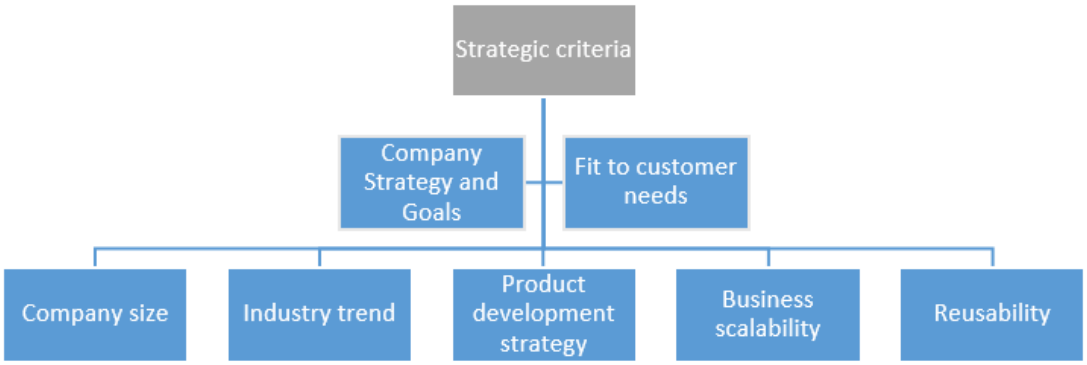


Figure 18: Strategic criteria for centralization of a subledger for financial products

The literature suggests that company strategy and goals and their mapping to software functionality is a key strategic criteria for selecting accounting software. The data has confirmed this observation to be valid for choosing the subledger for financial products too. Depending on the company strategy and roadmap, the subledger for financial products shall be able to scale up for bigger volumes of data (when the expansion strategy is exercised), it should be able to adopt new products on the newly occupied market or reduce long-term costs. Depending on organizational goals, it is expected that the subledger for financial products works in sync with those goals.

Another strategic factor proposed by the researchers in the literature is a general fit to new customer needs. This criteria means that the software shall be customizable and flexible enough to be adopted to new customer needs on the market, which the company strategically decides to satisfy. This criterion is also confirmed by the data from interviews, clarifying the need for this alignment in the digital era with ever-changing customer behaviors.

Several articles touched on the topic of the connection of company size with the decision on the accounting software to use. The research shows different accounting packages and choices done by small companies, medium-sized businesses, and large corporations. The decisions about software in different company sizes, according to researchers, were different since different features and volumes of detail are required. The data collected from interviews was from representatives of large international banks, thus could not confirm or deny the general statement that the size of the company matters in the decision for subledger for financial products. Some sources claimed that the subledger, and the level of detail it provides, are not needed

in smaller scaled businesses. But the data has shown that with growing data volume in the banks, the requirements and the need for a central subledger increases.

The subject of scaling the business has been touched on in the literature research and the thesis data. It is stated that the software solution should be able to grow as the business grows, expand, and be able to process more volumes of data as the company grows. This statement agrees with the data collected for the central subledger for financial products. The subledger shall be able to accommodate all financial products the company currently uses and plans to use and be easily scalable through the server extension or via cloud memory increase. This way, a subledger accommodates current and future business needs.

During the research in this thesis, several additional strategic criteria have been found, which were so far not covered in the literature. One of these factors was the industry trend. The industry trend has been discussed in the literature as a criterion for digitalization, for switching from manual “pen-and-paper” accounting to automatized accounting solutions. The data in this research shows that industry trend has become a criterion for choosing a central subledger for financial products not due to digitalization, but since competition is choosing a particular solution or building a particular IT architecture. The data suggests that in the DACH region, several banks are following the trend to implement the IT landscape with a centralized subledger by looking at the successful start of similar products by competitive banks.

One more factor not covered by the literature so far was an alignment of a product development strategy. By this criteria, it is meant that the central subledger is not expected to be a fully finished and static product, but that the financial product scope and functionalities would expand together with the demands of the key users of the software. Namely, the banks expect that any new product they implement or create is going to be included in the subledger roadmap and be implemented in it.

The last strategic criterion suggested by the data collected in this thesis was reusability. This factor was not found in the literature so far but was mentioned in the interviews with financial industry experts. By reusability, it is meant that the features already implemented in the subledger for financial products can be then, to some extent, reused for implementing other products or other subsidiaries. The level of reusability is mentioned as a criterion for choosing only a central subledger since only a central subledger provides the opportunity to implement a standard logic for all products in the company’s portfolio.

5.2.2.2 Economic criteria

Subledger for financial products is a significant investment, therefore, economic, budgetary, and risk factors for implementing the solution have been discussed in the literature intensely.

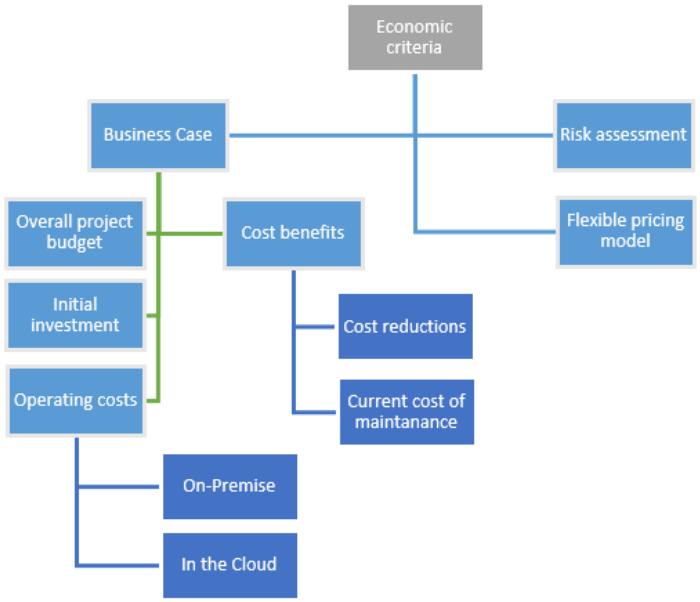


Figure 19: Economic criteria for centralization of a subledger for financial products

The data agrees with the literature found that the creation of a business case for a project like the implementation of accounting software is a key element for a decision about a solution. The business case considers both the expense side of the implementation of accounting software as well as the benefit side of it. The scope of the research are companies working for profit, therefore, the economic impacts of any decision are very important.

On the cost side of the business case, assessment according to the literature and data collected are the overall project budget, initial investment, and operating costs. By overall budget, it is considered to sum up all expenses connected to the project implementation within the accounting units, as well as the external impacts of the implementation. For example, in the overall budget, the salaries of internal resources used in the project, consulting fees, software costs, maintenance costs, interfaces from the software to external systems, as well as efforts of the feeder systems and

reporting teams, to adapt to the newly implemented data source should be included. For long-term projects, the costs for 5-7 years are included in the overall budget.

The initial investment represents the expense needed for the installation of a subledger for financial products (or any software) and costs for external and internal resources implementing the software solution of the choice.

Last but not least, on the costs side, the operating or so-called maintenance expenses are to be taken into consideration. Depending on the software model and option chosen for a subledger for financial products, the maintenance costs can represent the amount of license fees, servers, memory extensions, and salaries of internal and external resources maintaining daily operations of the newly implemented subledger for financial products. With the digitalization of the financial service industry, the criteria of operating costs can be also split, depending on the technical solution chosen by the company. Even though the majority of the sector is still using on-premise solutions, meaning operating costs would include maintenance of servers, storage, archives, and daily operations. The solution in the Cloud provides the opportunity to pay rather a license fee per year and a price for required memory without any infrastructure costs. In this regard, literature and data agree, clarifying also different cost models and solutions in the cloud (e.g. PaaS, SaaS, and IaaS) and on-premise.

The data collected suggests that the business case shall be measured not only from the cost side but also from a properly assessed and calculated benefit side. The literature mentions shortly the benefit side of the deal but rather focuses on the costs. During the interviews, it was highlighted multiple times that in order to decide on a central subledger for financial products, the impacts of the implementation have to be calculated and presented to the senior management. It is expected that the cost reductions occurring after the implementation of a central subledger shall not only cover the initial investment but also be compared to the 5-7 years of maintenance cost of the current solution. In the literature, the consulting companies go even further suggesting targeting at least 10% of profit as a cost reduction target from a centralization project. This figure was not confirmed or denied by data collected for this thesis.

The business case calculation is closely connected to the risk assessment. The literature suggests properly calculating the operational and security risks of the investment into accounting software. This is also confirmed by data valid for subledger for financial products. Any exposure to the internet or storage of data outside of the

organization is connected to risks. This risk assessment shall be compared to the risk appetite of the company, namely its willingness to accept a certain level of risk when making a strategic decision.

One additional criterion suggested by the data was a pricing model for software like subledger for financial products. This factor was not covered in the literature but was mentioned by industry experts in interviews. The flexible pricing model, it is considered that the subledger provider can propose multiple options and alternatives for a price calculation of a subledger implementation. Data suggests that subledger providers can propose license costs based on the number of contracts planned to be used in the system, an actual volume of data in the system, or memory storage requested by the financial institution. Another variable in the pricing model can be fixed price or time-and-material costs for yearly maintenance when the company can decide based on the planned requirements if a certain cap of vendor support is sufficient. The chosen pricing model then becomes part of the overall project budget.

5.2.2.3 Business functional criteria

Software functionality from an accounting perspective has been discussed in the literature from different perspectives and during different stages of technological advancements. Together with technological changes and digitalization, the requirements for software are changing. This is relevant for accounting software as a whole and subledger for financial products in particular.

Multiple sources in the literature review section were mentioning that the solution should be multi-lingual to accommodate the needs of business users in international companies, multi-entity to be able to scale up to subsidiaries and create a centralized platform, multi-ledger since each company needs to follow both international and local standards of accounting. These features become a standard in software development in recent years, thus being taken as the default functionality of accounting software. The data collected confirmed and agreed with this statement, the financial institutions are expecting these functions in any basic package of a subledger for financial products.

Business functions	User-friendliness
	Multi-lingual
	Multi-entity
	Multi-ledger
	Extensive reporting functionality
	Product coverage
	Posting functionality
	Posting rule engine
	Product relevant calculations
	Deal-level information
	Dimension concept
	Business data model
	General ledger account derivation
	Automatic business checks
	Automatic EOD/EOM/EOY processes
	Cash-flows import
	Target values import
	Manual corrections

Figure 20: Business functional criteria of a subledger for financial products

The topic of the user-friendly design was not found in the data collected but in the literature review. The assumption is that in the time of digital platforms and web interfaces, companies are expecting this feature out-of-the-box, thus not mentioning that it is as important compared to other factors. Another aspect here is the specialty of accounting work and accounting software, the completeness and correctness of financial statements are prioritized here above the report looks like thus, the user-friendly design of the software was not mentioned as a feature requiring attention.

The availability of extensive reporting functionality is where the data and literature agree on all points. The key function of accounting is to produce a correct financial statement thus, the possibility of reporting views internally in the system and sending or extracting reports externally was stated as a key functionality for any accounting system, especially the product responsible software like subledger for financial products.

All the rest of the business functions presented in Figure 20 are the result of data collection in this research paper. The academic literature does not cover so far subledger for financial products and criteria for its selection, but rather an implementation of accounting software packages. Thus, the next criteria on the list are purely business functionality relevant for subledger for financial products identified

during the interviews and from articles of consulting firms supporting the implementations of this software.

The data suggests that product coverage is one of the main criteria for the centralization of a subledger for financial products. In several interviews and data sources, it has been mentioned that financial institutions are looking for a software solution that can accommodate their entire portfolio, meaning all the products in the scope of the bank. Moreover, with each product coverage goes hand in hand the relevant product calculations. Several sources, as well as my own experience, confirm that different types of calculations relevant to banking products (e.g. effective interest rate, accruals, modifications, etc.) are key selling points of a subledger for financial products and the main criteria for their comparison.

The distinguishing factor of a subledger for financial products to the other accounting software is said to be the availability of the business data model, customized banking products, their specialties, treatments, and requirements. The fit of this business data model to satisfy the standardization goals of the company is an aspect being discussed and considered when deciding about the centralization of a subledger.

Posting functionality, meaning the possibility of a software solution to create automatic accounting records based on the input data, has been also recognized by several data sources. Moreover, it is expected that this functionality is included in the basic package of any subledger by default. The posting rule engine, on the other hand, according to data is expected from the subledger too, but not widely used. A lot of interviewees said that they are planning to expand the current usage of the solutions to use the automatic rule engine for postings, but they do not have it in use at the moment.

The reporting functionality is closely related to deal-level information and a sophisticated dimension concept allowing reporting on a horizontal and vertical level. It is expected that the subledger provides an overview of the balance sheet and profit and loss statement on a high level and can be drilled down to individual accounts and even individual deals. Dimension concept helps here to group the different accounting records to fit all regulatory reporting requirements and also internal needs for managerial accounting.

The subledger for financial products in the IT landscape of a financial institution is not a standalone system. The subledger, as stated in the literature, represents the subset of data from the general ledger providing more granularity and volume of information

on the deal level. Thus, the topic of the flexibility of chart of accounts and general ledger account derivation has been mentioned in multiple data sources describing the subledger features. The general chart of accounts is a responsibility of a general ledger, so the subledger is expected to accommodate that chart of accounts and be able to customize the posting rule engine in a way that proper general ledger accounts are posted.

The subledger for financial products is a very complex system with numerous automatic processes. A lot of them are purely technical, allowing solutions to perform needed tasks, but some were found in the data sources as part of business functionality expected from the subledger for financial products. Some experts name automatic business checks and automatic daily, monthly, and yearly processes as purely business processes implemented within the subledger. For example, some sources ask for a subledger to be able to check if the contract data matches customer data available in the system as a part of a business check. Daily, monthly and yearly processes can include but are limited to fx accounting, posting and calculation of accruals, month-end processes, year-end closing, and balance carry forward. All these processes are expected to be basic functionalities of a subledger for financial products.

The calculations of cash flows and target values for fair values and impairments are normally expected to be functionalities of core banking systems or separate calculation engines. But industry experts and accounting professionals are expected subledger for financial products to be able to connect, import, and account for these data on regular basis.

Last but not least, numerous sources and literature suggest that subledger for financial products, along with any accounting software, shall be able to receive or perform manual corrections on demand of the user. This is a regular business process, most often during month-end closing, when accounting users are performing the corrective postings recording the actions needed for disclosures, or fixing the errors found in the financial statements.

Business criteria go along with the technical criteria for the centralization of a subledger for financial products. The key takeaways from the literature and data collected are clarified in the next sub-section

5.2.2.4 Technical criteria

There were multiple technical criteria for selecting accounting software, in particular, a subledger for financial products, where the data and the literature agree upon. Figure 21 below provides a high-level picture of the criteria mentioned in the literature and additions from the research data.

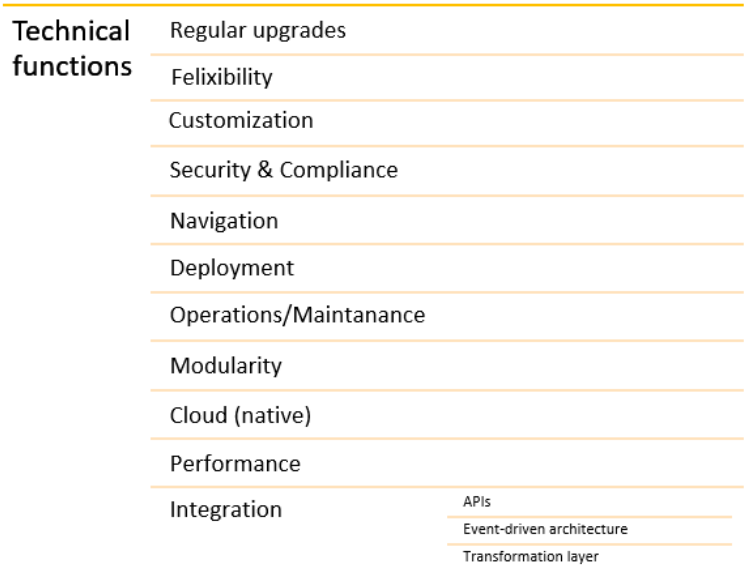


Figure 21: Technical functional criteria of a subledger for financial products

Most often in literature and the data collected during this research were the features of flexibility and customization. Flexibility is described as a technical characteristic of the system, which means the systems can be easily adapted and changed product-wise and interface-wise to meet business and technical requirements so that it can easily expand to a new product range and be connected to the outside systems. Customization is connected to flexibility in a way that the systems are expected to be as standard as the business processes in the industry require it, but have enough room for customizing both the views for the user and its technical features, be able to change for special non-standard product portfolio.

The regular updates are also more and more mentioned in the literature in the 21st century, and the data confirms that this functionality is important in the digital age. The software is not expected to be standard and not changed for 20 years, but instead should progress, together with the technology allowing more and more features with each upgrade. The upgrades are expected to be available from the software provider according to the user group requirements and regulatory changes.

Security and compliance of a software solution, especially one like a subledger for financial products, which holds entire banks' portfolio information, was an important criterion in both academic literature and the data collected. Moreover, security standards are evolving, requirements are growing as a reaction to more and more threats to digital systems from the world web. Any software having a connection outside of the internal network is a security risk, therefore, it has been highlighted by multiple sources that a proper security and compliance check of subledger for financial products, its security system set-up, servers, and connections are of the utmost importance. This importance grows even more when the system goes to Cloud.

Cloud solutions and selecting cloud-based software was a topic of discussion in the literature review. The data from the interviews suggest a trend for financial institutions to move their on-premise accounting solutions into the cloud (be it as SaaS PaaS or IaaS). Moreover, the most recent data states that banks are looking for Cloud-native software, meaning the accounting solutions that were initially built in and for the Cloud environment, believing in their potential cost efficiency and performance.

Navigation is a functionality that was more mentioned in the literature rather than in the current data. Navigation in the sense of subledger software is the mirror characteristic to the user-friendliness business criteria. Navigation should provide a smooth and easy switch between the screens, easily recognizable and understandable tools and patterns in the interfaces, and allows the user to get to know and learn the application faster. Recently, this characteristic is less mentioned in the data, not because it is less relevant, but rather because it is now expected as a basic software characteristic, which is expected in the package by default.

Deployment and Operations/Maintenance are the purely technical characteristics of any modern software. These criteria were mentioned in both literature and the data. Deployment in the scope of a subledger for financial products meant that any changes that are developed for the solution and in the solution can be easily brought into the system, tested, and deployed into products via an automatic process. This process is also a part of regular operational activities and system maintenance, which is also broadened to daily technical checks of the system, daily processing, maintenance of servers, archiving and storing the data, etc.

The last three technical criteria have been suggested by the data collected during the research. The literature does not cover those characteristics yet, but the data states that their importance is growing.

Together with new technologies and digitalization, the data volumes skyrocketed. The new technological trends created new solutions, which are more modular, consisting of numerous detachable parts, which the user can choose and implement. This is what happened with the accounting software and the subledger for financial products in particular. The data suggests that modularity became a criterion for selecting the central subledger since the banks would like only to pay for the packages and products they are going to use in the solution. Thus, the banks are buying only some modules of the software solution, which would satisfy their needs.

Performance has been mentioned in the data as the topic that keeps the technical experts implementing subledger for financial products very busy. The subledger is a solution that is expected to receive, process, and store millions of records per day. A simple memory extension does not speed up the daily processing since the user needs to wait until the system is finally available. Thus, performance, namely how many records can be processed during a dedicated period of time or how much it takes to create one particular report, has been stated to become very important success criteria for choosing a subledger for financial products.

Integration is a pain point mentioned in all the interviews. Integration in the scope of a subledger, it is meant that the system can connect to external sources of data, receive them, check, process the data, and send the data to outside sources in a specific format. The data from the research suggests that the complexity and the efforts for the integration of a particular software solution to the current bank's architecture have become a significant factor in deciding about the centralization of a subledger. Moreover, most recent data states that with the new technological advancements in IT, financial institutions as customers of a subledger software vendor expect basic solution package standard APIs, events-driven transactions/messaging, and a sophisticated transformation layer, which can take over some pre-calculation logic from feeders.

5.2.2.5 Vendor criteria

Vendor criteria were not so far extensively covered within the literature. The literature review states that finding a trustworthy vendor for solution implementation is important, but the data collected recently within the interviews with experts in financial institutions around the world suggests that vendor requirements are becoming as important as business features of the future software packages.

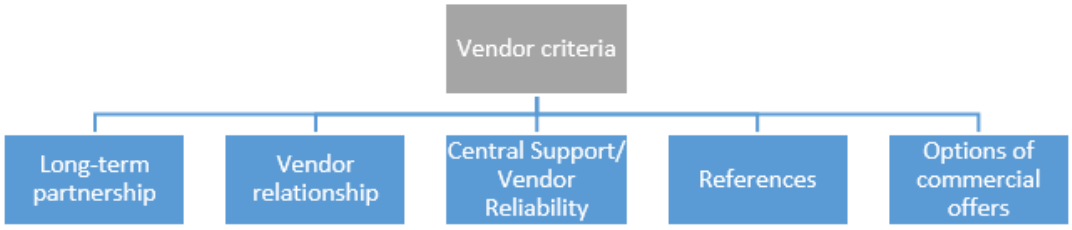


Figure 22: Vendor criteria of a central subledger for financial products

Data states that, on multiple occasions, long-term partnerships with the vendor have been major criteria for selecting a subledger for financial products. Several interviewees confirmed that they went for a particular solution due to a long-lasting trustworthy partnership with a vendor or even that the vendor came to them with the new idea. These long-term partnerships were built on personal connections to the vendor employees, a history of successful products, and a belief in the professionalism of the partner that even a challenging new project would be finished successfully.

Those financial institutions which did not have long-term partnerships with a vendor proving a subledger for financial products as a module of their software have stated that the criteria for selecting the software were vendor relationships, vendor communication during the selection process, and the proof of concepts.

Some data also suggested that it is also important for financial institutions to know if the vendor will support the solution after the implementation, namely if there is ongoing vendor support and there is a proven history of situations and cases where the reliability of the vendor occurred toward the client needs and requirements.

Another criterion mentioned multiple times, was successfully confirmed references from similar projects. These are the criteria that are checked first during the selection and decision process. Moreover, some data suggest that without successful confirmation of references given by the vendor, the selection does not proceed to the proof of concept phase. Financial institutions expect from the vendor a presentation of several examples of similar scope projects in similar size institutions, which can be confirmed by a meeting with their representatives.

Last but not least, experts from procurement highlight that recently it is not just important to have one commercial offer from the vendor, but as a new criterion for selecting the central subledger, it has been requested by senior management to see

several alternative offers from vendors, which would represent the vendor understanding of the company's situation and complexity of a future project.

5.2.3 Analysis of the importance of common criteria for financial products subledger centralization

In this section, the results of the analysis of the importance of identified criteria for centralization of financial products subledger are summarized and synthesized based on the data found during the research and input from the literature review.

In the previous section, it has been clarified that there are numerous factors and criteria impacting the decision of senior management on the implementation of a centralized subledger for financial products. The analysis showed that the criteria can be thematically grouped into five categories, namely strategic, economic, business functions, technical functions, and vendor criteria.

Considering the input from academic literature, professional articles, consulting reporting, and confirmation from the data collected, the strategic criteria for centralization of the financial product subledger keeps the most important among all the groups.

As data states, financial institutions do not start considering the subledger software as an option before they can assure it fits the long-term strategy of the company. Some data suggests that the new company strategy triggers the search for new innovative solutions like a subledger, other data states that implementation of a subledger triggers the review of the current company strategy more fitting to the client's needs.

The second most important criteria group for deciding upon the subledger for financial products is its business functional coverage. According to experts and a history of successful implementations in the industry, the subledger is not chosen or incorporated into the IT landscape if there is not an almost complete product and functional coverage within the software package bought. Here is where the mapping of features to business needs agrees with the data from the literature found.

Economic criteria, budget constraints, and expected cost optimizations, are considered to be the same or almost as important as business functionality coverage of the subledger for financial products. With the increased competition in the financial market by FinTechs, the old traditional banks feel the pressure on reducing their costs

and optimize internal processes. Implementation of a centralized subledger for financial products is seen as an opportunity to reach those aims and targets.

The technical functionality, including the integration criteria, new technologies, and operations, are the factors that follow the economic criteria by their weight. The digitalization of the economy and the digital transformation of the financial industry pushes the banks to react quickly to customer demands, and provide more and more services online, keep up with technological advancements and be more adaptable.

As mentioned in the previous section, vendor relationships are becoming more and more important in recent years as financial institutions are looking for long-term partners that would support them during the transformation process and help them innovate and easily transition from one solution to another still maintaining stable daily operations for all upcoming years.

Considering the abovementioned, the data analysis suggests the following approximate ranges of the weighting of criteria group importance when deciding upon the centralization of a subledger for financial products.

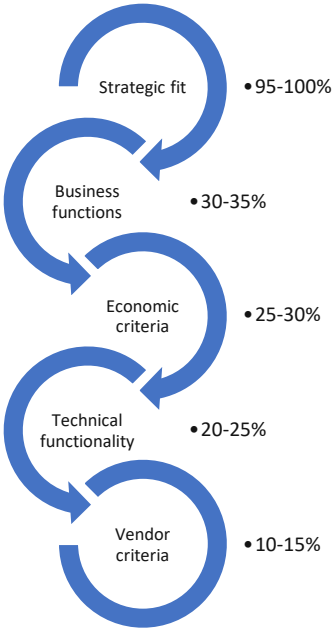


Figure 23: Estimated weighting of criteria groups in deciding upon implementation of a central subledger for financial products

Figure 23 represents the sequence and importance of identified groups of decision-making criteria for implementing a centralized subledger for financial products in financial institutions.

The figure is presenting potential application guidance toward the financial institutions showing that the process of selecting a central subledger shall start with a check of strategic criteria fit of a centralized subledger (without details of a particular software solution). If the strategic criteria are met, further criteria groups shall be assessed. Business functions, economic criteria, technical functionalities, and vendor criteria might be estimated in parallel, and the results of the assessments summed up into the criteria catalog with a total weight of 100% in total. Several alternative software components or alternative implementation options might be compared based on the created catalog. The weighting scale proposed is a suggestion based on the data from industry experts and presents a best practice at the time of the research-creation. The weighting shall not be considered as final instruction but as a guide for weighting different criteria groups, which shall be adjusted according to the company's priorities and strategic outlooks as well as current IT architecture and situation.

This section contributes to the body of knowledge and current literature since there are so far no criteria catalogs or suggested weighting models available to support the financial institution in the decision to implementation of a centralized subledger for financial products. This section shall cover the gap and extend the current literature with additional criteria and factors for selecting accounting software and a subledger for financial products in particular

5.3 Conclusion

In this chapter, the results of the research have been analyzed, described, and compared to the current body of knowledge in the literature. The data collected during this research agrees with the current body of knowledge, and several additional contributions were found, with regard to different alternatives for the implementation of a subledger for financial products, criteria for centralization of a subledger, and the importance of different criteria groups in the final decision of senior management.

The analysis of the data showed several criteria for the centralization of a subledger appeared due to recent market trends and technological advancement. In addition, the data suggest categorization of the criteria found into 5 groups, such as strategic, economic, business and technical functions, vendor criteria, and potential weighting of those criteria groups based on the importance of different factors and their impact on the success of the implementation of a centralized subledger.

Chapter 6: Conclusion

6.1 Introduction

This chapter will conclude the master thesis by summarizing the key research findings concerning the research aims and research questions, as well as the value and contribution thereof. It will also review the limitations of the thesis and propose opportunities for future research.

This chapter will serve as a closing summary of the research performed within the master thesis scope. The conclusion chapter will present the findings from the Result and Discussion chapters on a high level and clarify the thesis contribution to the field.

6.2 Key findings in relation to research aims

This thesis aimed to identify, categorize and evaluate the decision-making factors and approaches for the centralization of subledger for financial products utilized by financial service companies in the European Union.

The results indicate that there are two alternatives to the centralization of financial product subledger. Both alternatives are part of a decentralized approach to management and IT architecture in particular. The decentralized approach from an IT perspective provides the options of a traditional decentralized core banking system alternative, where the functions of a general ledger and subledger are covered by the product system, as well as a mixed form. In this case, the product system takes over the functions of a subledger, while the general ledger is centralized and remains in a separate system.

Considering the centralization approach, the data analysis shows that there are three ways of implementing a subledger for financial products. The “buy” option constitutes the implementation of ready software from available vendors on the market. The “build” option provides the opportunity to develop and customize the subledger for financial products with their resources to own requirements and designs. And the “frame” option is a combination of a solution bought from a vendor with high flexibility and customizing capability in order to satisfy the needs of all customers.

The key takeaways were also found within the analysis of the criteria for centralization of financial product subledger. The data suggests that in the financial area, multiple important criteria and aspects are influencing the decision to centralize the subledger for financial products. Thanks to the context analysis, the criteria could be categorized

into five thematic groups, namely strategic and economic factors, business and technical functionality, and vendor criteria.

The data indicates that the strategic criteria group holds the highest importance and weight, where the financial institutions are mapping the strategic targets and goals of the company to the functionalities and capabilities of the subledger for financial products. Strategic criteria focus not only on the current functions of the software and current customer demands but measure whether the software fits the future company roadmap, plans, and changing customer requirements. The other criteria groups are not commonly considered within the process of deciding about the centralization of financial subledger before the majority of strategic indicators are met.

The economic criteria are traditionally important for any decision involving significant initial investment, like the implementation of a subledger. The key finding here is that not only the cost side of the potential implementation is being considered but also potential benefits, cost reductions, and optimization, which the system can bring as well as sunk costs for maintaining the old IT architecture if the central subledger is not implemented. Data suggests that economic criteria weights around 25-30% of the total decision criteria group evaluation.

The business and technical functionality of a central subledger for financial products continue to be the selling point of the software solution. The standardization and optimization the central solution brings together with the mapping of expected subledger functions to current gaps and workarounds in IT architecture or the core banking systems are the cornerstones of deciding on a central subledger. Technological advancements have changed the view on the importance of technical features of the software in the overall project success and its future benefits. The increased importance of the technical advantages is represented by 20-25% of the total weighting of the criteria group. The business functions remain the most important criteria after the strategic aspects with a weight of 30-35%.

The new discovery of thesis research was a set of criteria, which were suggested by the data as factors growing rapidly in their importance in the central subledger implementation were vendor criteria. Recent data indicate that long-term relationships with vendors and partners, which can support the financial institution with their strategic outlooks and provide customized and flexible offers with special conditions relevant only to the specific implementation project become more important in the current environment. Thus, this new category of vendor factors is weighted with 10-15% of the total group evaluation.

The weighting of the criteria groups represents their importance based on the data collected. The weighting is not exact, but rather a range based on current industry practice. The financial institutions decide on the weighting and categorization based on their specifics and needs, proposed weighting is rather a high-level indication.

6.3 Research contributions to the field of study

The research performed and described in this master thesis has aimed to cover the gaps and contribute to the existing body of knowledge on the topic of a subledger for financial products, alternatives for its centralization, and the criteria for such a decision.

The literature review has identified that there is a lack of academic research about a subledger for financial products in general. Since it is a new solution on the market, high-level information was available from the software providers and consulting firms supporting the implementations of this solution around the world.

The existing literature agrees with the majority of the data collected during the research for this thesis. The current body of knowledge is advanced, clarified, and improved by additional information collected on the topic. The key contributions of this research to the existing knowledge are the detailed overview of a subledger for financial products, its functionalities and its value, alternative options for implementation of a centralized subledger, and several additional criteria for deciding upon introducing g the subledger in the architecture of financial service company. The current literature has provided an overview of potential factors which can influence the selection of accounting software. The identified factors were acknowledged to be relevant for the subledger with additional contributions in each criteria category, as well as an additional group of vendor aspects growing in significance in recent years.

The research can be applied in the financial service industry practice as a guidance or a checklist when considering if the subledger for financial products is the solution to the current strategic targets and a criteria catalog of what factors shall be considered before making a final decision about the implementation. Additional benefit can be taken out of benchmarking the common importance/weighting of different criteria groups to the criteria catalog created by a financial institution in order to compare its specific to industry best practice.

6.4 Research limitations

The research performed has several limitations, which can be analyzed and investigated in further research papers.

The scope of this master thesis is limited to subledger for financial products used in the finance industry. This is a product relevant only to financial institutions. Other accounting software and other subledgers are not covered in this text. Moreover, the research was focused on centralized subledger for financial products. The data provides a high-level overview of the alternatives to the central subledger, but the key findings are relevant for a centralized solution.

Due to convenience and data availability, the sampling strategy has been chosen to focus on non-probability sampling. In order to overcome the limitations of this sampling method, the data has been collected from multiple different sources, including financial institutions with headquarters in Austria, Germany, Netherlands, Ireland, and the United Kingdom. All financial institutions are international or even global corporations with subsidiaries in Europe and around the world. The representatives chosen for interviews are experts and professionals from the fields of management, banking, IT, and procurement with multiple years of experience in the field. Nevertheless, due to data availability, probability sampling was not possible.

The data collected are represented by interviews with the industry experts, which can be their subjective opinions on the topic of discussion and only based on their experience during their professional careers. The most objective overview of the research findings has been provided by the feedback from consulting companies, confirming the common understanding of the industry experts.

6.5 Recommendations for future research

The recommendations and suggestions for further research are based on the limitations of the master thesis.

The key gap identified in the academic literature is a clear understanding and definition of a subledger for financial products and their functions. The literature has covered the accounting software as a whole, separate software packages, and criteria for their selection. Further research might be dedicated to this new product on the financial market, which is driven and created by raising regulatory requirements and digital transformation of the field.

Since the scope of the thesis is limited to the centralized subledger for financial products. Future research might be potentially focused on other alternatives to the centralized subledger. This research has presented on a high level the alternative decisions, which can be further analyzed and investigated.

The research has mostly used sampling from financial institutions and industry experts in Europe with subsidiaries around the world. Further research can be dedicated to the analysis and benchmarking of the implementation aspects of subledger for financial products in other regions like Asia, Africa, North and South America, and the Middle East. All geographical areas have their specifics of doing business, and the business need for a subledger for financial products might be driven by different factors. These regional aspects might be further analyzed and discovered. Additionally, the non-probability sampling can be expanded with additional interviews from different European countries, including variations for geographical factors, gender, and company size.

The additional gap identified during the research, which might be worth further analysis, is the topic of FinTechs, the forces of their raise in the financial industry, their impacts on the market, and potential outlook/synergies with traditional banking. This topic is out of scope for this thesis, but the lack of data about the topic has come to light.

6.6 Closing summary

This master thesis aimed to discover the alternatives for the implementation of a centralized subledger for financial products in the finance service industry. The research has identified, categorized, and evaluated the common criteria for the centralization of a subledger. The criteria catalog created within the research and weighting of the importance of different factors for centralization of a subledger for financial products can be applied in practice by financial institutions in the form a guidance or a benchmark when providing the argumentations to the senior management for recommendation to go for centralization of a subledger.

The scope and sampling limitations of this research can be further analyzed, expanded, and investigated in further research papers dedicated to the topic of a subledger for financial products, alternatives to its centralization, and regional specifics.

Bibliography

1. Abu-Musa Ahmad A. (2004): The Criteria for Selecting Accounting Software: A Theoretical Framework. In: *The Second Conference on Administrative Sciences: Meeting the Challenges of the Globalization Age.* King Fahd University of Petroleum & Minerals, Saudi Arabia, pp. 19-21
2. Abu-Musa Ahmad A. (2005): The Determinants of Selecting Accounting Software: A Proposed Model. In: *Review of Business Information Systems (RBIS),* King Fahd University of Petroleum & Minerals, Saudi Arabia. Vol. 9(3), pp. 85–110
3. Adhikari A. / Lebow M. I. / Zhang H. (2004): Firm characteristics and selection of international accounting software. In: *Journal of International Accounting, Auditing and Taxation.* Vol. 13, Iss. 1, pp. 53-69
4. Adukia Rajkumar (2011): History of Accounting and Accounting Standards. In: *Taxguru - Finance-News*. https://taxguru.in/finance/history-of-accounting-and-accounting-standards.html#:~:text=Between%201973%20and%202001%20the,Accounting%20Standards%20Board%20(IASB) - retrieved on September 30, 2022
5. Al Hafiz M. F. / Indriyani R. H. / Muda I. (2022). The Role of Subsidiary Ledgers in The Company's Financial Reporting. In: *International Journal of Mechanical Engineering*. Vol. 7, No. 1
6. Al-Hashimy H.N.H. / Yusof N. A. (2021): The relationship between the computerized accounting information system and the performance of contracting companies. In: *Materials Today: Proceedings.*
7. Almgrashi Ahmed (2020): Determinants of computerised accounting information system adoption using an integrated environmental perspective: An Empirical Study. In: *IEEE Asia-Pacific Conference on Computer Science and Data Engineering (CSDE).* From 16-18 December 2020, pp. 1-7, DOI 10.1109/CSDE50874.2020.9411591

8. Aptitude (2022): Accounting Hub software website. www.aptitudesoftware.com/product/aptitude-accounting-hub/ - retrieved on December 2, 2022
9. Barret Matt (2014): Centralized vs decentralized management explained. In: *Personal Finance Lab Blog.* https://www.personalfinancelab.com/finance-knowledge/management/centralized-and-decentralized-management-explained/ - retrieved on September 29, 2022
10. Bishop William Arthur (2016): Addressing the challenge of strategic alignment faced by small and medium-sized entities during the selection of accounting software packages. In: *The International Business & Economics Research Journal.* Vol. 16, No. 1, 2016, pp. 31–54
11. Brandasa C. / Megana O. / Didragaa O. (2015): Global perspectives on accounting information systems: mobile and cloud approach. In: *Procedia Economics and Finance.* No. 20, pp. 88 – 93
12. Bucha Rishab (2021): SAP Financial Product Subledger overview. In: *SAP Community Blog*, from 14.01.2021. https://blogs.sap.com/2021/01/14/sap-financial-product-subledger-overview/ - retrieved on November 28, 2022
13. Campbell A. / Kunisch S. / Müller-Stewens G. (2011): To centralize or not to centralize? In: *McKinsey Quarterly*, from 01.06.2011. https://www.mckinsey.com/capabilities/people-and-organizational-performance/our-insights/to-centralize-or-not-to-centralize - retrieved on October 10, 2022
14. Canals Jordi (2011): The Evolution of the European Banking Industry: An Overview. Competitive Strategies in European Banking. In: *Oxford Academic.* Online ed., 3 Oct. 2011, Ch.2
15. Collins J Carlton (1999): How to select the right accounting software. In: *Journal of Accountancy*. New York. Vol. 188, Iss. 4, pp. 67-77
16. Dudovskiy John (2022a): Interpretivism (interpretivist) Research Philosophy. In: *Business Research Methodolgy* from Jan.2022 https://research-methodology.net/research-philosophy/interpretivism/ - retrieved on January 03, 2023
17. Dudovskiy John (2022b): Non-Probability Sampling. In: *Business Research Methodolgy* from Jan.2022

https://research-methodology.net/sampling-in-primary-data-collection/non-probability-sampling/ - retrieved on January 03, 2023

18. England Joanna (2022): FinTech Timeline: The history of Open Banking in Europe. In: *Fintech Magazine* , from 01.09.2022. https://fintechmagazine.com/banking/fintech-timeline-the-history-of-open-banking-in-europe - retrieved on September 30, 2022
19. Feyen E. / Frost J. / Gambacorta L. / Natarajan H. / Saal M. (2021): Fintech and the digital transformation of financial services: implications for market structure and public policy. In: *Bank for international settlements papers*, from July 2021. No 117
20. Ghasemi M. / Shafeiepour V. / Aslani M. / Barvayeh E. (2011): The impact of Information Technology (IT) on modern accounting systems. In: *Procedia - Social and Behavioral Sciences.* Vol. 28, pp. 112-116
21. Gortsos Christos (2021): The Evolution of European (EU) Banking Law under the Influence of (Public) International Banking Law: A Comprehensive Overview. 4th ed., from 31.01.2022. DOI 10.2139/ssrn.3334493
22. Hamad H. A. / Hamza P. A. / Gardi B. / Qader K. S. / Anwar D. G. (2021): The influence of accounting software in minimizing business costs. In: *International journal of Engineering, Business and Management (IJEBM).* Vol.5, Iss.5, pp. 13-22
23. IFRS.ORG (2022): History of IASB. https://www.ifrs.org/about-us/who-we-are/#history – retrieved on October 5, 2022
24. Kassander, A. R. (1949). Centralized v. decentralized accounting organization: How to decide. In: *Journal of Accountancy.* Vol. 88, p. 138
25. Li Guanyue (2014): Researches On The Centralized Accounting Impact On Corporate Financial Audit. In: *Proceedings of the 2014 Conference on Informatisation in Education, Management and Business.* Published by Atlantis Press in September 2014. DOI 10.2991/iemb-14.2014.56
26. Marushchak L. / Pavlykivska O. / Liakhovych G. / Vakun O. / Shveda N. (2021): Accounting Software in Modern Business. In: *Advances in Science, Technology and Engineering Systems Journal.* Vol. 6, No. 1, pp. 862-870
27. Mattingly Tim (2001): How to select accounting software. In: *The CPA Journal,* New York. Vol. 71, Iss. 11, pp. 48-53
28. Mitic Ana (2020): Experience Study: Creating a Central Subledger for Finance Transformation. In: *MSG Global Solutions Magazine*.

https://www.msg-global.com/central-subledger-experience-study - retrieved on October 10, 2022

29. Morey Scott (1999): Software 99. In: *Journal of Property Management,* Chicago. Vol. 64, Iss. 4, pp. 80-92
30. O'Malley Nora (2022): What is Subledger? In: The Balance, from 30.05.2022. https://www.thebalancemoney.com/what-is-a-subledger-5216992 - retrieved on September 30, 2022
31. OECD (2018): *Financial Markets, Insurance and Private Pensions: Digitalisation and Finance.* In: WWW.OECD.ORG. Ch.1, pp.7-35. https://www.oecd.org/finance/financial-markets-insurance-and-pensions-2018.htm - retrieved on October 5, 2022
32. Paul L. R. / Sadath L. (2019): Choosing the Right Accounting Software for Organised Retail Environment. In: *International Conference on Computational Intelligence and Knowledge Economy (ICCIKE)*. Amity University, Dubai, December 2019, pp. 505-510
33. Pidun U. / Stange S. / Roos A. (2015): To centralize or not to centralize? In: *BCG Perspectives*, from 07.12.2015. https://www.bcg.com/publications/2015/centralize-or-not-to-centralize - retrieved on October 5, 2022
34. Prichici Cristina / Ionescu Bogdan S. (2015): Cloud Accounting – A New Paradigm Of Accounting Policies. In: *SEA - Practical Application of Science.* Romanian Foundation for Business Intelligence, Vol.III, Iss. 7, pp. 489-496
35. Putnis J. / Goldstein B. / Kasal D. (2022): The Banking Regulation Review: European Union. In: *The Law Reviews online journal*, from 11.05.2022. https://thelawreviews.co.uk/title/the-banking-regulation-review/european-union - retrieved on September 30, 2022
36. Quaglia Lucia (2014): The European Union and Global Financial Regulation. In: *Oxford Academic*, online edn, 21 Aug. 2014, Ch.3
37. Rauscher Manuel (2020): SAP S/4HANA for Financial Products Subledger (FPSL): Features & Functionality. In: *ADWEKO Blog*, from 07.04.2020. https://www.adweko.com/sap-s-4hana-for-financial-products-subledger-fpsl-features-functionality/?lang=en - retrieved on November 21, 2022
38. Riahi-Belkaoui Ahmed (2001): *Advanced management accounting*. 1st ed., Greenwood Publishing Group, Quorum Books, Westport, Connecticut
39. SAP (2022): Financial Product SubLedger. Official software website.

https://help.sap.com/docs/S4HANA_FIN_PROD_SUBLEDGER?locale=en-US - retrieved on November 30, 2022

40. The Economist (2022): The slumps that shaped modern finance. Essay. https://www.economist.com/news/essays/21600451-finance-not-merely-prone-crises-it-shaped-them-five-historical-crises-show-how-aspects-today-s-fina - retrieved on September 30, 2022
41. Walters Kluwer (2022): OneSumX Software website. https://www.wolterskluwer.com/en/solutions/onesumx-for-finance-risk-and-regulatory-reporting/onesumx-advanced-ledger-accounting?compositeLink=%7B6C699229-A877-4BA4-A572-64715D161036%7D – retrieved on December 2, 2022
42. Wenfeng Li (2022). The Design for Distributed Ledger Based on Main-Sub Ledger Architecture. In: *Saudi Journal of Engineering and Technology.* Vol. 7(3), pp. 151-155.
43. Werner Sarah (2019a): Why IFRS 17 is giving subledgers the chance to (finally) shine. In: *The Ledger - Digital CFO Magazine.* Aptitude Software Limited Journal, from 15.01.2019. https://www.aptitudesoftware.com/blog/why-ifrs-17-is-giving-subledgers-the-chance-to-shine/ - retrieved on October 10, 2022
44. Werner Sarah (2019b): 5 Benefits of using a subledger for LDTI. In: *The Ledger - Digital CFO Magazine.* Aptitude Software Limited, from 14.03.2019. https://www.aptitudesoftware.com/blog/5-benefits-of-using-a-subledger-for-ldti/ - retrieved on October 10, 2022
45. Werner Sarah (2019c): Is your General Ledger under too muchpressure? In: *The Ledger - Digital CFO Magazine.* Aptitude Software Limited, from 19.06.2019. https://www.aptitudesoftware.com/blog/is-your-general-ledger-under-too-much-pressure/ - retrieved on October 10, 2022
46. Wickramsainghe D.M.J. / Pemarathna R.M.M.D. / Cooray N.H.K. / Dissanayake T.D.S.H. (2017): Impact of Accounting Software for Business Performance. In: *Imperial Journal of Interdisciplinary Research (IJIR)..* Vol.3, Iss.5, pp.1-6

List of Figures/Charts/Diagrams

List of Tables

List of Appendixes

Appendixes

Appendix 1. Structured interviews

Interview 1. Date 15.11.2022

Question Number	Question	Answer
1	What is your position at the current employer?	Senior Finance Consultant (freelance). My employer is a Top 10 German Banks by total assets with HO in Munich and representations in UK, Italy, France, US and China.
2	When did you come across the topic of accounting subledger for financial products?	As a freelance consultant I have been participating in several implementations of accounting subledgers during the last 20 years of my professional experience. In the beginning of my career the subledger for financial products was a necessary mean to cover expanding business and regulatory requirements. The solution was built in core banking systems based on open business demand. In time vendors like SAP created a centralized software solution like Bank Analyzer, which was supposed to combine subledger features from different core banking modules and allow reporting from one central place.
3	What was the as-is situation before the start of centralized subledger implementation in your company?	The project started in 2020. At that time the IT infrastructure of the bank was very complex and heterogeneous, there were multiple core banking systems managing different types of banking products, e.g. one for loans, one for securities, one for derivatives etc. Each of these core banking systems had features of a subledger, which were relevant for particular product type. Each of the systems were self-developed by the bank, therefore, fully customized for the needs of the company, but also bearing all maintenance costs and risks coming with it. In addition,

		there was several general ledgers in different representations and in head-office, data from which was combined in a common data warehouse. Reporting was built both from numerous core banking systems as well as general ledgers in order to satisfy the audit and regulatory requirements in all details. The average age of the core banking systems was around 15 years, all were developed based on older technologies and had limitations for further changes.
4	What is the current project status for implementation of centralized subledger?	The Go-decision for the project was made in the beginning of 2020. The project plans for a “big bang” group-wide implementation in 2023 including Head-Office and representations in other countries. The program contains implementation of a centralized subledger, a central general ledger and a new finance data warehouse for reporting. At the moment, the project is going according to plan. Pre-study and analysis is completed, subledger customizations are 75% done, general ledger upgrade is planned for March 2023, finance data warehouse will keep us busy until October 2023 with a final go-live at 31.12.2023.
5	What were your main considerations when deciding upon an implementation of a subledger for financial products?	The idea of building up a central accounting platform in the group was coming out of several important aspects. From internal factors, the key decision driver was complexity of existing IT architecture, its age and limitations for future business expansions. The bank required multiple changes in the existing systems and planned for further business growth, which current architecture would not be able to easily provide. The second internal factor was connected to costs of maintenance, which the de-centralized chain of core banking systems with subledgers brought every year. Moreover, any further development in them required very costly workarounds. We desperately needed optimizations and simplifications both on business and IT side. All-in-all, the investment in the new platform in the long term was cheaper. Other internal aspects were also connected to missing internal and external IT resources to maintain those old systems. It was time for modernization. External factors combine advice from multiple

		international consulting firms and software vendors to try the new solutions on the market and follow the trend in DACH region. Numerous sources informed us about successful implementations around the globe with SAP as main partner. The business case calculation for the project was positive and we went for it.
6	Which solution(s) have you decided to choose and why?	We are implementing SAP Hana General ledger, Financial Product Subledger (FPSL) and Financial Services Data Management (FSDM). The choice was actually easy for us as SAP was our partner for a long time, we were happy with the collaboration with them and all the consultants told us that SAP FPSL is the best solution on the market in DACH region. We did not consider alternative vendors, but only compared the case with self-development costs. We decided to go for private cloud platform deal.
7	Which features are you using/planning to use in a subledger and for which financial products?	We will implement FPSL for entire scope of our products, meaning all investment banking products and saving products on our portfolio including the foreign exchange and real estate business. We are planning to use the subledger to centralize accounting posting logic on deal-level for those products and provide aggregated data to the general ledger and data warehouse. The calculations of cash flows, effective interest rates, fair values and modifications will be provided to FPSL from core banking systems. But we would like to implement calculation of impairments in the solution. Reporting will be done from FPDM, not from subledger.
8	What are the challenges so far in the implementation of a subledger for financial products that you faced?	What we found out during the pre-study of FPSL is that it is a very standardized solution. This is good and bad at the same time. This means that on one-hand the solution standardizes internal business processes for banking products, triggering massive optimizations in the company. On the other hand, the standardization comes with the price that customized customer products will not fit into those boundaries and would require self-development in

		addition to regular implementation. In addition, we have found out that the biggest burden is the integration part of the solution, since it requires data to be delivered in a very structured precise way and not flexible and adoptable to the old fashioned core banking systems that we have in IT landscape. Adjusting those interfaces to work as FPSL would need it takes a lot of time and effort, much more than we initially expected.

Interview 2. Date 31.03.2022

Question Number	Question	Answer
1	What is your position at the current employer?	IT Lead Finance and Procurement. My employer is a market leader in Netherlands, Belgium and Luxembourg, a global universal bank with HO in Netherlands and representations in France, Germany, Italy, Spain, Australia, Poland, Romania, Turkey and Asia.
2	When did you come across the topic of accounting subledger for financial products?	Our bank is a global enterprise for almost a century, thus volumes of data created and processed per day was always significant. Thus, the core banking systems in our IT landscape has been implemented to manage that volumes and have capacity for business expansion. Therefore, accounting subledger was always on our radar and a part of core banking system enabling a correct and on-time reporting. Five years ago our bank faced the pain point that further expansion of the old legacy systems according to new regulatory requirements is not possible due to technical reasons. We started looking for alternatives in the market and considering options of vendor solutions and self-development. This is about the time we have

		come across an idea of centralized subledger solution, which would take over the complexity of posting logic from core banking systems to a separate software in responsibility of accounting
3	What was the as-is situation before the start of centralized subledger implementation in your company?	We are a truly global organization with multiple subsidiaries in different countries and participations. Each of the companies in the group was enjoying the feeling of freedom to decide, which software solutions they would like to have as long as the reporting to head-office was on time and correct. Thus, at the as-is state before the decision we had a diverse and very complex IT architecture in the group with multiple general ledgers, subledgers, data warehouses and calculation engines. With the shift of customer need for FinTech companies, we saw the market opportunity to be the follower in the new digital banking market. Our bank decided that the only way to be competitive with FinTechs in terms of speed, creativity and cost is transformation of our IT architecture, full upgrade of the systems and streamlining of business processes. Multiple programs have been launched to achieve this goal, one of them was implementation of a centralized subledger for financial products, which could be flexible aenoug to satisfy the accounting and regulatory requirements of all companies in the group world-wide.
4	What is the current project status for implementation of centralized subledger?	We have started the subledger implementation 3 years. By now we went live in three countries including Head-Office. In next years we are planning to implement the solution in all countries and expand the functionality to all products in our portfolio.
5	What were your main considerations when deciding upon an implementation of a subledger for financial products?	It was a strategic initiative, meaning the decision was aiming to follow the roadmap to gain strategic market advantage and keep up with FinTechs, gain more customer base and expand the business. For this we needed significant business and structural changes, we needed standardization and centralization of support functions (like Accounting) on Head-office level. Our idea was to relief the burden of operational functions from subsidiaries allowing them to

		focus on customers. And of course, we urgently needed an upgrade of technology in our legacy core banking systems, which could not provide the services for future customers. Last but not least, it was important for us to find a long-term trustworthy vendor/partner, who would be able to develop, implement and grow the solution together with us. We needed a partner and a solution, which was flexible and could accommodate the needs of accounting experts in all countries and companies of the group. And, of course, a positive business case providing significant cost reduction due to centralization comparing to numerous separate systems in all units has made a final statement in this decision.
6	Which solution(s) have you decided to choose and why?	We have chosen Aptitude Accounting Hub solution for a centralized subledger. The General ledgers stay separate in each country on SAP technology since we were happy with it. Accounting Hub bought us with its flexibility. This solution can be customized to any need of our units and countries, supports multi-ledger, multicurrency and multi-language. Aptitude Accounting Hub was built for big investment banks and had a good reputation on the market. In addition, the solution had an out-of-the-box interface to SAP General ledger, reducing costs and time for integration. Other solutions on the market at that time had a lot of limitations, and were lacking the features we needed. We are happy with that decision up to now. The solution was initially bought for on premise use, but now fully migrated into SaaS and managed by the vendor.
7	Which features are you using/planning to use in a subledger and for which financial products?	We are using actively the posting rule engine and all event streaming functionalities. This year we also expanded the package to use Aptitude calculate solution, which allows us also to centralize calculations of effective interest rate, fair value adjustments and impairments. So far

		we covered mostly the loan products, including retail and corporate deals, current and saving accounts. In the next year we would also like to implement treasury products in the subledger.
8	What are the challenges so far in the implementation of a subledger for financial products that you faced?	Most the implementation challenges were connected to the need for internal structural changes, optimization of business processes across the group and training of personnel to the new reality. From technical perspective, we spent a lot of resources for integration. Solution is flexible, but still has its own data model, which requires specific delivery of data and specific formats. Not all our old legacy systems were easily up to that challenge.

Interview 3. Date 03.05.2022

Question Number	Question	Answer
1	What is your position at the current employer?	Head of Finance Change & Strategy in Singapore branch at a global banking group operating in 59 countries of the world including US, South America, Western Europe, Africa, Middle East, Australia and Asia with head-office in New York.
2	When did you come across the topic of accounting subledger for financial products?	Since the beginning of my career I was working in banking. The topic of subledger for financial products was always on the minds of management for as long as I remember. All my previous places of occupation had some kind of accounting subledgers implemented due to regulatory need. In most cases, subledger was a part of core banking system. At my current employer there was a central subledger per each country/market, where the bank was operating. In our case it was a self-developed solution.

3	What was the as-is situation before the start of centralized subledger implementation in your company?	Since I am employed in a subsidiary of a large world-wide bank, the key strategic decisions were made usually locally for each market. But there was an understanding on the management level that the bank is too big to keep up with new market players and have to make changes in order to keep up. The IT architecture of our branch at that time was consisting of multiple product core banking systems, a self-developed subledger and an old SAP general ledger. The subledger for financial products was maintained by internal resources and each change was taking a lot of time and money, every year the costs were increasing drastically. Two years ago SAP approached the office in Germany with an offer to be a pilot and a co-partner for implementation of their new solution called Financial Product Subledger. The Germany office proposed to implement the pilot in Singapore in order to check the most complex banking products first, before deciding for a roll-out globally.
4	What is the current project status for implementation of centralized subledger?	Currently we went live with our investment banking portfolio of products in Singapore. Entire scope and obligo of treasury and security products are migrated into FPSL and new SAP Hana. Since the project was a success and a Pilot state is over, we are planning the roll-out to all of our banking portfolio in Asia including loans and current accounts as well as further implementations of the solution in other countries of the group. The implementations in other countries will be based on our findings and lessons learned, but be done locally.
5	What were your main considerations when deciding upon an implementation of a subledger for financial products?	The decision was made on the group level. SAP was a long-term partner of our bank. The initiative came from the vendor. This opportunity allowed us to shape the solution in a way that it fits our portfolio and also economize on the vendor fees during the partnership. In addition o that, we were able to get rid of old self-developed software with significant maintenance costs

		and move to new technology stack. We have chosen the solution in the Private Cloud, which is serviced by the vendor, thus also transferring IT security risks to a professional team.
6	Which solution(s) have you decided to choose and why?	As mentioned, we went for SAP without much of consideration. The initiative came from the vendor directly, thus for the decision we only considered the new solution against the as-is situation. Partner relationship really played a big role here. SAP is global provider that can satisfy the needs of our subsidiaries in all of the countries, where we operate.
7	Which features are you using/planning to use in a subledger and for which financial products?	We are currently using the accounting rule engine for investment products, treasury and securities. For some core banking systems we implemented the direct load of final postings into FPSL. We are not using any kind of calculations, they are delivered and posted directly into the system. In the future, we plan also to use posting engine for loans and simple accounts.
8	What are the challenges so far in the implementation of a subledger for financial products that you faced?	We were not able so far to cover all complex products and all events in the solution so far. The software is very standardized and cannot be adjusted for much customized banking products. We do not have a lot of those products, thus we had to create workarounds and load the postings until the features are available. Multi-currency accounting is also been a challenge. The software provides the functionality to revaluate foreign currency, but to the extent we have seen it in the general ledger. We have found a solution with the vendor, but it took some time.

Interview 4. Date 23.03.2022

Question Number	Question	Answer

1	What is your position at the current employer?	Head of Finance Transformation at one of the largest financial services groups in Ireland
2	When did you come across the topic of accounting subledger for financial products?	Around 5 years ago we have started thinking about financial transformation. Markets trends were supporting new customer experiences and digitalization and we decided not to wait until we lose our market share. At that time there were already several solutions on the market proving subledger for financial products and we decided to look into them.
3	What was the as-is situation before the start of centralized subledger implementation in your company?	Out IT architecture was and is very complex, we had several separate subledgers for core banking systems, which could not provide those functionalities. We also had several systems, which had integrated subledgers. And we had multiple general ledgers, data from which was then consolidated in a reporting tool. The systems were divided basically in the same way as our organization structure. Each organization unit could choose and decide the solution they want to use to perform daily tasks, this created our IT landscape. When IFRS 9 came into play neither our organizational structure nor IT architecture was prepared for the changes required. We started thinking about the initiative that would allow us to reduced running costs and be prepared for any upcoming regulatory requirements and fit into new organizational structures. This was in the beginning of 2018.
4	What is the current project status for implementation of centralized subledger?	We went live with the subledger for financial products in 2020. Currently we continue working on the solution and considering to migrate the system from on-premise to cloud to optimize the costs even more. At the moment we have covered most of head-office portfolio in the solution and planning roll-outs in several participations. We still have some separate core banking systems with integrated subledger functionalities due to convenience and simplification

		reasons. They are not planned to be migrated to a central subledger, but rather provide the final posting to the solution for consolidation purposes.
5	What were your main considerations when deciding upon an implementation of a subledger for financial products?	Our main criteria was flexibility. We needed a system that would be able to combine the features of all those divided subledgers in core banking systems and process millions of data records every day. We needed a solution that would be easily adjustable and can be taken over by internal resources, reducing external cash out in the long-run. We were looking for the system with big integration capacities. It was important for us that the subledger is able to take over any data gap or feature, which the core banking system cannot provide.
6	Which solution(s) have you decided to choose and why?	We have chosen Aptitude Accounting Hub. This was the only solution on the market, which would give us that flexibility we wanted and still help us streamline operations. Ongoing support of the vendor and regular upgrades of the system allows us to be up-to-date with the technology, market requirements and regulations.
7	Which features are you using/planning to use in a subledger and for which financial products?	We are using both the accounting posting rule engine as well as direct posting loads in the software. The solution is implemented for retail and corporate loans, guarantees and treasury products. Security business stays in a separate subledger. All calculations are done outside of the solution and values delivered and loaded. We also use the integrated module of data transformation area in the software to fill the blanks and gaps of the feeder system not capable to deliver required information.
8	What are the challenges so far in the implementation of a subledger for financial products that you faced?	Biggest challenge was integration. The system is flexible and provides the option to fill in missing data, but “teaching” the feeder core banking systems to deliver in the right time and format was a long and bumpy road.

Interview 5. Date 11.05.2022

Question Number	Question	Answer
1	What is your position at the current employer?	Solution Architect for Finance & External Reporting at one of the largest cooperative banks in Netherlands with subsidiaries in 42 countries including Germany, USA, Brazil and Australia.
2	When did you come across the topic of accounting subledger for financial products?	Our bank has been a first comer in digitalization from early 2000s. We have recognized the need for transformation and new customer experiences and decided to make it happen. First online banking, then mobile banking and all customer facing services were going digital. The support functions and accounting had to follow that trend. We had accounting subledgers integrated in our IT landscape for decades. Most of them were distributed within core banking systems as well as some specially developed solutions. But with the new strategy of the bank to become one bank, the accounting had to become one too and follow the lead to have one single source of truth for finance data, which meant centralization for us.
3	What was the as-is situation before the start of centralized subledger implementation in your company?	We were living in silos. Risk and Finance departments had their own solutions, own data and own reporting. This meant a very distributed IT landscape with numerous subledgers, general ledger, risk calculations and even data warehouses. With the new bank strategy and new program to meet our customer expectations, we wanted to build one voice – one source for finance and risk data, streamline our business processes and simplify the IT architecture. So we started the initiative to create one source of truth for finance data, meaning central subledger

		for financial products, centralized finance and risk data warehouse and centralized general ledger. The program has launched in 2018.
4	What is the current project status for implementation of centralized subledger?	We went live with a centralized subledger and general ledger. Currently we are working on implementation of a central finance and risk data warehouse, which would provide the reporting based on that single source of truth. The subledger is already covering entire head-office portfolio. We are planning the roll-out to subsidiaries in phases in next years..
5	What were your main considerations when deciding upon an implementation of a subledger for financial products?	Multiple factors influenced our decision. We were looking for a platform, which would incorporate all the modules we would require, including the subledger, general ledger and data warehouse. The trustworthy vendor/partner and availability of consulting resources was also important, since we were planning a long-term project and wanted to build long-term relationship with a partner, who would support us every steps of the way. New technology, availability of regular upgrades and changes was also important, that we would keep up with customer demands and be able to provide the quality service over the years to come. And we wanted a seamless integration, we wanted a solution that work together and does not require too much adjustments or maintenance. Last but not least, in the digital age we needed to be sure that we choose a secure solution following all European Standards.
6	Which solution(s) have you decided to choose and why?	We have decided to go for SAP Hana, namely their new product FPSL (Financial Product Sublegder), FSDM (Financial Sevices Data Platform) and a general ledger on the latest Hana database. SAP at that time was the only provider, which would be able to have all the needed solutions on one platform and satisfy all our requirements.
7	Which features are you using/planning to use in a	We are actually using almost entire FPSL feature stack, namely the posting engine, delivery of pre-calculated postings, calculation of effective interest rate, impairments, cash flow projections

	subledger and for which financial products?	etc. We are also glad to use seamless integration to general ledger and out-of-the-box transformation capabilities. As a cooperative bank, our portfolio is mostly comprised with simple loan products for customers in agriculture sector. All of the bank's products we could cover in the solution.
8	What are the challenges so far in the implementation of a subledger for financial products that you faced?	The biggest challenge for us was not the implementation itself, but a complete redefinition and transformation of business processes in the organization, which comes with the solution. Breaking up internal silos and defining new responsibilities and data flows was by far the biggest challenge, which we have mastered successfully.

Interview 6. Date 01.12.2022

Question Number	Question	Answer
1	What is your position at the current employer?	Head of Accounting at one of the Top 3 universal banks in Austria with subsidiaries in CEE & SEE.
2	When did you come across the topic of accounting subledger for financial products?	The functionality of accounting subledger for financial products was there was decades. In our case it was implemented as features in different product systems, including posting logic and providing data to a general ledger. In time more demands and requirements came to those separated subledgers and legacy systems were not able to satisfy those demands. This is where we thought about a separate software solution for financial instruments.

3	What was the as-is situation before the start of centralized subledger implementation in your company?	As said, we had bits and pieces of a subledger for financial products in different systems, a lot of manual workarounds, excel spreadsheat etc, but with IFRS 9 and BCBS 239 it became clear we need a long-term solution. For the start we need a place to store the data from all those distributed subledgers in one place. This was our idea of a subledger. At the same time, we were in the middle of a big migration project to move to SAP Hana General ledger, and we decided to try the new SAP solution on the market, be a pilot in Austria. This was in 2018.
4	What is the current project status for implementation of centralized subledger?	We went live with the subledger for financial products and migrated to new SAP Hana platform in 2020. After a period of stabilization, we are now trying to implement additional features of the solution and expand the portfolio coverage. At the moment we have only retail loans included in the software and we are building the plan to add treasury products by 2024.
5	What were your main considerations when deciding upon an implementation of a subledger for financial products?	Our key requirement to the subledger was a sophisticated business data model and database prepared for all of banking products and volumes. And we considered only modular solutions that we can add features step-by-step, roll-out to other products and units in time rather than requiring a “big boom”. Partnership with a big trustworthy vendor was also very important as we wanted to built long-term relationships and solutions fit for the future.
6	Which solution(s) have you decided to choose and why?	We have chosen Financial Product Subledger (FPSL) from SAP because it came with that structured data model, the solution features were growing and we could use it seamlessly with our new SAP Hana General Ledger. It was an MVP for us, which finished as a success.
7	Which features are you using/planning to use in a subledger and for which financial products?	At the moment we use the subledger as a central data storage for loans. We are currently working on implementing a posting rule engine to relief the core banking systems from posting logic complexity. In the next step we want to introduce securities and treasury products and onboard units in the solution.

8	What are the challenges so far in the implementation of a subledger for financial products that you faced?	Integration to old legacy core banking system was a lot of work as well as finding good implementation partners. We did not have internal resources for the project, so a lot of time we needed two or more partners to implement different features of the solution.

Interview 7. Date 18.03.2022

Question Number	Question	Answer
1	What is your position at the current employer?	Senior IT Architect at one of the Top 3 universal banks in Austria with subsidiaries in CE & WE.
2	When did you come across the topic of accounting subledger for financial products?	The subledger for financial products is relatively new term. I have heard it first maybe 15 years ago, when first solutions were starting to appear on the market. In our bank there was no central subledger. The features were implemented in different systems. Each department was choosing for themselves how to satisfy the reporting demand and it was working for some time until new accounting standards, market conditions and regulatory pressure came into play.
3	What was the as-is situation before the start of centralized subledger implementation in your company?	We had a central general ledger for 3-4 years, but core banking systems were producing accounting information separately. Some had integrated features, some has workarounds implemented. Since any new change required us more and more time, in 2021 we decided to look for optimization potential and speed up the process of monthly reporting routine. The management decided to go for a strategic project to centralize the subledger functions in one place and release the pressure on customer facing units.

4	What is the current project status for implementation of centralized subledger?	We are in the middle of implementation. So far the project is on track and we are planning go live of a centralized solution in 2023. After initial go-live a backlog and further ideas will be developed.
5	What were your main considerations when deciding upon an implementation of a subledger for financial products?	We were looking for something flexible, highly customizable since the products we propose to clients are very customer oriented and individual. These products often do not fit to generic boundaries of software solutions. Also it was important to have a solution that we could in the long-term maintain in-house and reduce the yearly cash-out.
6	Which solution(s) have you decided to choose and why?	We decided to develop the central subledger on our own. There were resources assigned to develop the solution to fit the bank's specifics, be maintained in-house and fit to our self-developed general ledger. Since we were not satisfied with customizing capabilities of solutions on the market and had already a lot of experiences with "home-made" products, the choice was obvious for us.
7	Which features are you using/planning to use in a subledger and for which financial products?	We want the subledger to be able to ingrate to any system in our IT landscape. We want the system to adapt to receiving the postings from the core banking systems that can do it, and also be able to create postings for those who cannot. We want the system to able to calculate effective interest rates, cash flow plans, fees distributions etc. Basically take over the gaps, which other systems cannot provide. And the subledger is supposed to be a central place, where the banking product data is stored and reported from.
8	What are the challenges so far in the implementation of a	The biggest challenge is the complexity of our product portfolio and the number of customizations and exceptions that we had to build in the subledger to fit all those products.

	subledger for financial products that you faced?	

Interview 8. Date 20.12.2022

Question Number	Question	Answer
1	What is your position at the current employer?	Product Owner for Subledger and General Ledger at one of the Top 3 universal banks in Austria with subsidiaries in CEE.
2	When did you come across the topic of accounting subledger for financial products?	We were considering the subledger for banking products a part of core banking. For decades the core banking systems were expanded and upgraded with new features including subledger functionalities resulting in increased complexity in IT architecture. In time the complexity grew to the extent that systems reached their technical limitations and we had to look for new solutions, seek advice on the market. We have run several proof of concepts of vendor solutions, pre-study of self-developed option, but all-in-all strategic decision was to go for centralization of subledger functions.
3	What was the as-is situation before the start of centralized subledger implementation in your company?	The IT landscape was diverse. Some of the product systems had subledger functions integrated, some had to build separate module to satisfy reporting requirements. In 2020 we went live with one central general ledger in head-office and new subsidiaries were onboarded into it. We saw how much value centralization of accounting function can bring and a new program has launched to streamline business processes, built central subledger, general ledger

		and finance single source of truth in order to propose those advancements and services to subsidiaries in the countries. The first pre-studies and proof of concepts started in 2021.
4	What is the current project status for implementation of centralized subledger?	Pre-studies and concepts are finished. Partner selection and software has been chosen. The decision to start implementation of MVP in pending till January 2023 with potential go-live of MVP until end of year. After MVP the program is planned with phase roll-out to other units, counties and products until the end of 2027. The investment into centralized subledger is significant, therefore, a positive business case with expected cost optimization in long-term was important to be developed.
5	What were your main considerations when deciding upon an implementation of a subledger for financial products?	Considering the costs and long-term impact involved multitude of aspects and factors have been taken in consideration. We actually checked each potential scenario on the range of functional, technical, operational factors, integration, security, and strategy and contract terms. The factors then have been weighted based on the agreement for importance of each category for business and for IT and solutions have been assessed respectively. The key criteria for us was functional coverage to be able to meet the requirements of entire portfolio, future-proof technology, ongoing vendor support, scalability and modularity for phased implementation, high security standard and performance dealing with big data volumes.
6	Which solution(s) have you decided to choose and why?	For general ledger we decided to keep our SAP Hana General Ledger. For a subledger we have chosen to go for Aptitude Accounting Hub. Accounting Hub has bought us with its flexibility to adapt to any banking product, future-proof technology (we will go for SaaS) and user friendliness. The partnership with Aptitude was going very well and we are looking forward for long-term cooperation with them.

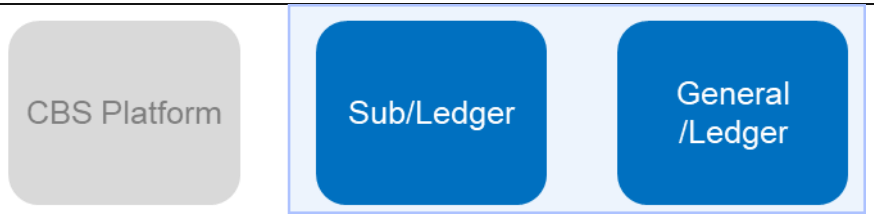
7	Which features are you using/planning to use in a subledger and for which financial products?	We are planning to use the software to almost complete extent. We will implement entire banking portfolio in the solution. The integration layer will be built directly in the software. Rule engine and creation of postings will be main functional blocks. In addition, we are planning to use Aptitude Calculate module to be able to calculate effective interest rate, fee distributions, modifications etc. And, of course, the interface to general ledger and external reporting tools.
8	What are the challenges so far in the implementation of a subledger for financial products that you faced?	We have not started the implementation yet. But we can see big challenges in business process changes, interfaces and integration to existing systems. This change will bring organizational changes and different responsibilities, which would be hard to tackle in a big bank like ours.

Appendix 2. Unstructured interviews. Expert opinions

Interview 9. Date 15.03.2022

Question Number	Question	Answer
1	What is your position at the current employer?	Enterprise Solution Architect at one of the Top 3 universal banks in Austria
2	What are the main functions of subledger for financial products?	On high level the subledger for financial products should be able to create accounting records in due time to fit reporting requirements, in best case in real time. The booking engine should be multi-company, multi-language, multi-ledger and flexible to scale up to all banking products

		and regulatory requirements. Recently, the calculation functions are also becoming important as more technical limitations appear in core banking systems.
3	How would you define the alternatives to central subledger?	In my experience in banking practise there are 3 options of alternative design patterns for bank finance architecture: 1. Traditional Integrated Corebanking architecture, when subledger and general ledger are strandard CBS capabilities.  2. Core accounting solution combined with product subledger, where there is a centralized general ledger and distributed subledger functions.  3. Standardized, integrated finance architecture with centralized subledger and general ledger

		 Each of the options have their advantages and disadvantages and shall be decided for strategic, business and architectural maturity reasons.
4	From your experience what are the options for implementation of centralized subledger?	From the market analysis we have been performing there are only 3 classic options dealing with centralized subledger: a. Buy, namely implement a vendor solution available on the market. This solution would require acceptance of standard features and limitations of vendor solution. b. Frame/Customize – which would mean to buy a platform or a highly customizable software (e.g. PaaS) and built any features and tools required c. Build, meaning develop the software from scratch with internal resources All of the options above exist in market practise in banking, each organization decides which one of the options fits their strategy and scope better.
5	What would be the key criteria from your perspective to choose a central subledger for financial products?	As an IT expert I cannot judge the business functionality, but would rather highlight the technology stack and system capabilities. The most important criteria for any new software in the era of digitalization are security, scalability and modularity, real-time capability, event-driven architecture, API, cloud integration and continuous improvements. There are much more factors from IT perspective, but these are the key for future-proof solutions. In my experience the IT criteria was contributing to around 30% weighting of subledger decision results.

Interview 10. Date 23.04.2022

Question Number	Question	Answer
1	What is your position at the current employer?	Procurement Expert & Contract Manager at one of the Top 3 universal banks in Austria
2	What contractual and commercial terms were important in your experience in the choosing of subledger partner?	The most important contractual points from my experience with implementation of a subledger for financial products were availability of cloud integration (e.g. via separate agreement) and a flexible pricing model allowing to see different options for licencing costs and maintenance costs over next 5-7 years. When working with vendors for subledger licence costs might have different baseline and might frow as business grows. This is already a standard practice. But the implementation costs require flexibility and negotiation. The banks expects presentation of different alternatives and conditions for fixed price and time-and-material options. Moreover, big topic in subledger implementation is reusability of the solution for future pahses and units, thus a sophisticated cost calculation is very important and requested from all vendors and partners. What was new in the process for subledger implementation is a check of references, the opportunity to talk to real clients of the vendor, be able to check the reality of marketing slides. The conditions for each installation scenario and pricing options can be different too.
3	How would you see the importance of procurement terms in the final decision of subledger implementation?	In my experience, the contractual terms, vendor relations and flexibility of commercials come up to 30% of final software weighting score. For subledger implementation, additional 5 % were granted for checked references of the software provider.

Appendix 3. Market analysis of subledger for financial products from Big4 consultancy companies

Presentation 1. Date 15.05.2022

SAP Dominates the Market, Difficult to Compete Against

Criteria	Leader	Challenger	Small Banks Solutions
Vendor / Solution	▪ SAP FPSL (Finanz)	▪ Wolters Kluwers OneSumX ▪ Oracle IFRS9 Solution	▪ Fernbach FlexFinance ▪ msgGillardon THINK ▪ Zeb/ Control
Experience@DACH	▪ SAP Bank Analyzer discarded ▪ SAP TRM evaluations (loans, securities), discarded	▪ Software in the end of the life cycle	▪ Fernbach FlexFinance → known performance issues ▪ Zeb/ hedge/manager - complex and pricy
PRO	+ Network externalities eg. availability of broad ecosystem	+ Functional coverage + Solidity of the vendor	+ Valid alternative for small banks
CON	– SAP is expensive – Different experiences with SAP consulting	– Assembled solution, weak integration of components – No reference implementations – Availability of localizations – Lack of experienced consultants / implementation partners	– Availability of consultants – Feasibility for complex institutions not proven

Uncommon Alternatives

SAP TRM

☐ **SAP Sub/Leder offering non-financial sectors**

- Standard ERP module
- Widespread usage among manufacturers

☐ **Why is it a potential alternative?**

- Mature, capable solution
- SAP projects in manufacturing are much cheaper compared to those of financial sector

☐ **Feasibility**

- Was analysed by different market players - no show stoppers identified (loans, securities)
- Feasibility for retail / mass processing to be analyzed
- Broad consultant base available

Aptitude AccountingHub

☐ **Offering used by FI acting on capital markets**

- Goes back to the microgen aptitude BPM tool and rule engine
- Known to be used by FI acting on captial markets in UK, seem to have expanded with IFRS17 into the insurance market

☐ **Why is it a potential alternative?**

- Technological approach workflow tool/rule engine is unique and from architecture point of view interesting

☐ **Feasibility**

- To be analyzed