

UNIVERSIDADE ABERTA

INSTITUTO SUPERIOR TÉCNICO



Adoption of ISO 20022 for Payments

João Carlos Setúbal Constantino

Master's Degree in Information and Enterprise Systems
(master's degree in association)

October 2022

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October 2022

Acknowledgements

I would like to express my deepest appreciation to those, who directly or indirectly, some even without knowing it, helped me to overcome all the difficulties and challenges in the past few years. Without you, this work would not have been possible.

Resumo

O cenário dos sistemas de pagamentos mudou significativamente na última década, e mais mudanças estão no horizonte para os próximos anos. A adoção global da norma ISO 20022 é uma iniciativa de grande alcance e impacto. Tanto as instituições financeiras como os seus clientes *corporate* são encorajados a proativamente se adaptarem a um cenário em constante mudança e evolução, e assim colher os benefícios de uma adoção oportuna, eficaz e sustentável.

Apesar do impacto dessa iniciativa, além das instruções técnicas, faltam modelos de referência que possam auxiliar no processo de adoção efetiva da norma ISO 20022 para a realização de pagamentos. Para resolver este problema, propõe-se um modelo de adoção, composto por um conjunto de diretrizes, boas práticas, *templates* para recolha e mapeamento de requisitos, e um conjunto de objetos técnicos que permitem flexibilidade e a transformação dos dados no seu formato final. Este modelo é aplicado num contexto real, numa organização que pretende adotar a norma ISO 20022.

O desenvolvimento de tal modelo, dota os adotantes, não apenas ferramentas para aderir com sucesso à norma ISO 20022, mas também a possibilidade de criação de uma fábrica de pagamentos eficiente e sustentável.

Palavras chave: ISO 20022 ; modelo de adoção ; fábrica de pagamentos ; iniciação de pagamentos

Abstract

The payments landscape has significantly changed in the past decade and more changes are on the horizon for the coming years. The global adoption of ISO 20022 is a far-reaching and impacting initiative. Both financial institutions and their corporate customers are prompted to proactively adapt to the ever-changing and ever-evolving payments landscape and reap the benefits of an effective, timely, and sustainable adoption.

Despite the impact of this initiative, apart from technical instructions, there is a lack of reference models or bodies of research that can assist in the process of effectively adopting ISO 20022 for payments. To solve this problem, an adoption model is proposed, composed of a set of guidelines, best practices and templates to collect and map requirements, and technical objects that enable flexibility and the transformation of data into its final output. This adoption model is applied in a real-life context, in an organization in the process of adoption of ISO 20022.

The development of such a model, endows the adopters, not only with the tools to successfully adhere to ISO 20022, but also with setting up an efficient and sustainable payment factory.

Keywords: ISO 20022 ; adoption model ; payment factory ; payment initiation

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Glossary of Abbreviations and Acronyms

ATM	Automated Teller Machine
BBAN	Basic Bank Account Number
BSS	Business Supporting Systems
CGI	Common Global Implementation
CHIPS	Clearing House Interbank Payments System
DSR(M)	Design Science Research (Methodology)
EC	European Commission
ECB	European Central Bank
EFT	Electronic Funds Transfer
EPC	European Payments Council
ERP	Enterprise Resource Planning
GPI	Global Payments Innovation
IBAN	International Bank Account Number
ISO	International Standards Organization
KYC	Know Your Customer
POP	Purpose of Payment
SEPA	Single Euro Payments Area
SLR	Systematic Literature Review
SWIFT	Society for Worldwide Interbank Financial Telecommunications
TMS	Treasury Management System
XML	Extensible Markup Language
XSD	XML (Extensible Markup Language) Schema Definition
XSLT	Extensible Stylesheet Language Transformations

1 Introduction

ISO 20022 is an emerging global and open standard for payment messaging. It creates a common language and model for payment data across the globe¹.

It is a global standard comprised of a repository of messages and rules for the exchange of electronic instructions between financial institutions (and intermediaries) and between corporates and financial institutions. It was first introduced in 2004 to provide the financial services industry with a common platform for the development of messages using a central dictionary and a set of design rules². Extensive Markup Language (XML), a widely used markup language that is both human and machine-readable, is used as the means to structure and present data.

Major initiatives are already live or ongoing. The most relevant development to date is the Single Euro Payments Area (SEPA), and thanks to this initiative, it is now possible to initiate euro payments (credit transfers and direct debits) within the European Union (EU) together with several non-EU countries, efficiently, quickly, and with fewer costs. In theory, it is as easy to make a euro payment to another SEPA-zone country as it is to make a domestic payment³. This was achieved through a phased implementation which has been completed in 2014 for the eurozone, and in 2016 for the non-eurozone SEPA countries.

The implementation of ISO 20022 for SEPA has contributed to the efficiency and easiness of issuing payments within the participating countries and institutions, by eliminating the differences between national and cross-border payments, and through further harmonisation of the messages and the rules to create them. The framework for SEPA is the result of cooperation between the European Central Bank and the European Commission.

The launch of SEPA was a milestone in the adoption of ISO 20022. European banks were the first in the world to embrace the standard and reap the benefits associated with the harmonisation it provided, and so did their corporate customers. Yet, other local

¹ <https://www.swift.com/de/node/301036>

² <https://www.iso20022.org/sites/default/files/2022-02/introtoiso20022.pdf>

³ https://ec.europa.eu/commission/presscorner/detail/fr/MEMO_08_51

standards and proprietary formats remain commonplace, with ISO 15022 messaging still dominant in terms of utilization.

The introduction of ISO 20022 represents a seismic shift in international payments, with more than 200 initiatives in over 70 countries either live, being rolled out, planned or under discussion. Provided implementation deadlines are met, ISO 20022 will dominate high-value payments by 2023 and will account for 79 per cent by volume and 87 per cent by value of electronic payment transactions globally (Accenture, 2021).

This comes in response to new market demands for which the legacy standards proved inefficient to address, such as increased automation and cost efficiencies, volume and quality of data, lack of interoperability, enhanced market integration, Know-Your-Customer (KYC) requirements, and real-time services. The common denominator for all these improvement programs is the need for a global migration to ISO 20022 by November 2025, widely recognized as the standard for the future (Deutsche Bank, 2019).

While the standard exists for approximately 18 years, and significant initiatives have already been successfully implemented, the adoption at a global scale brings new challenges to the table. Compared to the interbank space, there is less attention paid to what it means for payment users and in particular the cash management processes of corporates⁴. The global initiative is relatively new, and so far, there hasn't been a significant amount of research undertaken on this topic.

The choice of approach to overcome these challenges is providing corporates with knowledge, a technical solution, a set of guidelines, best practices, and technical considerations, to allow them to efficiently transition to ISO 20022. Or, in the case of organizations that have already migrated, to improve the performance of their electronic payment functionality and further optimize and rationalize the use of their bank accounts.

Based on Kitchenham's Procedures for Performing Systematic Reviews (Kitchenham, 2004), a Systematic Literature Review (SLR) has been conducted to gather a summary of the available literature relevant to the research questions. To develop and evaluate the

⁴<https://corporates.db.com/in-focus/Focus-topics/iso20022/blogs/let-s-isofy-it-what-s-next-on-corporate-treasurer-s-agenda>

necessary artefacts in an organized and consistent way, the guidelines related to the Design Science Research (DSR) methodology have been followed (Kitchenham, 2007).

The development, demonstration and evaluation of the artefacts were conducted in a professional environment with a complex payments landscape and in need of an overhaul of its fund's disbursement-related functionalities. More specifically, it was conducted in a multinational organization, issuing payments to virtually every country or territory in the world, in significant volume, in multiple currencies, and maintaining several distinct payment instruction formats and standards.

The artefact was developed, demonstrated, and integrated into the organization's back-office system and business processes and was evaluated according to several approaches: simulations, evaluation from experts, and through collection and analysis of metrics and statistics.

1.1 Research Methodologies

This section describes the research methodologies that were used to prepare this master's thesis. These are, respectively, Systematic Literature Review and Design Science Research.

The SLR was conducted to synthesize the evidence of multiple investigations on the topic, including all published evidence, and evaluate its quality. It also aims to identify the challenges, opportunities, and success factors that corporates need to observe on the road to the adoption of ISO 20022, as well as the identification of research gaps

The entire development process of this thesis was guided by the DSR methodology, aiming for the creation and evaluation of artefacts, and supporting the solutions proposed for the identified problems.

1.1.1 Systematic Literature Review

A Systematic Literature Review (SLR) is a means of identifying, evaluating, and interpreting all available research relevant to a particular research question, topic area, or

phenomenon of interest (Kitchenham, 2004). It is achieved through a systematic search of literature through designated and clearly defined sources, followed by systematic data analysis and reporting.

In contrast to a non-systematic process, an SLR is performed formally and meticulously. This means that a strict review protocol must be followed, establishing a well-defined sequence of steps. Due to its meticulous nature, one of the advantages of an SLR is allowing other researchers to produce further updates on the review if the same set of steps defined in the protocol is followed.

The need for an SLR is born due to the requirement of researchers to summarize all existing findings of a well-defined topic in a thorough, focused, replicable, and unbiased way, to respond to relevant pre-defined questions and draw well-supported, unbiased, and more general conclusions than those obtained from individual research studies (Bidwell et al., 2001).

The SLR has been conducted by following Kitchenham's guidelines for systematic literature reviews (Kitchenham, 2004). As such, the procedure can be broken down into three stages:

- **Planning:** evaluates the need for an SLR, defines the research question(s), and produces a review protocol. The search strategy and inclusion/exclusion criteria need to be specific for the process to be rigorous and replicable;
- **Conducting:** the review protocol is applied, and its output consists of a selection of primary studies containing information considered to be relevant regarding the subject being studied;
- **Reporting:** relevant information from the selected studies is gathered and summarized.

The three stages described above are represented in Figure 1.1, which summarizes the tasks and outputs of the work that was performed in each phase.

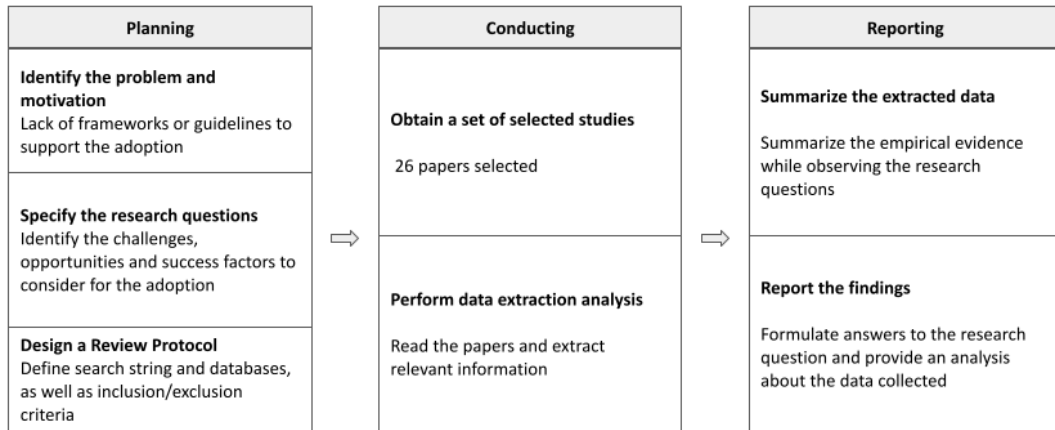


Fig. 1.1: The three stages of a systematic literature review as per Kitchenham

1.1.2 Design Science Research

According to traditional approaches, the theory produced is rigorous and scientifically valid but not necessarily relevant in the practical sense. These approaches filter out the context and a set of other variables to validate the theory and explain the cause-effect relationship of the variables in the object being studied. However, in the real world, the context exists, and so does the sense of practicality and utility.

The Design Science Research methodology is mainly driven by the need to solve a real problem rather than simply filling in a lack of knowledge or attempting to explain reality. It is a methodology concerned with the creation of an artefact, its pragmatic validity, and its orientation to achieving a set goal.

Peppers et al. propose a six-step process to be applied in the field of Information Systems (Peppers et al., 2007):

- **Identify Problem and Motivation:** identification and statement of the research problem, and the relevance of a solution for it;
- **Objectives for a Solution:** conclude by reasoning the solution objectives for the previously defined problem;
- **Design and Development:** identification of the methods, models, and concepts for the development of the solution;

- **Demonstration:** practical application of the developed solution into solving a particular case of the problem;
- **Evaluation:** observation and measurement of the quality of the developed artefact as a solution for the problem;
- **Communication:** communication of the problem and its relevance, the artefact, and its importance and utility.

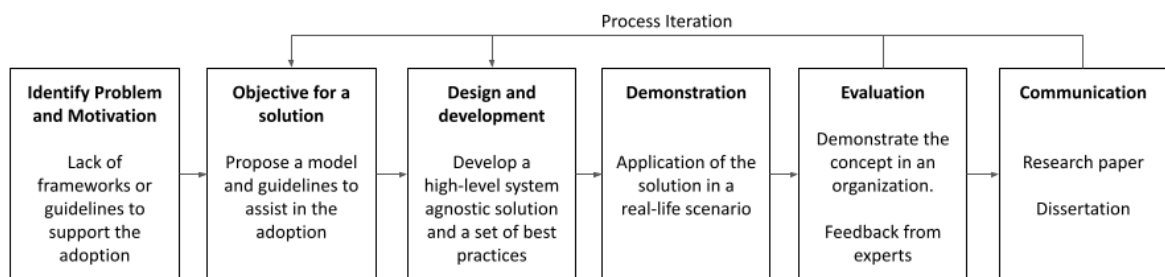


Fig. 1.2: The six steps of Design Science Research as per Peffers et al.

It is an iterative methodology as the latter two steps (evaluation and communication) feedback into the second and third steps (objective for a solution, and design and development), constantly redefining the problem and knowledge base, which in turn are incorporated again into the research process.

The SLR is targeted at the identification of the research problem and motivation. The definition of the problem will be the foundation for the development of an artefact that can effectively deliver a solution to the problem

1.2 Document Structure

The remainder of this document is structured as follows. Chapter 2 provides the Theoretical Background necessary to better understand the object of study of this paper, focusing on how electronic funds transfers are executed, and on how ISO 20022 relates to the topic.

Chapter 3 presents the Systematic Literature Review, composed of its multiple phases: Planning, Conducting, Reporting and Discussing. The research problem is detailed

in Chapter 4, which also presents the research proposal: the development of a model of adoption of ISO 20022 for payments by any corporate organization.

Chapter 5 covers the development of the model, presenting a series of guidelines and the building of the required technical components, applying them to an organization undertaking an ISO 20022 adoption project.

Chapter 6 describes the demonstration of the model using a prototype as the vehicle for the demonstration. Chapter 7 exposes how the evaluation of the model was designed and executed, and shares the relevant results. Conclusions are presented in Chapter 7, which also explains the limitations faced during the elaboration of the study, communication strategy, and intentions for future work.

2 Research Background

This chapter is used to identify the key concepts related to the object of study and provide a background to the same topic.

2.1 Electronic Funds Transfer Payment

An electronic funds transfer (EFT) is the electronic transfer of money between people, banks and companies. EFT payments are frequently used in place of paper-based payment methods - like bank checks and cash - to make transactions faster and safer.

EFT payments require at least two parties to work: an initiator/payer and a beneficiary/payee. When the initiator commits to sending funds to the beneficiary, that payment goes out through the appropriate payment network and moves the funds from the payer's account to the payee's account.

There are several types of EFT payments, such as direct deposits, ATM transactions, credit card transfers, and electronic bank checks, among others. Every business or organization needs to manage payments and transactions, often between multiple bank accounts, in several currencies and geographies. For that purpose, traditional ERP, TMS and other back-office systems generally offer some level of functionality that enables the processing of payment-related EFTs.

To initiate an EFT payment from such a system, a payment message is always required. A payment message can be a file, containing at least one payment instruction, which in turn contains the details required to execute one or more payment transactions. For example, for a deposit, the message will include a payment instruction, which in turn includes the elements related to the initiator, beneficiary, banking details of both parties, currency and amounts, among others. A credit card payment would require different elements, such as the cardholder's name, card number, security code, and expiration date, among others.

Figure 2.1 illustrates, in a simplified way, the flow of a typical EFT payment, more specifically a deposit.

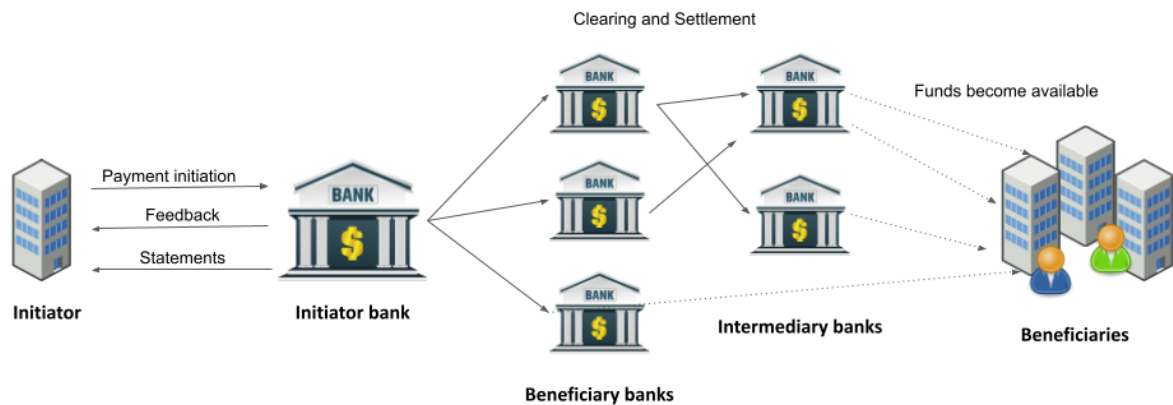


Fig. 2.1: High-level process flow of an electronic funds transfer (deposit)

The process starts with the action of a corporate transmitting a payment initiation message to its bank. Each message will contain one or more instructions, and ultimately several payment orders to pay the beneficiaries, who hold bank accounts in several different banks. This message includes a set of information necessary for the initiator and beneficiary banks to process the transaction and transfer the funds, with or without the involvement of intermediary banks, to the beneficiary's bank account. The data includes a wide array of information from the initiating party, the payment beneficiaries, internal identifiers, dates, currencies, amounts, intermediaries (if any), bank details, payable documents, charges, and purposes, among others.

An intermediary bank is a middleman between an initiator bank and a beneficiary bank. Their intervention is often required whenever the initiator and beneficiary hold accounts in different countries, having no established financial relationship between them. It is then necessary, under special sets of circumstances, to specify the intermediaries between the initiating and beneficiary banks, so that the payment transactions can be executed with minimal disruption, avoiding additional charges, inquiries and delays.

The initiator bank validates the message, and, in case of success, initiates a clearing and settlement message to the payee's banks. If clearing is successful, this results in a transfer of funds.

A feedback message is sent to the initiator including successful and rejected transmissions (if any). This feedback may not indicate if the transfer to the beneficiary has been

successful, it tells that it passed several validations performed by the bank and that any rejected payment transactions will not be carried further in the payment chain.

Lastly, bank statement messages are transmitted to the initiator for reconciliation, and at this stage, it is possible to match all the successfully processed payments against the statement lines, triggering the process of investigating which payments have not been completed successfully.

2.2 ISO 20022 vs other standards and formats

For an EFT payment to be processed, several messages need to be exchanged between all the parties involved. To be processed electronically by computerized systems, such messages in the form of files need to follow consistent rules, that define both what data needs to be presented and how it needs to be structured – the file format standard.

In a fragmented customer-to-bank and interbank space, multiple standards exist for the same purpose, with different sets of rules between them. For a single EFT payment, it is commonplace to observe the use of multiple formats or standards throughout the flow, especially in the case of cross-border payments and whenever intermediary banks are called to perform the settlement to the beneficiaries. Different settlement and clearing platforms (payment processing systems) may be called to process the transactions, each potentially adopting different standards and using specific rules when dealing with cross-border payments.

Such fragmentation results in the need of developing mechanisms to translate and transform, enrich, and truncate data within each iteration, which may result in a degradation of the quality of the data and, consequently, the effectiveness of the process.

For example, for the initiation of payments alone, multiple formats may be used, depending on the scenario, geography, or simply on whether the banks can accept them. Such formats could be, but are not limited to:

- ACH-PPD – United States Automated Clearing House⁵ - Prearranged Payment and Deposit: Exclusive use for United States banks for eligible transactions;
- UN/EDIFACT PAYMUL - United Nations rules for Electronic Data Interchange for Administration, Commerce and Transport⁶ - Multiple Payment Order: Recommended within the framework of the United Nations and applicable for both domestic and international payments;
- SWIFT⁷ ISO 15022 MT101 – Message Type 101 – Request for Transfer⁸: Currently the most widely accepted payment initiation format, both for domestic and international payments.

The global adoption of a single standard covering all the stages, from initiation, through clearing and settlement, feedback, and bank statement, would assist in the enablement of the interoperability between financial institutions, market infrastructures and their corporate customers. To reap the potential benefits, all mentioned parties need to invest in readiness and prepare for significant changes in their technology infrastructures and workflows.

The ISO 20022 migration strategy is phased over three years, starting in November 2022 with a co-existence between ISO 15022 (and other standards) and ISO 20022 until November 2025 (Swift, 2021). Corporates can continue to send payment instructions in legacy formats (e.g., MT101) until retirement from the network in November 2025 (BNY Mellon, 2021) or until not anymore supported by the bank of the initiating party.

One key reason that a new messaging standard is necessary is that ISO 15022 MT standard is no longer suitable. Its limited data-carrying capabilities are the product of a time when bandwidth and storage were expensive, while regulatory requirements mean much more data is now needed to fully comply with regulations (Accenture, 2021). Other regional and proprietary formats are likely to follow the same line and be decommissioned.

⁵ <https://www.nacha.org/content/ach-network>

⁶ <https://unece.org/trade/uncefact/introducing-unedifact>

⁷ Society for Worldwide Interbank Financial Telecommunications

⁸ <https://www.iso20022.org/welcome-iso-15022>

ISO 20022 XML guidelines for payments contain large amounts of data being transmitted, and even though a structure exists, the standard allows significant flexibility. It is possible that the same payment instruction can be produced in countless different ways and still comply with the same standard. A payment initiation message definition may include several hundred different elements. Generating a sample file with all possible elements would produce a message with 949 printed lines of text (Mäenpää, 2015), but only a subset needs to be used, as many of the XML tags are not mandatory, can be conditional, and are often repeated in different nodes of the XML tree. Other tags may be used multiple times according to specified cardinality requirements.

An example of a part of a data-rich payment initiation ISO 20022 (pain.001) message and a full ISO 15022 (MT 101) message for payment initiation can be observed in Figure 2.2. It shows a similar payment instruction, comprised of a single payment for three payable documents (invoices). A mapping is established between the two formats by highlighting the corresponding elements in the same colours. The section of the pain.001 that was selected to be represented can, on a significant scale, be mapped to MT 101, and in this particular case, such data meets most of the essential requirements to cover the needs for the creation of the MT 101 message.

Examples of full MX pain.001 messages can be observed in [Appendix VII](#), according to several business scenarios.

```

<PmtInf>
...
  <ReqdExctnDt>2022-08-04</ReqdExctnDt>
  <Dbtr>
    <Nm>Institute of Microbiology of the
      Faculty of Sciences of the
      University of Brussels</Nm>
    <PstlAdr>
      <StrtNm>Avenue de la Nouvelle
        Université, Num 456,
        3eme étage, Chambre 27</StrtNm>
      <PstCd>9999-999</PstCd>
      <TwnNm>Brussels</TwnNm>
      <Ctry>BE</Ctry>
    </PstlAdr>
  </Dbtr>
  <DbtrAcct>
    <Id>
      <IBAN>BE12312312312312</IBAN>
    </Id>
    </DbtrAcct>
    <DbtrAgt>
      <FinInstnId>
        <BIC>BANKBE01XXX</BIC>
      </FinInstnId>
      </DbtrAgt>
      <CdtTrfTxInf>
        <PmtId>
          <InstrId>102200000001</InstrId>
          <EndToEndId>102200000001</EndToEndId>
        </PmtId>
        <Amt>
          <InstdAmt Ccy="EUR">1000.00</InstdAmt>
        </Amt>
        <CdtrAgt>
          <FinInstnId>
            <BIC>BANKBG02XXX</BIC>
          </FinInstnId>
        </CdtrAgt>
        <Cdtr>
          <Nm>Vissh institut po prilozhni nauki
            na Natsionalniya universitet
            na Bŭlgariya</Nm>
          <PstlAdr>
            <StrtNm>ul. Aleksandŭr Ekzarkh Ganchev,
              Bldg Plamen, Fl 6</StrtNm>
            <PstCd>1111</PstCd>
            <TwnNm>Blagoevgrad, Bansko, Gostun</TwnNm>
            <Ctry>BG</Ctry>
          </PstlAdr>
        </Cdtr>
        <CdtrAcct>
          <Id>
            <IBAN>BG12345678901234567890</IBAN>
          </Id>
        </CdtrAcct>
        <RmtInf>
          <Ustrd>Invoice 238746334/22 ; 300.00 ; Payment of Goods and Services</Ustrd>
          <Ustrd>Invoice 238746335/22 ; 600.00 ; Payment of Goods and Services</Ustrd>
          <Ustrd>Invoice 238746336/22 ; 100.00 ; Payment of Goods and Services</Ustrd>
        </RmtInf>
      </CdtTrfTxInf>
    </PmtInf>

```

```

:20:2208040404010000
:28D:1/1
:50F:/BE12312312312312
INSTITUTE OF MICROBIOLOGY OF THE FA
CULTY OF SCIENCES OF THE UNIVERSITY
AVENUE DE LA NOUVELLE UNIVERSITE, 3
EME ETAGE, CHAMBRE 27 999-999 BRUSS
:52A:BANKBE01XXX
:30:220804
:21:102200000001
:32B:EUR1000,00
:57A:BANKBG02XXX
:59:/BG12345678901234567890
VISSH INSTITUT PO PRILozhNI NAUKI N
ATSIONALNIYA UNIVESITET NA BULGARIY
UL ALEKSANDUR EKZARKH GANCHEV, BLDG
PLAMEN, FL 6, 1111 BLAGOEVGRAD, BAN
:70:INVOICE 238746334/22 300,00 EUR
2022-08-03 PAYMENT OF GOODS AND SER
VICES ; INVOICE 238746335/22 600,00
EUR 2022-08-03 PAYMENT OF GOODS AND
:71A:SHA

```

Fig. 2.2: Sample ISO 20022 pain.001 (left) and ISO 15022 MT 101 (right)

The differences become visible from a standpoint of structure and richness of data. Initiator and beneficiary names and addresses are truncated, and so does the remittance

message. Many other elements available in pain.001 cannot even be directly mapped to MT 101 as there is no dedicated room to accommodate them at the destination.

Not so clear are the limitations specific to ISO 15022, for instance, the inability to use character sets other than basic Latin, or the length limitation of 35 characters per line for the customer and beneficiary names and addresses (maximum of 4 lines). Another important constraint is the limit of 10.000 characters per message – given the example that was provided, a total of 580 characters were consumed. If we consider that figure as an average number of characters per payment, an average total of only 17 payments per message is possible. Several other limitations apply but are not to be detailed in this research.

ISO 20022 also has multiple constraints, for instance, on the allowed length for some of the tags. One good example is the beneficiary's name, which is limited to 140 characters. Nevertheless, it offers significantly more capacity when compared to ISO 15022, which uses the same room to store both names and addresses. In turn, pain.001 offers a structured format for addresses, allowing multiple address lines and dedicated tags for City, Postal Code and Country (among other possibilities).

If at some stage a conversion needs to occur from ISO 20022 to ISO 15022, then it is likely that some elements will be truncated or even left out. Even if a similar syntax exists for all the messages, success is not guaranteed as different initiator and beneficiary banks may require different sets of data or even require a specific structure. Banks may require elements that are taken into the bank's backend system, and leave out elements that are ignored, even when ISO 20022 schema allows them (Mäenpää, 2015). Even with a clearly defined common approach along the process, the quality of data may be negatively impacted.

For initiators and beneficiaries to exchange payment information, their banks need to understand each other's payment message format, including the payment initiation message (Mäenpää, 2015). A scenario of coexistence of standards and fragmentation may translate into issues that can hinder the entire process, therefore one of the main propositions of the value of the ISO 20022 global adoption initiative is to promote efficiencies by ensuring consistent messaging throughout the chain.

3 Systematic Literature Review

In this chapter, the systematic literature review will be executed. Following Kitchenham's guidelines (Kitchenham, 2007), the phases of planning, conducting, and reporting the review will be detailed.

3.1 Planning the Review

This subsection entails the first stage of a systematic literature review. The problem and motivation are presented, the research questions are introduced, and the review protocol is designed.

3.1.1 Problem and Motivation

The problem that has been identified is related to the complexity inherent to the process of adopting ISO 20022 for corporate organizations. This is felt, especially, for cross-border payments outside the SEPA zone.

Given the ongoing worldwide adoption of financial institutions, corporates are also affected by the changes in the inter-banking market. It is important to understand the challenges corporates face when on the road to adoption, gather evidence of the best practices, and understand the potential benefits.

A set of variables, such as the dimension of the organization, its geographical presence, the level of centralization, the volume and diversity of payments, the currencies transacted, the quality of master data, and the number of banks they operate with, dictate how complex the migration might become.

For the adoption of SEPA, the European Payments Council (EPC) and the European Commission (EC) published a set of rules to be observed in the entire SEPA space⁹, and a common payment processing and clearing system was established in the region, contributing to a full harmonisation of the use of the standard. For the ongoing adoption of cross-

⁹ A total of 36 European countries and territories

border payments, such harmonisation has not been achieved, and very often the messages need to be tailored to the specifications provided by banks and to local requirements.

This context has been observed in working environments, where setting up a payment factory on a global scale becomes a daunting task. The motivation for this research comes from that observation and intends to collect and evaluate published information on the topic of ISO 20022 adoption for corporates.

3.1.2 Research Questions

To achieve the objectives of this review, the following research questions have been formulated:

- **RQ1.** What opportunities can corporates take advantage of when adopting ISO 20022 for payments?
- **RQ2.** What challenges are faced by corporates when adopting ISO 20022 for payments?
- **RQ3.** What are the success factors corporates must observe when adopting ISO 20022 for payments?

3.1.3 Review Protocol

The review protocol is initiated by the action of searching for literature. This is achieved by the definition of search strings to be used in the online libraries together with other available filters.

To produce an optimal search string, the main concepts have been identified, and synonyms and keywords have been included in the search string. An iterative process was put in place as ISO 20022 is very comprehensive in terms of the array of messages and purposes it supports, and a search on “ISO 20022” alone would produce many irrelevant results. Therefore, it was decided to combine that term with at least one record from a series of keywords relevant to the topic being studied. This was achieved using Boolean operators AND/OR, together with truncation and wildcards. The results were reviewed and

evaluated at each iteration, and the keywords were adjusted until an optimal search string was achieved.

Multiple databases were tested as part of the search cycle, and the ones selected are B-On Universidade Aberta (EBSCOhost) and Bielefeld Academic Search Engine (BASE).

The same search string may not be interoperable between search engines; therefore two search strings were created, one for each database, using its syntax but applying the same logic.

The string used for EBSCO is (applied to the 'abstract' text):

("ISO * 20022") AND (payment* OR adopt* OR implement* OR migrat* OR framework* OR prepar* OR issue* OR challeng* OR harmoni* OR standard*)

For BASE, the string is:

desc:"iso*20022" (payment* adopt* implement* migrat* framework* prepar* issue* challeng* harmoni* standard*)

3.2 Conducting the Review

Once the search criteria are defined, it is now possible to move to the following stages, consisting of the selection of the studies and the analysis of the data retrieved from the final selection.

3.2.1 Selection of Studies

Provided the results from the databases, the inclusion and exclusion criteria are applied to filter the results. The criteria are presented in Table 3.1.

Table 3.1: Inclusion and exclusion criteria

Inclusion	Exclusion
Scientific and academic papers	Duplicate records
Reports from institutions operating in the financial services industry or related areas	Citations
	Languages other than English, Portuguese, Spanish or French
	Inaccessible documents
	Incomplete documents

No exclusions were put in place for the date the resource was published. As noted before in this document, ISO 20022 was published in 2004, and it is important to collect information about past initiatives as they may offer valuable detail to be incorporated into future adoption programs, for instance, lessons learned. The earliest publishing date identified was precisely 2004.

One important assumption that needs to be made is that financial institutions and their corporate customers, to a significant extent, and taking into consideration the similarity between payment initiation and payment clearing messages, are exposed to similar challenges and opportunities while adopting the standard. Therefore, no exclusions regarding relevance are made if the record is ambiguous or focuses mostly on the perspective of financial institutions.

Once the first set of records is retrieved from the databases, further filtering must be applied regarding relevance. The abstracts are read and, if deemed relevant, move to the final phase, which is reading the entire paper and, again, screening them for relevance, resulting in more exclusions.

As a result of the searches performed in both databases, 126 records were obtained. From there, the inclusion/exclusion criteria are applied which resulted in 30 exclusions, bringing the total to 96 selected records.

Afterwards, abstracts were read and those that were considered to have no potential to provide any input regarding the research questions were excluded, in a total of 43.

Finally, the content of the remaining 53 papers was reviewed to examine them from a quality perspective, ensuring that their content is relevant to the objective of this study. All the papers were subjectively examined to select suitable and fitted papers for the study. Consequently, a total of 21 papers were selected for further study.

The review protocol applied is represented in Figure 3.1.

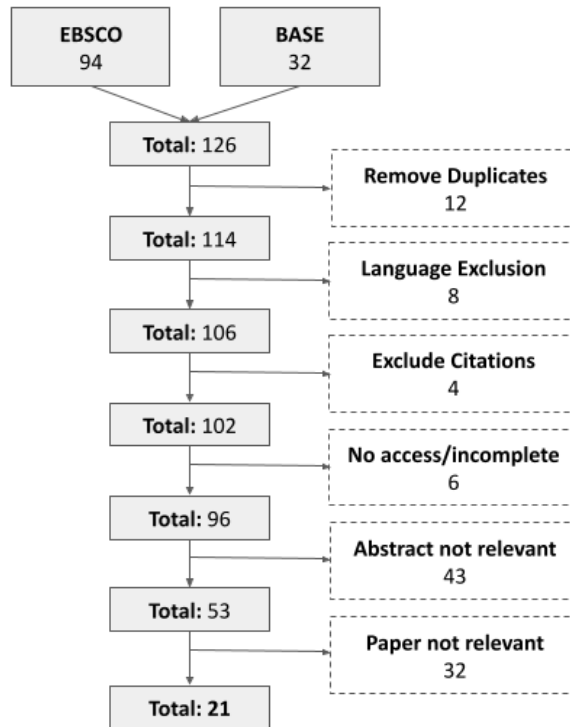


Fig. 3.1: Review protocol for the SLR

3.2.2 Data Extraction Analysis

The following analysis aims to add insight into several attributes related to the selected papers, such as the sources, and the type and year of publication.

The most significant source is EBSCO, totalling 15 records (out of 21), which corresponds to 71% of the total. The remaining papers were sourced through BASE, 6 in total and representing the remaining 29%.

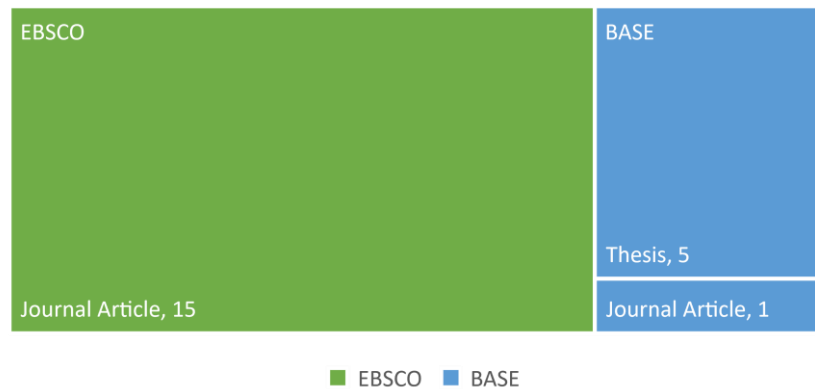


Fig. 3.2: Database and type of resources

From EBSCO, all 16 papers are journal articles, whereas for BASE a single journal article was considered, and a total of 5 theses were found to be relevant for the research. Note that 8 of the 12 duplicates that were identified between EBSCO and BASE, all of them journal articles, have been removed from the count of records obtained from BASE. The remaining 4 were duplicates within EBSCO.

Had the records not been excluded from BASE, the percentage of relevant studies per database would have shown that 44% of records from BASE were relevant, compared to the 15% from EBSCO that made the final selection.

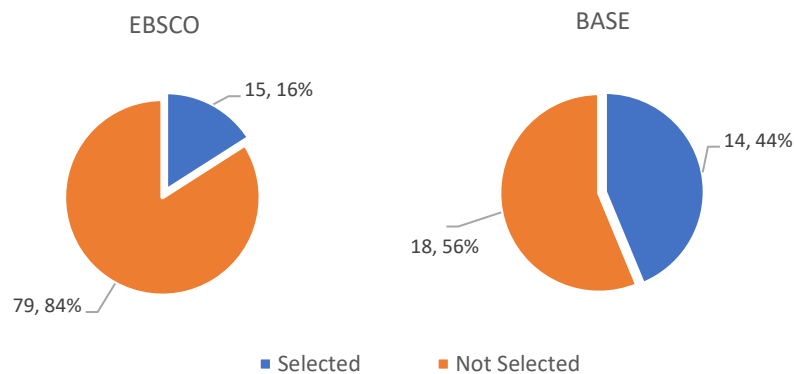


Fig. 3.3: Relevant records per database

Regarding the yearly distribution of the publication date, even though the population may not be statistically significant enough to draw scientifically valid conclusions, it

seems to indicate a peak between 2014-2015 and from 2019 onwards, with 12 records in total, approximately 57% of all papers.

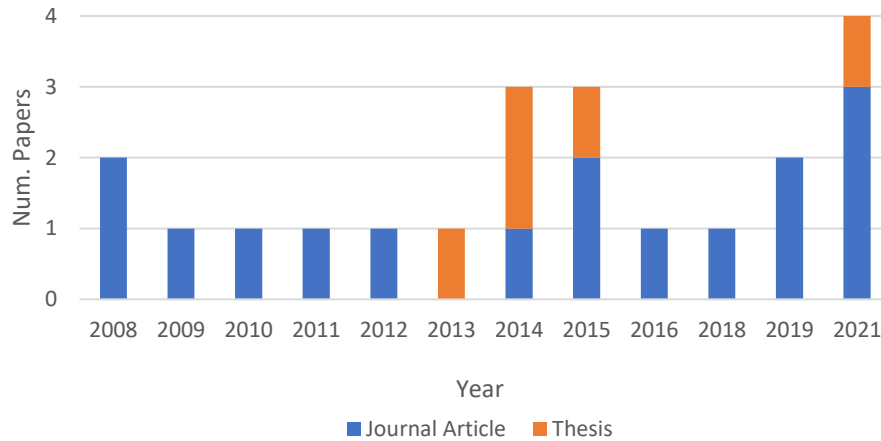


Fig. 3.4: Yearly distribution of publications

This may be explained by the fact that SEPA saw most of its development in the years 2015 and immediately before that, and by the increased awareness that the ongoing global migration is causing in the general audience, researchers included, spiking up in 2021.

3.3 Reporting

As per Kitchenham’s guidelines, this section corresponds to the last stage of the systematic literature review (Kitchenham, 2007). To summarize and simplify the analysis of the data, this study classified and discussed the findings related to the research questions. These findings were categorized into broader and more manageable categories, compiled by establishing the link between findings and paper, and then interpreted.

This exercise is executed for every research question.

- **RQ1.** What opportunities can corporates take advantage of when adopting ISO 20022 for payments?

Opportunities for promoting efficiencies are widely referred to in the reviewed literature. This broad term can be broken into smaller pieces, such as greater straight-through-processing, speedier reconciliation, use of e-invoicing, real-time tracking of a payment across multiple banks and payment systems, and less manual work.

Straight-through processing offers benefits to all the parties involved in the payment chain and can be defined as a fully automated execution of a workflow. Initiators will have a better experience and will acknowledge the reduced complexity associated with executing a payment (Euromoney, 2008).

Improved reconciliation and e-invoicing are also potential opportunities for corporates. ISO 20022 Extended Remittance Information in a structured format will allow more complete and granular information about transactions (documents, lines, etc.) to be provided, thus ensuring more potential for automatic reconciliation (Euromoney, 2008). Electronic invoices (e-invoices) are sent to the payer of the invoice and automatically complete the details for the payment and creditor reference (Svensson, 2014), reducing manual work and data entry errors, and at the same time easing the process of reconciliation.

It also opens the possibility for payments to be tracked through SWIFT's Global Payments Innovation (GPI) initiative. The service advertises the potential to reduce payment enquiry costs by up to 50% (Haataja & Stackenäs, 2021).

Very much interdependent with the 'Improved efficiency and cost reduction' opportunity, is the one related to the possibility of leveraging richer, more structured data and complying with requirements. Kwok states that more regulatory challenges are now felt than at any other point in history, particularly in the areas of fraud prevention and anti-money laundering (Kwok, 2021). Banks are required to report large amounts of crucial data to the authorities. Any counter-terrorism financing, embargo, sanction checks as well as know-your-customer (KYC) function should be identifiable from any payment or transaction. ISO 20022 allows a more transparent, enriched payment message to be used, and by taking advantage of this, corporates may avoid inquiries from the banks, additional manual work, and delays in processing payments.

According to Virtanen, operational risks arise from technological incompatibilities which would be limited by the adoption of a single standard (Virtanen, 2013). Large et al. reinforce this idea and state that corporate treasurers seek fully integrated automated systems and services. These would give them full visibility and control of their cash and risk exposures (Large & Large, 2009).

One not often mentioned opportunity for corporates is the possibility of rationalizing bank account use. Wandhöfer (Wandhöfer, 2015) and Virtanen (Virtanen, 2013) agree on the argument that ISO 20022 and its ability to facilitate cross-border payments, will allow a more effective and manageable centralization of payment processing. For SEPA, it is possible to make payments and process receipts in one single country or even one single bank account. This would save time and money and enable liquidity management to be consolidated.

- **RQ2.** What challenges are faced by corporates when adopting ISO 20022 for payments?

From the analysis performed, one topic is discussed across most of the literature - the coexistence of multiple standards and the fragmentation of the payments market landscape. A phased rollout of ISO 20022 means that not every actor will embrace the standard at the same time, and at any given moment different banks will be at different degrees of preparedness. And so will corporates.

Fragmentation in the payment flow means that no harmonised experience exists across the multiple 'legs' of the payment processing flow, from the initiator, through banks, intermediaries, and correspondents.

Lindsay notes that different standards can vary widely in terms of their functionality, notably in their capacity to carry remittance information (Lindsay, 2015). The adoption of ISO 20022 allows enriched and structured data to be sent down the entire payment chain, taking advantage of a consistent data dictionary. Retzer asserts that if somewhere along the chain this consistency is not observed, it can impact performance, reliability, and compliance. The same author expands his view on the subject and highlights uncertainty

as the main cause for the coexistence of standards (Retzer, 2013). The title can, however, be misleading as the opportunities the author refers to are mostly for software providers and consultancy firms, not for the corporate user.

Another frequently observed challenge is related to the continuous evolution of ISO 20022. Wandhöfer, in the context of SEPA, adds that rulebook changes and updates are applied as part of releases cycles where many improvements and enrichments to the original basic versions of the rulebooks are being made (Wandhöfer, 2015). This means that corporates need to regularly adapt to the changes and comply with the new versions, which inevitably involves effort and requires resources.

Also frequently raised is the need to overhaul the IT architecture. As per Gamble, new standards and a new syntax (XML) may require current technology infrastructures to be upgraded or migrated to one able to produce and handle the required outputs (Gamble, 2010). This can potentially translate into organizations having to implement system changes to handle the new requirements associated with the adoption. Such systems can be, for instance, Enterprise Resource Planning (ERP) or other back-office solutions (Virtanen, 2013).

Being a data-rich and structured format, organizations will require improved data management processes and procedures. Poser states that increased regulatory requirements in the fields of compliance, fraud prevention, and anti-money laundering, drive the need for comprehensive and structured data. However, to allow a more transparent, enriched payment message to be used, entities need to improve their data management processes for capturing, organizing, and maintaining new data, and curating the existing one (von Poser, 2019). Mäenpää refers to the XML schema, a file the XML message can be validated against, and stresses that its purpose is to define the structure, content, and semantics within the XML document. The schema does not provide the exact rules on what exact information needs to be provided, but instead, it defines how to provide the data, the format, the allowed length, and several other rules (Mäenpää, 2015). Therefore, significant flexibility is allowed for the same message, and the same set of data can be represented in a vast number of different ways, ending up with a unique combination of data elements.

Virtanen asserts that issues within the implementation of ISO 20022 have been especially relevant for the customer-to-bank and bank-to-customer communication space. The implementation of the standard in a consistent and harmonised manner has been problematic for SEPA and on a global scale (Virtanen, 2013). The same author addresses the topic of ambiguity and the difficulty in achieving consistency and harmonisation by providing examples of the European Payments Council implementation guidelines for SEPA, and the problems and challenges felt on a more global scale. The Common Global Initiative (CGI) was established by SWIFT, where several major banks and a community of corporates created a working group to address the mentioned issues by publishing common implementation guidelines.

Mäenpää presents the hypothesis that improving the way information is presented in implementation guides provided by banks would positively impact the number of resources needed for the customers to successfully implement a system generating payment messages. Even if the standard is well structured, it cannot work as intended if the guidelines for its use are ambiguous and implementers struggle to understand the content (Mäenpää, 2015).

- **RQ3.** What are the success factors corporates must observe when adopting ISO 20022 for payments?

Any transformational project involves multiple stakeholders, and the road to the adoption of ISO 20022 is no exception. As such, according to the perspective of various authors, the alignment between stakeholders is fundamental for a successful project. Kwok highlights the role of senior management in providing the necessary support during the process of adoption (Kwok, 2021). Resources and budgets need to be allocated, and other ongoing or future projects may need to be reprioritized. This strongly relates to another success factor related to planning and goal setting. The same author states that a clear time frame must be established for achieving the goals, as well as the approach for the migration: big-bang or phased (like-for-like).

Wandhöfer observes the phenomenon from a different perspective and considers the corporate itself as a stakeholder, as a part of a larger community of users (Wandhöfer, 2015). In the context of SEPA, and given the challenges related to flexibility and ambiguity, the author expresses the importance of the corporate community in emphasizing its wish that consistent use of ISO 20022 should be achieved over time. It should be ensured that their voices are heard in the appropriate forums to be a part of shaping the evolution of the standard.

Any complex project requires availability and knowledgeable resources. Cojocarui et al. observe this need and state the importance of the banks educating their corporate customer base to facilitate the adoption (Cojocarui & Cojocarui, 2015). Poser places himself in the role of an organization undertaking the adoption of the standard and reflects on the difficulty of securing not only enough resources but also ones with the required skill set to perform the changes (von Poser, 2019). The author also suggests that any gaps could be fulfilled by external partners specialized in the subject.

Provided that ISO 20022 can incorporate more data in its messages, and structure it logically, more attention needs to be given to data management in organizations. Corporates may find that their master data needs to be enriched and/or undergo a cleaning process to comply with new requirements or even specific requirements by different banks and from several geographies. Wandhöfer provides a concrete example: the Finnish tax authority requires that additional information needs to be populated when issuing payments to the tax agency. In the absence of these data, the Finnish tax authority would have difficulty reconciling the payment/payer, leading to delays and potential penalties (Wandhöfer, 2015).

Wandhöfer and Mäenpää disagree however on one of the approaches for creating the messages. While the latter advocates that overpopulating or including redundancies would not be the best practice to follow as it would increase complexity and maintenance (Mäenpää, 2015), the first asserts that the defined rules should not only be consistently applied but also become more comprehensive than the minimum baseline of mandatory fields (Wandhöfer, 2015). The level of information in the payment message is key for

corporates, and this can only be delivered if the data set can be supported by all entities in the payment chain, therefore the argument to overpopulate.

3.4 Discussion

One of the purposes of this paper is to collect information about the challenges and opportunities corporates are exposed to while adopting ISO 20022, as well as collect evidence of the best practices to achieve that. A comprehensive literature review was carried out, on a set of 21 papers, aiming to achieve the results and draw conclusions.

Based on those papers, the research identified a strong alignment between most of the literature concerning challenges and opportunities. Even though no filters have been applied to the date published, which could play a part if the perception of ISO 20022 had changed throughout time, more than 50% of the literature acknowledges the top two challenges (fragmentation of the space and coexistence of standards, and the evolution of ISO 20022) and opportunities (efficiency and cost reduction, richer data and improved compliance). However, except for Mäenpää (Mäenpää, 2015), no guidelines are provided that could help corporates on their road to the adoption of the standard. No inconsistencies or contradictions between authors are considered noteworthy.

Regarding the success factors, the same cannot be said. This topic was not explored much as it is approached by a limited number of authors, and with a not very significant level of detail. Apart from the stakeholder alignment, it cannot be stated that a strong consensus exists. Only one contradictory view was identified between Wandhöfer (Wandhöfer, 2015) and Mäenpää (Mäenpää, 2015) regarding the need to overpopulate or limit the data carried in a message.

Given the lack of literature on solutions or detailed guidelines for the challenges, this area is considered a research gap.

4 Research Problem

This chapter elaborates on the first phase of the Design Science Research methodology process as described by Peffers et al.. This phase consists in identifying the problem and motivation for the study (Peffers et al., 2007).

As of this date, ISO 20022 is used by payment systems in over 70 countries around the world. Swift estimates that by November 2025, 80% of all electronic payments and 87% of the transacted amounts will be based on ISO 20022, making it the *de facto* standard for the future (Swift, 2021). For reference, in 2019, the last measurable year before the COVID-19 pandemic struck and the global economic crisis set in, ISO 20022 represented approximately 25% of messaging traffic (Treasury Intelligence Solutions, 2021) when compared to MT (ISO 15022) messages. A long road lies ahead until ISO 20022 becomes dominant and finally replaces other standards in cross-border payment messages.

Recently, the standard seems to be raising more awareness from the public. Figure 4.1 compiles the popularity of the topics “SEPA” and “ISO 20022” since 2004, collected through Google Trends¹⁰. Even though lacking scientific rigour, this data seems to indicate that SEPA, being the first major ISO 20022 initiative, deserved significant attention during the years 2013-2015, peaking in 2014 to its highest popularity score ever. More recently, the term “ISO 20022” is seeing a steep surge in interest, achieving its highest-ever popularity score in January 2022, and staying highly popular ever since. Possible causes for this spike might be the ongoing global adoption program, its deadlines, and the need for information requested by financial institutions and corporates.

¹⁰ <https://trends.google.com>

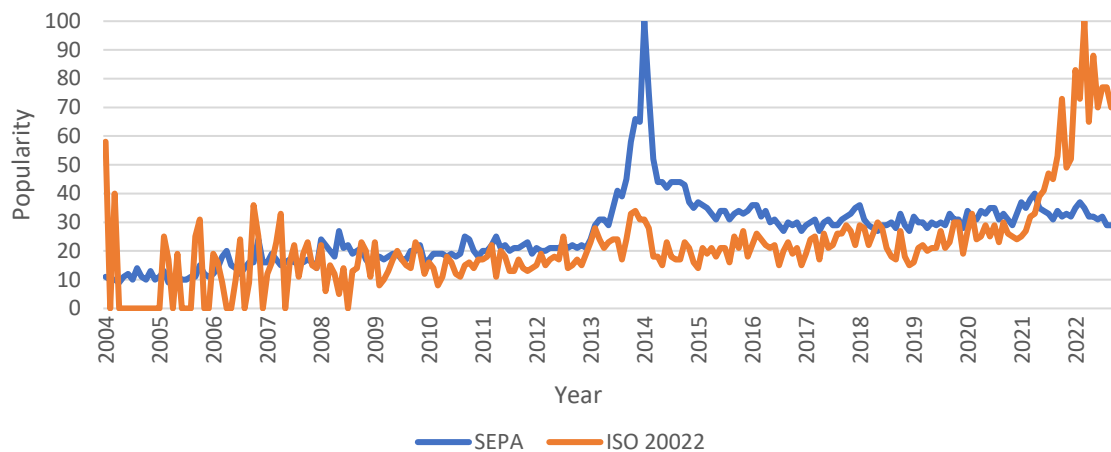


Fig. 4.1: Evolution of the popularity of the search terms ‘SEPA’ and ‘ISO 20022’

With a globally recognized and interoperable standard for messaging, corporates can process payments along the flow far more efficiently and economically. Better and more granular data can be transmitted resulting in improved digital fulfilment of compliance and regulatory requirements (Deutsche Bank, 2019).

However, to reap the potential benefits from the adoption, corporates are exposed to several challenges. Mastering such a complex migration relies on the definition of an appropriate strategy (Bouille & Haase, 2019; Kwok, 2021; Treasury Intelligence Solutions, 2021), one that reduces operational burdens and creates a seamless and non-disruptive transition, as well as a sustainable solution. It is therefore fundamental to understand how this can be achieved in the most efficient manner possible, and for that, a set of guidelines and best practices need to be defined.

As seen in the SLR, little information is available regarding the success factors for the adoption, compromising the attainment of the potential benefits and amplifying the challenges felt to achieve the said benefits. This obstacle has been identified as a research gap.

Given the inevitability of the migration, and acknowledging the increased interest in the topic, the main motivation for this study is to bridge any knowledge gaps that organizations may come across during their process of adopting ISO 20022 and therefore enable a successful transition. The research proposal consists in developing a model that enables organizations to adhere to the standard, effectively, in a sustainable and scalable way. The

model consists of general guidelines, and the development of a technical solution, that can be used as a reference, according to the needs of any organization wishing to adhere to ISO 20022.

5 Design and Development

This chapter details and describes the objectives the solution aims to achieve and describes the proposal in more detail.

5.1 Objectives

The main goal of this study is to facilitate the adoption of ISO 20022 for payments by corporate users. Even though the case that will be detailed is specific to the context of one organization, with its context and peculiarities, system landscape and challenges it is exposed to, the model of adoption that is followed and the design of the objects that support the model can be used as a reference by any other corporate wishing to adhere to the standard.

Financial institutions can also take advantage of this study to gain better visibility and understanding of the upstream challenges and limitations faced by their corporate customers and factor this knowledge in during their process of adoption of the standard.

As captured in the SLR, a research gap exists regarding the identification of success factors in the adoption of ISO 20022. This translates into a lack of guidelines and technical specifications that could potentially help corporates on their road to migrating to or adopting the standard. This research proposes to bridge that gap, through the development of an adoption model and required technical components. The objects to be developed all relate to the creation of the payment initiation instruction (the final output according to the ISO 20022 pain.001.001.03 format), and the supporting functionality to successfully achieve that final output. These objects have dependencies, meaning that the success of the implementation of one object heavily relies on the successful implementation of the previous object in the chain of dependencies.

The three proposed technical objects can be categorized as:

- Custom Forms – To enrich payment-related data and provide additional logic and flexibility;

- XML Master File schema – a set of instructions and rules required for the creation of a structured XML file containing relevant data and elements to be included in the payment instruction (including the enriched data from the Custom Forms artefact);
- XSLT Transformation Template – a set of rules to be applied to the XML Master File output which results in the creation of the ISO 20022 pain.001.001.03 instruction.

To develop the proposed objects, a project management and execution approach based on the Agile manifesto¹¹ was selected. This approach ensures that a project can be continuously improved upon throughout its life cycle, with changes being made quickly, responsively and in iterations. It is a widely used methodology in the IT world, and given the context, risks, challenges, requirements, and objectives, in addition to the organization’s experience in working in Agile-enabled environments, seemed like the best option to be adopted.

The approach follows a flow of steps, represented in **Figure 5.1**.



(source: <https://producttribe.com/project-management/agile-sdlc-guide>)

Fig. 5.1: The six steps of the Agile methodology

The planning phase consists of several activities, critical for the success of the project. Discussions are held with the relevant stakeholders (both internal and external) to

¹¹ <https://agilemanifesto.org/>

fully understand the 'as-is' status, the objectives to achieve, collect the requirements, define the strategy and prepare the next steps.

The design phase focuses on the specification of the components that will be developed, tested, deployed and reviewed. With continuous improvement in mind, several iterations are executed, as many as required to meet the objectives of the project.

5.2 Context

The elaboration of this master's thesis finds its foundation in a solution implementation project undertaken in a professional environment. This project aimed to assist an organization, acting as a payment initiator, in adopting ISO 20022, enabling it to effectively manage its disbursement process through the electronic transfer of funds to its beneficiaries.

For this purpose, an adoption model was created, comprised of processes to gather, compile and map requirements, and several technical objects were developed to create a technical solution.

It is important to know the organization and understand the context this project was executed. It operates on a global scale, undertaking projects in virtually every country or territory in the world. It is headquartered in one European Union (EU) country, where approximately 90% of its staff is assigned, having very few regional offices or facilities in countries other than the main site. Even with very few physical representations abroad, business is global and so is its distribution of beneficiaries of payments.

Statistics collected show that this organization issues, on average, over 60.000 payments every year for a total of over an equivalent of 550 million EUR. Beneficiaries of the payments hold bank accounts in a total of more than 175 countries or territories. Electronic payments are not issued to countries with underdeveloped banking platforms or facing sanctions.

All payments are issued centrally from the headquarters by a dedicated Treasury team, responsible for managing both the fund's disbursement and collection processes. Other teams have direct or indirect involvement in the process, such as Master Data

Maintenance, Accounts Payable or the IT Helpdesk. All these teams are also geographically centralized and operate from headquarters.

Electronic payments are currently issued from a total of 5 bank accounts, held in 5 different countries and belonging to 3 different banks. Table 5.1 lists the banks and bank accounts and additional relevant details. A profile is assigned to each bank account, describing its intended use. The definition of the profile is the consequence of applying selection criteria to the documents payable to be paid, based on the document currency, payee bank account country or the type of transfer. Following this configuration, a total of 5 different payment initiation formats are being maintained.

Table 5.1: Initiator bank account details and profile

Bank	Bank Acct.	Currency	Profile	Payment Format	Statement Format
Bank A	EU	EUR	SEPA (EUR payments to SEPA zone countries)	ISO 20022 SEPA	MT940
			Global (payments in any currency except for USD to any country). Can be a backup for both accounts in Bank C	UN EDIFACT	MT940
Bank B	NY	USD	ACH (US local payments in USD only)	ACH	MT940
			Booked Transfers and any international USD payment	Proprietary	MT940
	UK	EUR	Backup of 'Bank A – EU' account for SEPA payments	ISO 20022 SEPA	MT940
Bank C	CA	CAD	Local payments in CAD only	MT101	MT940
	JP	JPY	Local payments in JPY only	MT101	MT940

'Bank B – NY' account is particular in the sense that Bank B is a Clearing House Interbank Payments System (CHIPS) participant. CHIPS is the United States' main electronic funds-transfer system for processing international U.S. dollar funds transfers made among international banks (U.S. Department of Treasury, 2006). Access to the CHIPS payment system is conditional upon a financial institution's U.S. presence. In other words, the financial institutions using CHIPS must operate a U.S. branch or office for the use of the system. Accordingly, the CHIPS system does not permit a participating U.S. financial institution to transmit instructions or transfer funds directly to a non-U.S. financial institution, and for

this reason, an intermediary bank is always required. That intermediary may, or may not be, another CHIPS participant.

Beyond the scope of this project are the organization's plans to extend the use of 'Bank B - UK' account to serve as a full backup of 'Bank A - EU' account, not only for SEPA payments. A rollout to a sixth account is also on the horizon, pertaining to Bank A and serving as a full backup of 'Bank B - NY' account.

This configuration has not had any relevant change since the year 2015 when the SEPA initiative took place and ISO 20022 was adopted for the first time in the organization. The use of the remaining formats remains constant since its inception in 2010, a time when most financial institutions were not even technically capable of processing ISO 200022 instructions. This provides background to the current landscape, with the coexistence of multiple standards.

The two main accounts are 'Bank A – EU' and 'Bank B – NY', from which roughly 97% of all payments are initiated. In its database, the organization accounts for more than 140.000 different payees, for which at least one payment has been issued. The structure of its master data is complex, as real-life business scenarios allow the same payee to be paid to different bank accounts, held in several banks and geographies and different currencies. It is not unusual for the same payee to engage with the organization through different business processes, triggering the creation of payable documents with different characteristics, and consequently different means of payment.

The organization, driven by the quest for modernization, sustainability, and efficiency, has, throughout the years, embarked on the road to digitization. Several initiatives have already been undertaken, which have led to the consolidation of processes and workflows. Such initiatives include, but are not limited to, the acquisition and implementation of robust back-office software and other business support systems solutions. Several custom developments and services have been implemented as well, in attempts to bridge gaps in required functionality not covered by the licenced off-the-shelf commercial solutions – the best example is the acquisition and integration of a global bank and branch database, integrated with the back-office systems, ensuring the correctness of bank/branch related data.

Despite all the efforts, the organization is still feeling severe pain points in its payment-related operation. It wishes to take the current infrastructure and processes to the next level, be fully compliant in the future and take advantage of the potential benefits introduced by ISO 20022.

5.2.1 Pain points

The most impacting pain points felt by the organization are summarized below. These pain points have surfaced or aggravated throughout the years, and are mainly related to the changes in the payments landscape and the need to adapt operations to the new market needs, such as the availability of richer and better-structured data. Operational issues, such as difficulties in managing master data and other recommended or mandatory elements, arose because of the new market demands:

1. Noticeable increase in the volume of payment rejections and inquiries from banks, resulting in additional manual work, fees, and delays. This is visible on all payment profiles, except for SEPA. It originates from the tighter KYC requirements by regulators and local authorities, and the limited possibilities of the payment formats used in terms of richness and structure of data;

2. Difficulty in managing and supporting the different payment formats, often leading to significant time being used in clarifying the requirements, executing, testing, and deploying the required technical intervention. Such changes are typically urgent and expected to be deployed in the shortest time frame possible (ideally within 1-2 days). Failing to react quickly results in time-consuming manual workarounds (for instance, resorting to e-banking platforms to process every individual payment or temporarily update payee master data);

3. Inefficient management of payee and bank/branch master data. Given that all 5 different formats require data in different formats and configurations, and the fact that the same payee may be paid through different profiles, the organization faces difficulties in maintaining a set of data that can serve all the formats in use. Examples are related to the

allowed length of text strings and truncation, the allowed character sets which are not consistent between all the formats, and the unstructured approach to recording intermediary bank relationships;

4. Inability to derive Purpose of Payment (POP) codes and descriptions for every individual payment document, abandoning its use, or limiting it to the default value assigned at payee master data or manual input on every payable document. These are not viable options;

5. Ineffective management of intermediary banks, without established relationships between initiator and beneficiary bank or branch, resulting in repeated records and several inconsistencies;

6. Initiator bank usage rules for IBAN or BBAN are not consistent and often change, resulting in the need to remediate the payment file and/or resort to workarounds;

7. Inexistence of controls to proactively detect potential issues during the payment execution process;

8. Inefficient bank reconciliation process due to the inexistence of consistent cross-references between payment instructions and electronic bank statement formats, and the inability to take advantage of the batch-booking functionality when using the SEPA format. When batch-booking is used, a statement line refers to an entire payment batch and not to every individual payment, allowing multiple detail entries to be reconciled against a single bank statement line, whenever deemed appropriate.

5.2.2 Requirements

Given the difficulties explained above, the organization laid down its requirements, and objectives to be achieved by undertaking this project. These can be summarized in the following:

1. Harmonise the communication of the payment instructions by adopting one single standard, able to fulfil all the business scenarios. Such standard needs to be globally used, data-rich and compliant with KYC regulatory requirements;

2. Allow easy and prompt rollouts to new banks and bank accounts, and extend the functionality to existing bank accounts (such as different and richer remittance types, real-time payments, and Swift GPI tracking, among others);

3. Reduce the dependency on the internal IT Helpdesk or software vendor support. Adopt a solution that is more transparent and flexible, that relies less on “hard coding” or any type of technical intervention from external parties. Develop a flexible rules engine that can be exposed to and understood by selected non-technical business users, allowing their direct involvement in the definition and testing of the rules, contributing to a faster deployment of changes, corrections and improvements;

4. Enhance the quality of master data through a clean-up and data-enrichment exercise, and by adding structure to payee and bank/branch data. Improved handling of POP, adherence to IBAN, and flexible definition of intermediary bank relationships, abandoning unreliable workarounds and the use of free-text fields to store such details;

5. Significantly reduce the number of rejections or inquiries, and consequently time, effort and fees.

After extensive research, it was the understanding of the organization that the adoption of ISO 20022 would significantly contribute, directly or indirectly, to the attainment of these objectives. This is to be made possible through the extensive use of the following ISO 20022 formats:

- pain.001 - payment initiation format (customer to bank);
- pain.002 - payment status report - feedback (bank to customer);
- camt.053 - end-of-day bank statements (bank to customer).

It is to be noted that pain.001 was already in use by the organization, but for the SEPA payment profile only. Nevertheless, challenges remained and needed to be addressed, so it was considered necessary to revisit this format.

The integration of pain.002 files help allow the organization to acknowledge certain types of rejections within a short timeframe following the transmission of the payment instruction to the initiator bank.

Even though the use of the MT940 format for bank statements has never been problematic, the organization wishes to take advantage of ISO 20022 richer data capabilities. Due to its simplified structure, the integration of camt.053 bank statements into commercial cash and treasury management systems are typically made possible through out-of-the-box integrators, generally available in most commercial solutions.

The integration of pain.002 and camt.053 can vary in complexity, depending on what business processes are supposed to benefit from the integration. Bringing data into the system to fulfil the purpose of loading bank statements (for reconciliation against recorded cash-flows) and parsing the pain.002 file to create a report is typically not challenging from a technical perspective. If, for instance, the goal is to automate the execution of tasks, such as the automatic creation of receipts (from data in the bank statements and structured references), or the automated confirmation of payments in the system and communicating payment confirmation letters to beneficiaries, complexity increases significantly. In either case, this research will not focus on any of these formats and their possible integrations.

5.2.3 Risks

Several risks have been acknowledged. These can potentially make the adoption more difficult to achieve or compromise its overall success.

Having already gone through the implementation of electronic payment formats and having an established working experience with the three initiating banks, issues are being anticipated regarding the quality of support, especially in the provision of reliable technical specifications and functional manuals. Incomplete and not up-to-date documentation, as well as unclear or ambiguous rules, all translate into issues ahead in the process (Virtanen, 2013).

The most significant acknowledged risk is the fact that it is impossible to fully test the solution without being live. Initiator banks can validate the structure of the payment messages and perform data quality-related checks, but are unable to simulate full end-to-end flows. A full process would necessarily involve third parties, such as intermediaries and beneficiary banks, and processing data through several payment clearing and processing

systems. This means that a file may successfully pass the tests promoted by the initiator bank, but the same file may not result in successful payments in a live environment.

For the same reason, processing bank statement files cannot be fully simulated in test environments. Certain attributes of the payment initiating instructions, such as structured or unstructured remittance messages, batch-booking indicators, or several types of end-to-end references, will impact the format the bank statements are produced in.

It is also acknowledged that ISO 20022 is evolving and is subject to changes. From the perspective of banks, their specific requirements may change as well, and this is especially true for the financial institutions currently undergoing the update of their infrastructures to comply with ISO 20022 in the inter-banking space.

5.3 Phases

Following the Agile-based methodology described in the [Development](#) section, a description of the several project phases is provided.

5.3.1 Plan

Based on the context of the organization and several inputs, the baseline of the project plan was created. A high-level view of the baseline plan is presented in Figure 5.2.

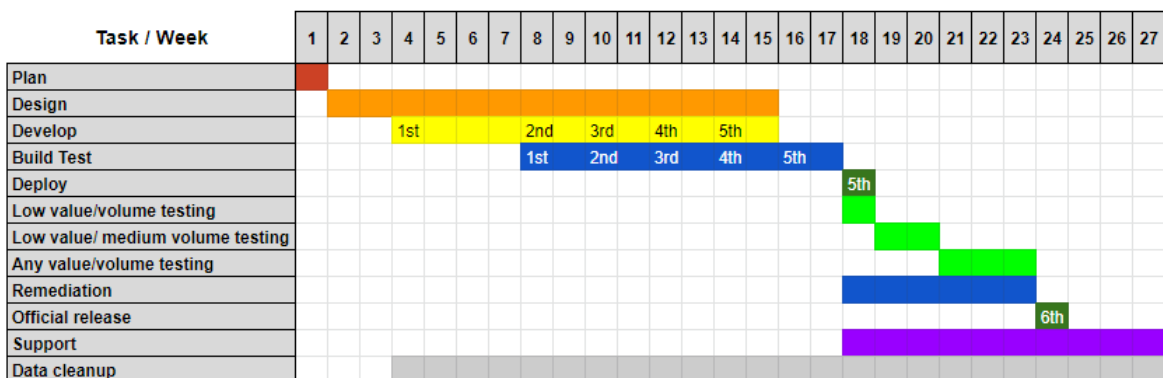


Fig. 5.2: Baseline of planned activities with an indication of each release

The duration of the project, from initiation until go-live, was estimated to be 23 weeks. Given the collected input and the analysis performed, a total of 6 releases of the product were estimated to be created, the last one ready to handle the entire volume of payments of the organization.

The first release, a functional prototype, was expected to be ready within the first five weeks of development, and the subsequent releases every two weeks following the first release (two-week sprints). It includes the development in parallel of all the technical components and preparation of the master data clean-up exercise.

Testing, with the acknowledged limitations, takes place in parallel with the development activities.

The deployment in the production environment was expected for week 18, consisting of a 5th release. Given the risks, controlled live testing, with growing value and volume of payments, would take place. Following the controlled testing, an official (and more stable) 6th release had been anticipated for week 24, after seven weeks of testing, or once the solution demonstrated enough robustness to be considered fit for use and not pose any substantial risk to daily operation.

5.3.2 Development

Agile is an iterative approach, that supports output delivery through increments. The design phase involves multiple processes: research, sketch, design, prototype, test and refine. During this phase, all the relevant information necessary for the design of the solution was collected and consolidated.

A series of documents were collected from multiple sources. Such documents include the most up-to-date SWIFT IBAN (International Bank Account Number) Registry¹² documentation, from which the official list of IBAN adopters was retrieved, as well as the indication of these adopters as being part of the SEPA zone.

The documentation from the three initiator banks was collected and consolidated, comprising functional manuals and technical instructions. It was possible to extract a list of

¹² <https://www.swift.com/standards/data-standards/iban-international-bank-account-number>

all the necessary elements to generate payment instructions, for each destination country or territory, and payment profile (SEPA, domestic or cross-border).

All the documentation that was collected included overlapping information on several elements, including the IBAN usage rules and required data to be included in the payment instructions. As a consequence of the consolidation exercise, it became clear that there is not a common understanding between banks on several of the elements that were collected. One clear example is the status of the adoption of IBAN by each country or territory, and consequently the recommended use of IBAN or BBAN (Basic Bank Account Number) as the account identifier. This happens for both adopters and non-adopters of IBAN (according to the official SWIFT IBAN Registry), with a third status of 'in transition to IBAN' having to be considered to accommodate more possibilities.

Several other local required elements were also not commonly handled by banks. These include, for instance, the need to provide beneficiary contact details, and beneficiary Tax Identifiers, among others. For such elements, it was decided to, whenever a discrepancy was identified for a specific element, always include the element in the payment instruction. For instance, if Bank A specifically requests the beneficiary Tax Identifier to be provided for a specific country, and Bank B doesn't, the rule is to consider that element to be included for all the banks and for that country. The output of this exercise is consolidated and detailed in [Appendix II](#).

Special requirements related to the Purpose of Payment and Intermediary Bank relationships were also captured. These cases will deserve more detail in sub-sections [IBAN Usage Rules](#), [Purpose of Payment](#), and [Intermediary Banks](#).

Having collected all the requirements, the next step is to map the data collected to the pain.001 XML tags, defining all the specific rules to present the data according to every country and initiator bank requirements. This mapping is made available in [Appendix III](#). A matrix was created, including all the XML tags that the banks require (excluding all the tags that will not be used) and the usage rules for each bank and payment profile. The intersections include references to the source of data, the XML Master File, which will be explored in subsection [XML Master File and Schema](#).

High-Level Solution

A high-level design of the solution was created, which is represented in Figure 5.3.

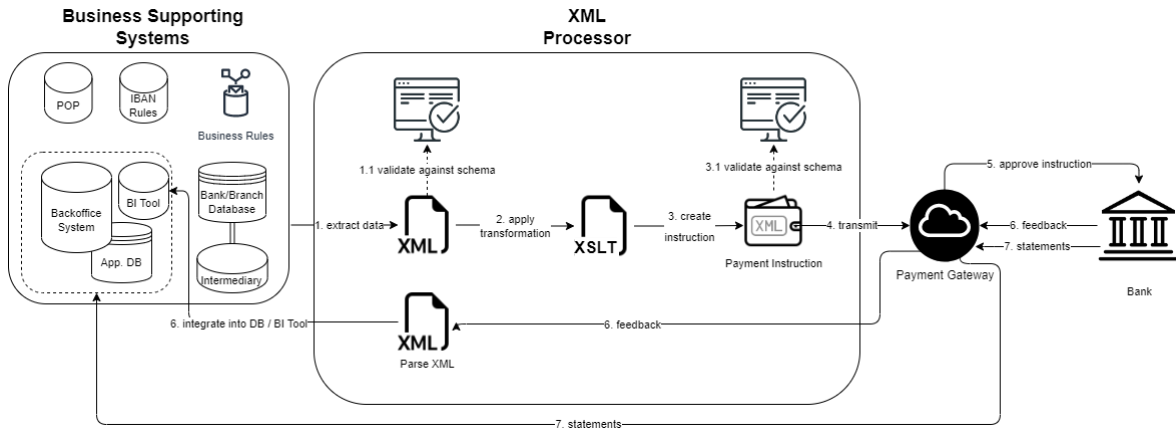


Fig. 5.3: High-level solution design

It provides an overview of the technical landscape and enables the understanding of how instructions are created, and feedback and bank statements are integrated.

The source of data for the payment instructions lies entirely within the Business Supporting Systems (BSS). The relevant systems are the back-office application, combined with data stored in the Bank/Branch Database, and custom extensions designed to cover for limitations or improvements identified during the analysis that was performed. These extensions are designed to derive the POP to be included in the payment instructions, allow a flexible mapping for the use of IBAN and BBAN, and manage intermediary bank relationships.

The flow initiates with the data extraction process from the BSS, directly into XML format. The output of these queries will be referred to as “XML Master File”. This is achieved by leveraging the database XML creation capabilities; therefore, no XML processor service or any other type of middleware needed to be called at this stage. The specifications of this format are detailed in an XML Schema Documentation file, containing all the design rules the structure of the XML must comply with. Such rules can be, for instance, the order of the tags, specification of mandatory/optional tags, conditional tags, cardinality, and minimum or maximum length, among other attributes.

During the data extraction process, a set of business rules needs to be applied to translate the data from the source BSS databases into a more meaningful and human-readable format, or into a final format that will be ready for use in the next stage of the process without any transformation. Every business rule used is detailed in [Appendix V](#) as part of the design of the XML Master file.

Once the data is extracted, using an open-source XML Processor service, the XML Master output is verified against its schema, and any violation of a rule will be highlighted. In this context, the main purpose of the schema is to assist in the development of the XML Master file, and a violation of a rule does not necessarily mean that the payment instruction creation process needs to be aborted and the XML Master extraction process remediated. For instance, if a mandatory XML tag is not generated because there is no data available at the source, that does not mean that there is a problem with the XML Master creation process. However, if a cardinality rule is violated because the same tag is created multiple times instead of creating a single occurrence, that may indicate a real issue in the development process of the XML Master file. Remediation is then necessary, as it could compromise the subsequent step related to the payment instruction creation process.

The next step consists of transforming the XML Master file into the final pain.001 XML instruction. For that, leveraging the open-source XML Processor service, an XML Stylesheet Language Transformation (XSLT) template is applied to the XML Master extract, resulting in the creation of a new XML file observing the expected structure and the requirements of the pain.001.001.03 format. This XML instruction can then be verified against SWIFT officially published schema files (as part of the ISO 20022 repository¹³), and any violation of the rules aborts the process. In such cases, urgent remediation is required, as it may indicate that a problem exists either with the XSLT template or the source data. A violation of a single rule makes the entire payment instruction invalid, and consequently, all the individual payments contained in it invalid as well.

A Payment Gateway cloud service is licensed and implemented, dedicated to exchanging messages and files between the organization and its banks. All ISO 20022 files

¹³ <https://www.iso20022.org/catalogue-messages/iso-20022-messages-archive>

with formats pain.001, pain.002 and camt.053 will be exchanged exclusively through this cloud service.

The service allows the organization to use a single point of connection, not having to develop new host-to-host integration services with every bank and maintain these connections. It also enables the definition of approval workflows and alerts, reports, and an anti-tampering security mechanism on the payment instructions. Such a mechanism works by verifying a digital signature (hash) associated with the payment message before the final transmission to the banks, blocking the possibility of final transfer whenever there is a mismatch of digital signatures generated at the moment of creation of the instruction and upon receiving it at the Payment Gateway cloud service.

Once the file is transmitted to the Payment Gateway cloud service, it follows an approval workflow, and once completed, the instruction is transferred to the initiator bank, which relays the instructions to the intermediaries and beneficiary banks. In a short period after the transmission (expected to be up to one hour), the initiator bank feeds back the payment status report (pain.002), another XML file, which is then parsed using the XML Processor, having its content integrated into a database pertaining to the BSS.

The Business Intelligence solution consumes this data and, in a custom-designed dashboard, presents all the accepted/rejected payments that formed part of the transmitted payment instruction, along with other informative elements relevant to the payment creation process. Any rejection or alert will deserve the attention of the responsible staff and corrective actions can be taken.

Once a day, the banks forward camt.053 XML bank statement files, which are integrated into the back-office systems, and are then reconciled against payments and other cash-flow transactions recorded in the BSS. The rejections identified in the payment status report will not have corresponding lines in the bank statement lines imported the next day or subsequent days, thus saving effort in identifying exceptions. This is an out-of-the-box integration provided by the back-office system vendor, not complex in nature.

Master Data Management

The quality of master data and its appropriate placement and formatting within the payment instruction is fundamental for the success of the execution of electronic payments. The adoption of ISO 20022, requiring highly detailed, granular, and structured data, stresses the need of performing a master data quality assessment exercise and clean-up. Not having quality master data to provide inevitably increases the risk of rejection or inquiries from the bank, which ultimately translates into additional effort and fees.

One goal of the exercise of collection of payment initiation-related elements and formatting rules, country, and bank-specific requirements, is to provide an input that would drive the structuring and clean-up of the payee and bank/branch master data.

It was noted that different banks and countries have different requirements in terms of the allowed character sets. A strategic decision was made to allow only subsets of the Latin-1 (ISO-8859-1, decimal positions 32-255¹⁴) and Latin Extended-A¹⁵ character sets to be used to record any payee or bank/branch master data. The only notable exception is for the payee's bank account alternate name, which should not have any restriction. The reasons supporting this decision are the technical possibility of translating Latin Extended-A into simpler forms of Latin characters, and the specific needs of countries in providing bank account names in local character sets (domestic payments in Japan require the bank account name in the half-width Katakana character set, for instance). A clean-up exercise ensures that these requirements were met upon testing and go-live with the solution.

Another important exercise occurred on the validation of the structure of IBAN and BBAN, check digits, routing codes, and bank and branch identifiers. Legacy formats, not rich in data, often concatenate several of these elements, whereas ISO 20022 provides dedicated tags to store all these elements. For instance, routing codes were often being concatenated with bank account numbers, however, doing so using ISO 20022 would likely cause issues while processing such payments as it needs to be broken down into two different tags.

¹⁴ <https://cs.stanford.edu/people/miles/iso8859.html>

¹⁵ https://en.wikipedia.org/wiki/Latin_Extended-A

The exercise focused on ensuring that IBAN and bank account numbers, bank and branch identifiers and any routing codes were broken down and stored in the appropriate fields, according to the specifications (length) that were collected and consolidated in [Appendix II](#). The bank and branch master records, being fed from and synchronized with a commercially acquired and highly detailed database, did not require any deep intervention.

However, this exercise could potentially raise issues. The planned activities state a period of six weeks of coexistence between legacy formats and ISO 20022 payment initiation formats, and this exercise would compromise the use of the legacy formats. The adopted strategy was the careful selection of payees to be paid through pain.001 format, cleaning up their master data and making sure that these payees are not paid through the legacy formats. Once confidence in the ISO 20022 format grows, and the go-live takes place, a comprehensive clean-up exercise takes place through a mass update, with rollback possibilities if major issues arise.

Given the complexity of the task, the significant number of payees in the database, and having acknowledged the rules necessary to perform the clean-up exercise, it was also decided to do it in multiple phases. The first phase would contemplate all the payees created in the past 365 days, and those who have had a payment issued to them in the same period. Subsequent phases incorporate more payees.

IBAN Usage Rules

It was observed that the IBAN adoption status and usage rules are not commonly observed between banks. Even though SWIFT regularly publishes the technical specifications of the IBAN formats of those countries that are compliant with the IBAN standard (IBAN Registry), the analysis showed that SWIFT's list of IBAN adopters does not fully match the ones provided by the banks. Exceptions were also noted for IBAN adopters and the IBAN usage rules, and for some countries like the UK, the use of IBAN was not recommended when processing domestic payments.

Other exceptions were observed, such as the existence of a third IBAN adoption status, the 'Transitioning' status. Countries such as Algeria or Angola, are not part of the official IBAN registry but are already producing IBANs, having different usage rules assigned

by each bank. Even the SEPA status of three territories (the British Crown Dependencies of Jersey, Guernsey, and the Isle of Man), despite being flagged by the EPC as part of the SEPA zone, were not acknowledged as such by Bank A.

A new form was designed to allow the configuration of such elements. By setting the context to each initiator’s bank and bank account, it is then possible to define the usage rules and SEPA status for each destination country or territory.

Bank Name		Bank Account			
Bank A		EU			
Country Code	Country	IBAN Status	SEPA Country	IBAN Usage	
				Domestic	Cross Border
AF	Afghanistan	No IBAN			
AL	Albania	Active	No	Yes	Yes
DZ	Algeria	Transitioning	No	No	Recommended
AD	Andorra	Active	Yes	Yes	Yes
AO	Angola	Transitioning	No	No	No
AI	Anguilla	No IBAN			
AG	Antigua and Barbuda	No IBAN			
AR	Argentina	No IBAN			
AM	Armenia	No IBAN			
AU	Australia	No IBAN			
AT	Austria	Active	Yes	Yes	Yes

Fig. 5.4: IBAN usage configuration form

The behaviour of this custom extension form and its relation with the XML Master generation process is detailed in [Appendix IV](#) and [Appendix V](#).

Purpose of Payment

It was observed that most countries require or strongly advise a text description of the POP, whereas a limited number of countries require a justification from officially published lists, different for every country requiring it. Differences were also identified in the lists available for the POP, which are different depending on the initiator bank (the case of China, for instance).

For that reason, a new configuration form has been designed, enabling the automatic derivation of the POP through the use of a rules engine. It works within the context

of each bank, and through the specification of rules for each destination country or territory, produces an output (a code, text, or combination of both) that will be used to populate the payment instruction.

The set of conditions used for the derivation of the POP is specific to every organization and the particular aspects of the back-office system it consumes data from; therefore it cannot be taken as-is by any other organization. It can, however, serve as a reference.

The behaviour of this custom extension form and its relation with the XML Master generation process is detailed in [Appendix IV](#) and [Appendix V](#).

Bank Name						Purpose of Payment		
Bank A						Code	Text	Print
Country Code	Country	Payee Type	Transaction Source	Transaction Type	Payment Group			
<Any>	<Any>	<Any>	Travel	<Any>	<Any>		Travel Related Expenses	Description
<Any>	<Any>	Employee	Payroll	<Any>	<Any>		Salary, Wages or Staff Welfare	Description
<Any>	<Any>	Supplier	Accounts Payable	<Any>	<Any>		Payment for Goods and Services	Description
AE	United Arab Emirates	<Any>	Travel	<Any>	<Any>	TKT	Tickets	Code
AE	United Arab Emirates	<Any>	<Any>	<Any>	AMEX	TKT	Tickets	Code
AE	United Arab Emirates	Employee	<Any>	Staff Welfare	<Any>	FAM	Family Support	Code
AE	United Arab Emirates	Employee	Payroll	<Any>	<Any>	COP	Compensation	Code
IN	India	<Any>	Travel	<Any>	<Any>	P0302	Business Travel	Both
IN	India	Employee	Payroll	<Any>	<Any>	P1401	Compensation of Employees	Both
IN	India	Supplier	Accounts Payable	<Any>	<Any>	P1002	Trade Related Services	Both

Fig. 5.5: Purpose of Payment configuration form

Until the development of this form, it was the responsibility of the payables document preparer to populate the POP for each document payable, which, given the complexity of the rules involved, often resulted in incorrect data being provided and rejection or delay of payments. No POP was being entered for system-generated documents payable, such as employee expense reports, and payroll documents, among others.

The payables document preparer no longer must type or select an appropriate POP unless it is necessary to override the automatically derived POP. For instance, if a rejection happens due to the use of an inadequate POP, the payables document preparer can access the document and select a more appropriate POP, that gets integrated into the XML Master file when reprocessing the payment in a subsequent pay run.

Intermediary Banks

Cross-border payments originating from Bank B - NY account may require the intervention of an intermediary bank, whenever such a relationship is established between the financial institutions. Failing to provide the intermediary bank details in the payment instruction can lead to delays, inquiries, and repair fees.

The only bank account considered in the scope of this project that requires this type of detail is the 'Bank B – NY' account. In the future, it is planned that the 'Bank B – UK' account serves as a full backup of the 'Bank A – EU' account (not only for SEPA payments), and it will require a structure of intermediary relationships to be created. More rollouts are planned for the near future, and the organization requires to have a common approach towards intermediary banking relationships for all the cases the definition of relationships is necessary and possible.

The analysis showed that despite belonging to Bank B, the relationships to establish are different for both accounts, and it was also concluded that the type of structure required for Bank B - UK account was aligned with the requirements of several other commercial banks. The case of Bank B - NY account is particular as it is a United States-based bank and is from a CHIPS participant, having its network of intermediary banks. This network is established by identifying the beneficiary bank account branch, and then selecting one bank (from the multiple available participants) to be used as an intermediary. These relationships can be consulted online, and the initial data to load the database was sourced from the existing unstructured master data (after a clean-up exercise). The 'Bank B – UK' account, despite being from a CHIPS participant, is not held in a United States branch and cannot use the same relationships defined for the 'Bank B – NY' account.

Therefore, a custom form has been designed to define intermediary relationships between banks and branches, allowing the possibility of user-defined configuration for all the known scenarios, current and future. A mock representation of the form is visible in Figure 5.6, with an example of the 'Bank B – NY' account and relationships defined between CHIPS participants (as intermediaries) and other banks and branches in foreign countries.

Bank Name	Bank Account	Branch	
Bank B	NY	NY Branch	

Currency	Beneficiary			Intermediary			
	Country	Bank	Branch ID	Bank	Bank ID	Branch ID	Account ID
USD	Australia	Bank of America - Australia	BOFAAUSX / CUID 280482	Bank of America	CHIPS 0959	N/A	N/A
USD	Australia	Bank of China - Australia	BKCHAU2A / CUID 433886	Bank of China	CHIPS 0326	N/A	N/A
USD	Australia	Bank of Communications	COMMAU2S / CUID 437213	Bank of America	CHIPS 0959	N/A	N/A
USD	Australia	Bank of Queensland	QBANAU4B / CUID 059479	Bank of America	CHIPS 0959	N/A	N/A
USD	Australia	Bank of Western Australia	BKWAAU6P / CUID 003864	Citibank	CHIPS 0008	N/A	N/A
USD	Australia	BNP Paribas Securities	PARBAU2S / CUID 438802	BNP Paribas NY	CHIPS 0768	N/A	N/A
USD	Australia	BNP Paribas Sydney	BNPAAU2S / CUID 011702	BNP Paribas NY	CHIPS 0768	N/A	N/A
USD	Australia	Citibank Limited Sydney	CITIAU2X / CUID 230911	Citibank	CHIPS 0008	N/A	N/A
USD	Australia	Credit Suisse 230911	CRSAU2S / CUID 341975	Bank of NY Mellon	CHIPS 0001	N/A	N/A
USD	Australia	Deutsche Bank Australia	DEUTAU2S / CUID 246051	Deutsche Bank	CHIPS 0378	N/A	N/A

Fig. 5.6: Intermediary Bank Relationships configuration form

The behaviour of this custom extension form and its relation with the XML Master generation process is detailed in [Appendix IV](#) and [Appendix V](#).

XML Master File and Schema

The creation of the payment instruction is the most important and complex process in this flow. To generate it, a two-step process has been designed, consisting of an initial extract of data in a fixed format (the XML Master), and an XML transformation template (XSLT) to be applied to the XML Master.

The XML Master is essentially the output of a query to the Business Supporting Systems databases, incorporating a set of business rules. The BSS databases include the data and rules defined for the definition of IBAN Usage, POP, and Intermediary Banks relationships. It is the result of a purely technical procedure, not accessible or fully acknowledged by users in the non-technical business units (Treasury, Accounts Payable and Master Data Management departments). However, once a version considered to be stable is released, it is assumed that little or no remediation is expected to happen to this XML Master extract in the future.

To minimize the risk of having to remediate and include additional tags in the XML Master, and to be able to support future rollouts to new bank accounts, a strategic decision was made, to capture more detail than the one considered strictly required and to create placeholder tags for future adoption of new functionality. Therefore, the structure of the XML Master is very rich in detail.

[Appendix V](#) includes the XML Schema file, against which the XML Master files can be tested. Its full structure is graphically detailed in the same Appendix, including annotations and the definition of business rules.

In summary, the XML Master file is comprised of one main branch (or tag), splitting into multiple sub-tags, which store data used for different purposes. A graphic image of the parent structure, showing up to three levels of detail, can be observed in Figure 5.7.

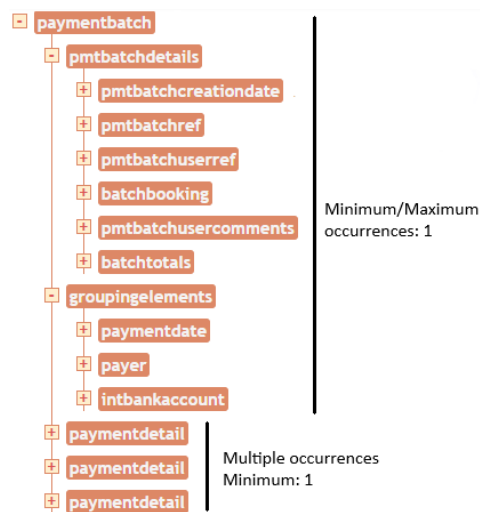


Fig. 5.7: XML Master file main branch

The 'paymentbatch' tag is the main tag, under which all the sub-tags form, allowing a single occurrence for this tag. The 'paymentbatchdetails' and 'groupingelements' tags are used to store miscellaneous information related to the payment batch, such as the creation date, miscellaneous identifiers, user-created references, a summary of the batch totals (total number of payments and amounts broken down by payment currency), and payer and initiator bank account details.

In turn, the 'paymentdetail' tag is created for every individual payment, therefore a minimum of one entry is expected and an unlimited number of occurrences are possible. It is comprised of several sub-tags, on multiple levels, and captures all the detail related to every payment that is part of the instruction. The first-level sub-tags are visible in Figure 5.8.

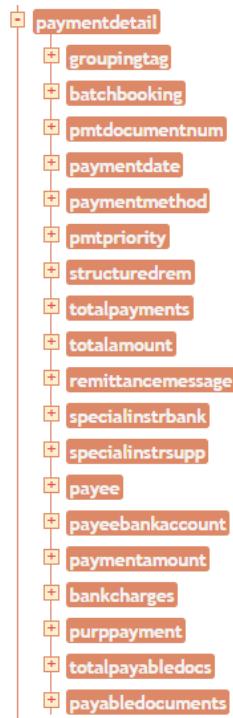


Fig. 5.8: First-level sub-tags of the 'paymentdetail' tag

Several levels exist in the structure, logically grouping a series of attributes under each parent tag. For instance, the 'payee' and 'payeebankaccount' tags are used to store the payee and payee bank account details, respectively. The first-level sub-tags of these two tags can be visualized in Figure 5.9. Tags such as the ones pertaining to the payee or bank addresses expand further into another set of sub-tags.



Fig. 5.9: Detail of ‘payee’ and ‘payeebankaccount’ sub-tags

XML Transformation Template

The creation of the pain.001 XML file is achieved, by applying an XSLT Template to the XML Master file. This template contains all the rules to be applied to the XML Master file, to produce the pain.001 instruction. Contrary to the process that generates the XML Master file, the XSLT template, its structure, rules, and conditions, are accessible and transparent, even to individuals lacking technical development skills. It allows changes to be performed, scenarios to be manually created, to be tested offline, and its structure and output validated, with ease and resorting only to offline desktop applications.

Two possibilities for the technology to adopt were on the table: XSLT and Freemarker Template Language¹⁶, both able to effectively create XML payment instructions, and rich in functions and functionality that could potentially be used to perform the transformations. Due to several factors, XSLT was ultimately chosen to be the technology

¹⁶ <https://freemarker.apache.org/>

to adopt as its syntax was considered to be simpler to understand and code in, it integrated directly with the XML Master file through XPath¹⁷ (a syntax able to point to specific tags and sub-tags of an XML structure), and the availability of free and lightweight desktop applications that allow the easy modification of the templates and testing them offline for various scenarios.

An example of a simplified transformation of the XML Master can be observed in Figure 5.10, detailing the creation of the header elements of the payment instruction in the XSLT file. The syntax to identify the source data is XPath.

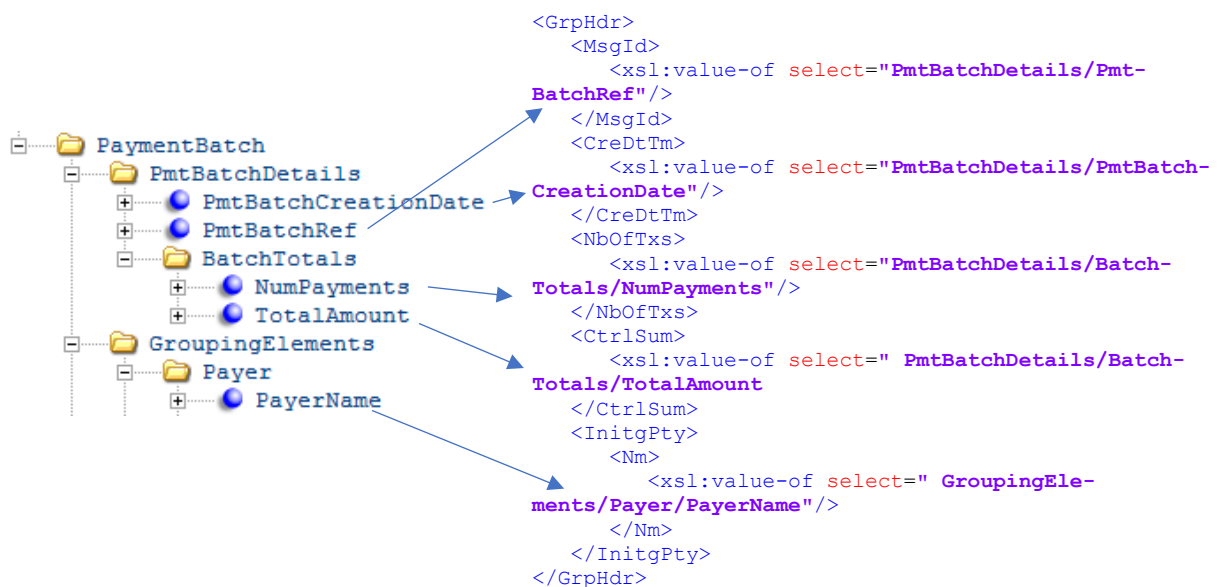


Fig. 5.10: Mapping between XML Master (left) and payment instruction (right)

Not only XSLT allows the possibility of mapping the contents of the XML Master file in the XSLT template, but it also enables:

- The ability to use functions to convert text strings or numbers, or apply other types of transformations (for instance, concatenate strings or truncate a text string to a defined number of characters);
- Define conditions to create and/or populate tags;
- Create groups, and loop within the contents of each group.

¹⁷ <https://en.wikipedia.org/wiki/XPath>

The final version of the XML Transformation Template, combining multiple examples of the use of the above-mentioned functionalities, can be consulted in [Appendix VI](#) as part of the [Demonstration](#) section.

Limitations do, however, apply to the use of XSLT as a technology. As the XML Processor service in use can only interpret XSLT syntax up to version 1.1¹⁸¹⁹, the development was constrained to the available functionality and functions in that version. Nevertheless, these were considered sufficient to proceed with the development, as workarounds were found for every challenge that was encountered. An example of such a limitation and the adopted workaround was the impossibility of resorting to the ‘replace’ function, which replaces a sequence of characters defined inside a string that matches an expression. Instead, the ‘translate’ function available in v1.1 achieved a similar result but using a slightly more elaborate syntax.

5.3.3 Test, Deploy and Review

The subsequent steps of the iterative process include the testing activities, deployment and review of the success of the implementation of the artefact.

Quality assurance testing is a critical component of Agile development. The developed product is tested regarding functionality and performance, making sure that it behaves according to the requirements. Any issues or glitches that are identified during this phase are resolved before the release of the product for the next stage. Following best practices, technical and functional documentation is produced and/or updated, reflecting the most up-to-date status of the product.

Testing strategies can vary and range from completely offline man-made scenarios to controlled cases in a live environment. Examples of such tests can be found in the [Demonstration](#) and [Evaluation](#) sections of this document.

¹⁸ <https://www.w3.org/TR/xslt11/>

¹⁹ XSLT v1.1 released in 2011, latest version is 3.0 as of the current date

After successful testing, the product release is promoted to the quality assurance or production environment, being made available to the user community. Following the deployment, feedback from the user community and relevant data from the system are collected and analysed with the intent of making improvements in upcoming iterations.

This development lifecycle consists of repeated iterations, leading to the improvement and quality of the product being developed.

6 Demonstration

This Chapter concerns the fourth step of the DSR methodology. According to Peffers et. al., this step consists in demonstrating the efficacy of the artefact to solve the problem (Peffers et al., 2007). Possible strategies can involve the artefact's use in experimentation, simulation, a case study, proof, or other appropriate activities. Resources required for the demonstration include effective knowledge of how to use the artefact to solve the problem.

The problem that has been identified is related to the complexity inherent to the process of adopting ISO 20022 for corporate organizations. This is felt, especially, for cross-border payments outside the SEPA zone. In the context of the organization where the adoption project is being carried out, the opportunities, challenges and success factors to observe are very much aligned with the outcome of the [Reporting](#) sub-section of the SLR, but more detailed and concrete, as one would expect when moving away from generalizations and embracing real-life problems.

The opportunity of carrying out an adoption project for an organization enables the demonstration through experimentation and simulation of multiple scenarios, being limited to the acknowledged constraints related to the impossibility of performing full end-to-end testing.

To demonstrate the feasibility of the artefact, several real-life scenarios were considered, and the artefact was put to the test. This was done using the prototype, which incorporates elements from all the components pertaining to the adoption model.

A prototype can be generically defined as an early sample, model, or release of a product built to test a concept or process, and is generally used to evaluate a new design to enhance precision by system analysts and users ²⁰.

According to Brocke et al., in the context of DSRM, the researcher might want to demonstrate that the artefact works in practice and solve the identified business problems, i.e. it is feasible, and identify unintended effects of an artefact as they emerge in the

²⁰ <https://en.wikipedia.org/wiki/Prototype>

interaction with other organizational elements. The researcher might want to see how the artefact interacts with organizational elements, i.e. “real tasks”, “real users”, or “real systems” (Brocke & Sonnenberg, 2012). A design researcher could already apply naturalistic evaluations to capture the organizational context and infer on the artefact’s usefulness before it is used within an organization.

Having a functional prototype available for demonstration and having a Quality Assurance infrastructure ready (a recent copy of the entire Production environment), enables the demonstration of countless business scenarios, including, but not limited to, the ones identified as pain points for the organization. It makes it possible to observe and measure how well the artefact supports the solution to the problems by comparing the objectives to the actual observed results from the use of the artefact (Peppers et al., 2006). Not only it is possible to fully reproduce issues that occurred in the past, but it is also possible to simulate scenarios by creating new master and transactional data in the system according to the needs. It is also possible to create ‘what-if’ scenarios, for instance, by simulating how the same payment would be represented in a payment instruction when created according to the specifications of different banks.

[Appendix VII](#) consolidates the input and output of six different business scenarios, considered to represent a reasonable array of possible situations for demonstration. Many other scenarios can be and were demonstrated. However, due to the high volume of possible inputs, these scenarios are not included in this research, only a summary of those considered to be the most relevant and representative of the challenges.

The scenarios include examples for all banks and bank accounts in scope, with variations in each format. For all situations, compliance with the published pain.001 XML schemas were observed, and visual inspections of the structure and relevant elements of the files produced were performed with special attention given to problematic scenarios. Despite the known limitations, sample files were sent to banks for validation of the structure and identification of possible violations of the rulesets required by the initiator banks. Visual inspection of the elements of the output of each scenario was equally performed, in search for inconsistencies of possible issues.

As such, the creation of remittance messages (the composition of structured or unstructured, multiple occurrences of unstructured), the way payments were broken down by document payable, the identification of the POP, Intermediary Bank and the usage of the IBAN, among other rules, were all demonstrated during this phase.

Table 6.1 summarizes the test scenarios and indicates what elements to pay attention to when evaluating the contents of the payment instructions. Offline tests can be performed by simply combining the XML Master samples provided for each scenario with the single XSLT transformation template developed for this project, resulting in a payment instruction.

Table 6.1: Sample scenarios considered for evaluation

Bank Acct.	Profile	Remit	Total	Breakdown	To Observe
Bank A - EU	SEPA	Unstr.	550 EUR	Pmt. 1: 300.00 (100.00 + 200.00) Pmt. 2: 250.00 (300.00 - 50.00)	-Compliance with SEPA rules -Unstructured remittance message (multiple payments and documents) -Batch Booking (grouping rules)
Bank B - UK	SEPA	Struct.	550 EUR	Pmt. 1: 300.00 (100.00 + 200.00) Pmt. 2: 250.00 (300.00 - 50.00)	-Compliance with SEPA rules -Structured remittance message (multiple payments and documents) -Batch Booking (grouping rules)
Bank C - CA	Global	Unstr.	7000.00 CAD	Pmt. 1: 5000.00 (3000.00 + 2000.00) Pmt. 2: 2000.00	-Proprietary local instrument code -Routing details
Bank C - JP	Global	Unstr.	9000 JPY	Pmt. 1: 7000 JPY Pmt. 2: 2000 JPY	-Proprietary local instrument code -Routing details -Inclusion of alternate bank account name (in Katakana) -Bank branch address removal -Bank account type
Bank A - EU	Global	Unstr.	6000.00	Pmt. 1: 2000.00 AUD Pmt. 2: 2000.00 GBP Pmt. 3: 1000.00 EUR Pmt. 4: 1000.00 EUR	-Concatenation of beneficiary bank name and address -Concatenation of routing numbers with bank account numbers -Rules for populating the Bank Account tag for countries like Côte D'Ivoire -IBAN usage rules for Azerbaijan (an IBAN country) -Purpose of Payment

Bank Acct.	Profile	Remit	Total	Breakdown	To Observe
Bank B - NY	Global	Unstr.	4000.00 USD	Pmt. 1: 1000.00 Pmt. 2: 1000.00 Pmt. 3: 2000.00	<ul style="list-style-type: none"> -Domestic ACH payment (ABA routing code) -Cross-border with an intermediary (CHIPS Participant) -Cross-border without an intermediary (urgent payment) -Payee contact details -Purpose of payment

7 Evaluation

This chapter is dedicated to describing how the developed artefact is evaluated. This corresponds to the evaluation step of the Design Science Research methodology as described by Peffers et al. (Peffers et al., 2012).

The evaluation strategy of choice is the one proposed by Pries-Heje et al.. The author's formulation of a framework for DSR evaluation considers two main dimensions:

- Its environment: whether the evaluation is performed in a real-life setting (naturalistic) or involving simulation or experimentation (artificial);
- The timing: whether the evaluation is performed before (*ex ante*) or after (*ex post*) the development of the artefact (Pries-Heje et al., 2008).

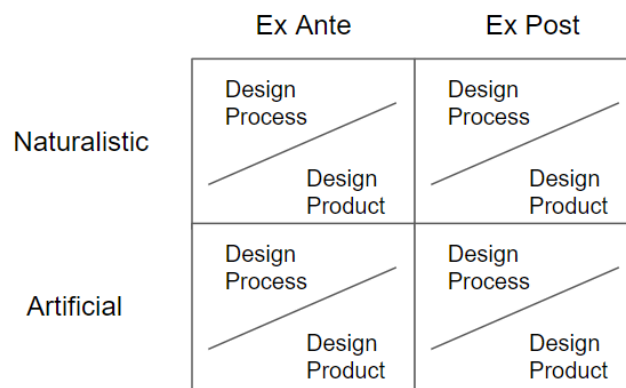


Fig. 7.1: DSR evaluation framework as per Pries-Heje et al.

Venable et al. propose a framework for the selection of an appropriate strategy (or combination of strategies) for the evaluation of the design artefact (Venable et al., 2012). Taking into consideration the context and the criteria set proposed by the framework, the relevant quadrants for the evaluation of the artefact are Naturalistic and Artificial / *Ex Post*.

The techniques used for evaluation are:

- Simulations: the utility and efficacy of the artefact are tested in a real-world scenario with real users and real problems, in a fully or partly functioning system;

- Expert Evaluation: a collection of feedback from the user community, functional and technical experts;
- Statistics: a collection of relevant metrics from the live environment, identification of events and comparisons.

	Ex Ante	Ex Post
Naturalistic	—	Expert Evaluation Statistics
Artificial	—	Simulation

Fig. 7.2: Approach to the evaluation of artefacts

The dimensions to evaluate are those defined by Prat et al.: goal, environment, structure, activity and evolution (Prat & Akoka, 2014).

7.1 Simulations

Due to the dependencies between objects, the strategy for the evaluation consists of segmenting the technical solution into three parts, each being evaluated individually. The technologies selected for the adoption were also challenged in terms of their ability to comply with the requirements, and their flexibility and easiness to adapt to new requirements and circumstances.

The tools used for testing the technical objects are free-to-download software applications and plugins that allow the creation and manipulation of XML/XSLT files, performing validations of XML against its schema, and applying XSLT templates to XML files. Such

tools are Notepad++²¹ in combination with the 'XML Tools' plugin, and the open-source software XML Notepad²² published by Microsoft.

7.1.1 Custom Forms and XML Master File

Evaluation of the Custom Forms object is only possible through the integration of its outputs into the XML Master file, which will then feed the XML Transformation Template to produce a valid payment instruction.

Several test cases and scenarios were created, all of them representative of real issues felt by the organization. Given the additional flexibility provided by the new forms in terms of configuration, several possible outputs were simulated and evaluated. Visual inspections of the contents of relevant tags of the XML Master file were performed and data was validated. Examples of the scenarios for each form are:

- IBAN Usage – the expected output of this form is to provide the logic to populate either the 'BankAccountNumber' or the 'IBAN' tag in the XML Master file, having as drivers the initiator bank and bank account, the beneficiary's bank account country, and whether the payment is within the SEPA-area, is domestic or cross-border. One configuration record exists for every country or territory. For instance, for Afghanistan, a non-IBAN country, only the 'BankAccountTag' is expected to be populated irrespective of the scenario. For Albania, an IBAN country, only the 'IBAN' tag is expected to be populated. And it is not a SEPA country, therefore the 'PaymentMethod' tag should be populated with the value 'Global'. The logic defined in the form needs to be integrated during the data extraction and transformation process that assembles the XML Master file. The output of the example provided can be observed in Figure 7.3.

²¹ <https://notepad-plus-plus.org/>

²² <https://microsoft.github.io/XMLNotepad/>

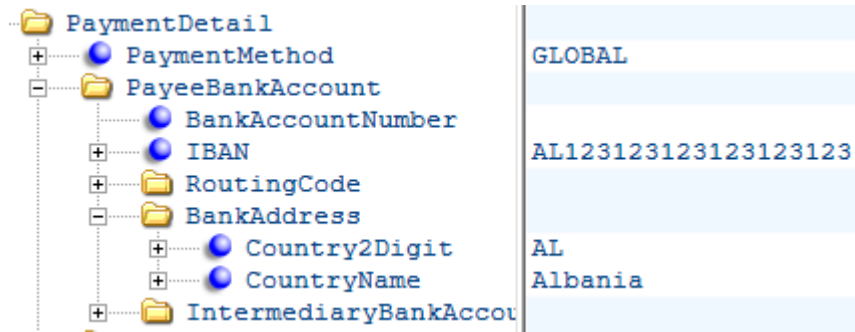


Fig. 7.3: IBAN usage mechanism and its relationship with the XML Master File

- Purpose of Payment - the expected output of this form is to provide the logic to populate the 'PoPCode', 'PoPMeaning' and the 'DisplayValue' tags in the XML Master file. The configuration is done for each initiator bank, and the rules are specified taking into consideration attributes of the payable documents. For instance, a document sourced from Payroll paid to a bank account held in India, will display a POP comprised of the concatenation of a code and a text string. The output of such an example can be observed in Figure 7.4.

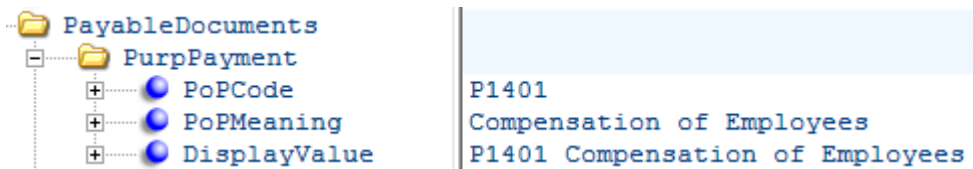


Fig. 7.4: Derivation of POP and its relationship with the XML Master File

- Intermediary Banks - based on the configuration of this form, the tags pertaining to the sub-tags of 'IntermediaryBankAccount1' are generated. As of the present time, the only possible business case is for cross-border payments initiated from the 'Bank B - NY' account, using CHIPS identifiers as a means of identifying and linking the intermediary bank. One example is for payments to 'Bank of America - Australia' for all branches with a BIC code of 'BOFAAUSX', with an expected outcome of populating the tags 'BankName' and 'CHIPS' with the values mapped in the custom form. In this case, 'Bank of America' and '0959'

respectively, demonstrating a successful case. The output of this example can be observed in Figure 7.5.

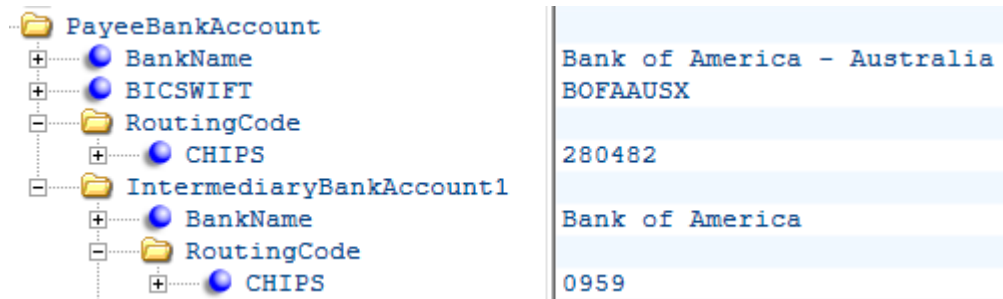


Fig. 7.5: Intermediary Bank and relationship with the XML Master File

7.1.2 XML Master File and Schema

To evaluate the utility and efficacy of the XML Master File and Schema, several scenarios were created to verify the application of the rules specified in the XML Schema file. If no rules are violated, this means that the structure of the XML Master file is compliant with the structure and rules defined in the XML Schema file, maximizing the chances of a successful transformation of the XML Master into a valid payment instruction, and consequently into a successful payment. The type of issues it addresses is mainly the ones linked to the extraction, transformation, and data-validation processes from the BSS databases, by providing an easy-to-read structure that can be validated immediately following its creation. This carries a change in the paradigm on how data is presented before being re-processed, now being logically grouped under one single relevant business object (payment instruction) and not any more through a relational model (payments, banks, payees, documents, among others.).

The XML Master files used for the evaluation were either generated from test cases (setup in the back-office system and custom forms) or originated from manual adjustments to an XML Master File output, creating even more scenarios for validation. Very diverse scenarios were considered, mostly focusing on the ability of the technology in capturing data in an adequate format and structure, and validating the quality of that data and its

compliance with the target structure. Such scenarios can be consolidated into three major categories. One example is provided for each:

- Mandatory / non-mandatory tags - the example below focuses on the 'PayerName' tag, which according to the schema definition is a mandatory tag. It is expected to carry the name of the payment initiator. The scenario depicted in Figure 7.6 shows a null value for that tag, which automatically triggers an error message, thus demonstrating that the validation rule is working as expected;

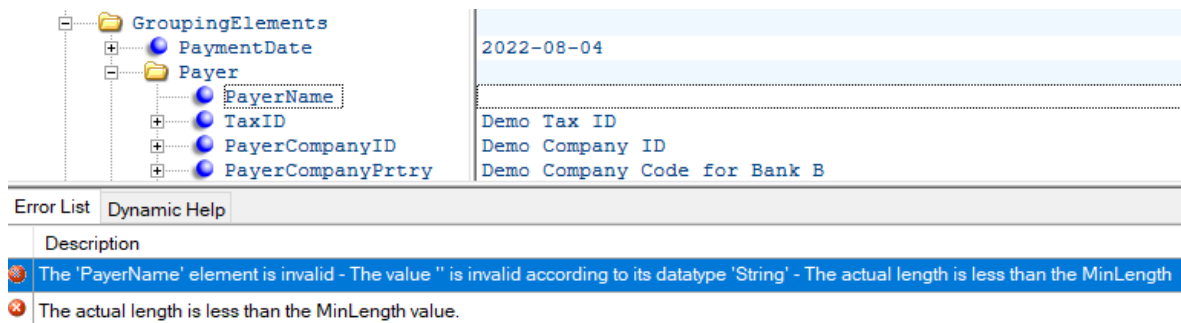


Fig. 7.6: Validation message for missing value for tag 'PayerName'

- Number of occurrences - another possible violation is related to the number of occurrences of a tag. Depending on the rules defined in the XML Schema, multiple occurrences of the same tag may not be allowed, or at least one instance of the tag may be required. Such validations are visible in Figure 7.7 and Figure 7.8 respectively;

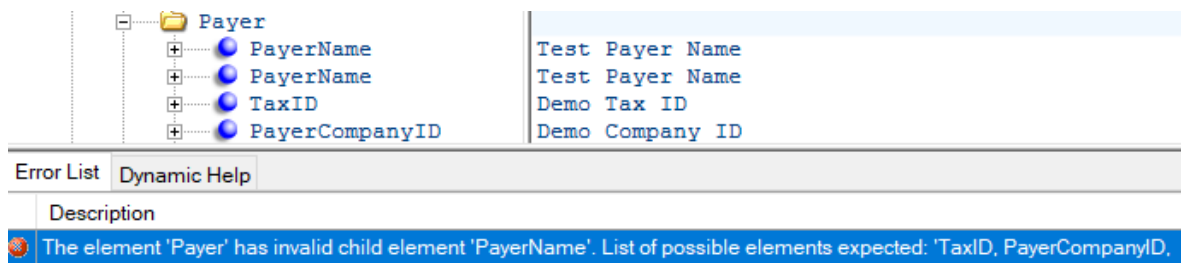


Fig. 7.7: Validation message for multiple occurrences of tag 'PayerName'

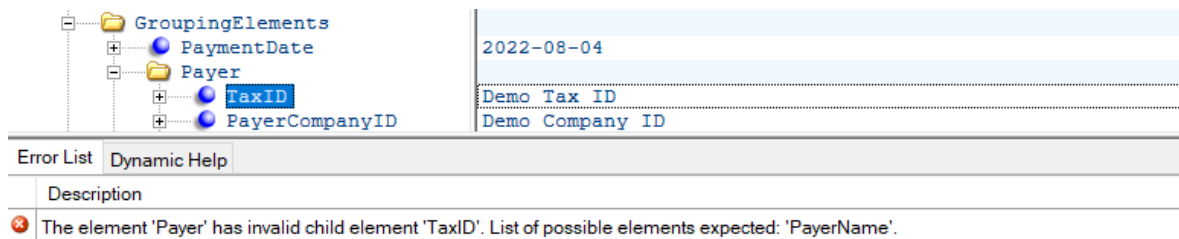


Fig. 7.8: Validation message for missing tag 'PayerName'

- Validation of patterns - certain tags require data to be presented in expected fixed formats. One example is the 'BICSWIFT' tag, which is expected to carry a string of 8 or 11 alphanumeric characters, comprised of 6 alphabetic characters, plus 2 alphanumeric characters plus 3 optional alphanumeric characters. Figure 7.9 shows a violation of this rule for having a 12-digit string;



Fig. 7.9: Validation message for not respecting the expected pattern

7.1.3 XSLT Transformation Template

The validity of the XSLT template depends on its ability to effectively transform the XML Master file into a valid payment instruction, according to all the relevant specifications and business scenarios, and the ability to test the output that is produced.

Given the different structures of both source XML Master File and target payment instruction, and the different specifications the finalized payment instruction must comply with, several features need to be challenged that enable the success of the transformation.

In addition to the possibility of mapping the content of tags between the XML Master and the XML Transformation Template, as already demonstrated in the sub-section [XML Transformation Template](#), another functionality was identified as critical to the success of the transformation.

The ability to use functions to convert text strings or numbers and apply other types of transformations can be observed in Figure 7.10. It demonstrates the use of translation, concatenation and truncation applied to strings, through the combined use of the ‘translate’, ‘concat’ and ‘substring’ functions, respectively. In the example provided, these functions are applied to the element of an address structure, converting the text string to its basic Latin equivalent (resorting to global variables as arguments of the function, not detailed in this example), concatenating the two lines of the address as specified in the XML Master, and truncating the output to a limit of 70 characters.

```

XML Transformation Template:
<StrtNm>
  <xsl:value-of select="translate(substring(concat(//Payer/Address/AddLine1, ',
', //Payer/Address/AddLine2), 1, 70), $extlatin, $basiclatin)"/>
</StrtNm>

XML Master File:
Payer/Address/AddLine1: Long address using extended latin characters
Payer/Address/AddLine2: such as ĀāĂăĄ to demonstrate the utility of functions

Output:
<StrtNm>
  Long address using extended latin characters such as AAAAA to demonstr
</StrtNm>

```

Fig. 7.10: Combined use of ‘translate’, ‘substring’ and ‘concat’ functions

Figure 7.11, on the other hand, not only demonstrates the conversion of a numeral, from a format with two decimals (as defined in the source XML Master File) into a numeral without decimal places, but it also applies a set of conditions. In this example, if the payment currency is any of ‘JPY’, ‘KRW’ or ‘VND’, then the payment value should be transformed into a numeral without any decimal places. Otherwise, the value should be presented as it is captured by the XML Master File.

The syntax using the ‘choose’ element is used in conjunction with ‘when’ (one or more instances) and ‘otherwise’ (optional) elements to express multiple conditional tests. If none of the conditions created using ‘when’ is verified, then the instruction specified in the ‘otherwise’ element is executed.


```

XML Transformation Template:
<InstdAmt>
  <xsl:attribute name="Ccy">
    <xsl:value-of select="./PaymentAmount/Currency"/>
  </xsl:attribute>
  <xsl:choose>
    <xsl:when test="((./PaymentAmount/Currency='JPY') or (./PaymentAmount/Currency='KRW') or (./PaymentAmount/Currency='VND'))">
      <xsl:value-of select="format-number(./PaymentAmount/Value,'#')"/>
    </xsl:when>
    <xsl:otherwise>
      <xsl:value-of select="format-number(./PaymentAmount/Value,'#.00')"/>
    </xsl:otherwise>
  </xsl:choose>
</InstdAmt>

```

```

XML Master File Scenario 1:
/PaymentAmount/Currency:   JPY
/PaymentAmount/Value:     10000.00

```

```

Output Scenario 1:
<InstdAmt Ccy="JPY">10000</InstdAmt>

```

```

XML Master File Scenario 2:
/PaymentAmount/Currency:   EUR
/PaymentAmount/Value:     10000.00

```

```

Output Scenario 2:
<InstdAmt Ccy="EUR">10000.00</InstdAmt>

```

Fig. 7.11: Conditions using the ‘choose’, ‘when’ and ‘otherwise’ elements

Alternatively, the ‘if’ element can also be used to create conditions. The example in Figure 7.12 demonstrates the use of such an operator to only generate a local instrument code tag for the two bank accounts belonging to ‘Bank C’, a different value for each bank account.

```

XML Transformation Template:
<xsl:if test="/PaymentBatch/GroupingElements/IntBankAccount/BankAccountName='Bank C -
CA'">
  <LclInstrm>
    <Cd>BKCA780</Cd>
  </LclInstrm>
</xsl:if>
<xsl:if test="/PaymentBatch/GroupingElements/IntBankAccount/BankAccountName='Bank C -
JP'">
  <LclInstrm>
    <Cd>BKJP410</Cd>
  </LclInstrm>
</xsl:if>

XML Master File Scenario 1:
/IntBankAccount/BankAccountName:   Bank C - CA

Output Scenario 1:
<LclInstrm>
  <Cd>BKCA780</Cd>
</LclInstrm>

XML Master File Scenario 2:
/IntBankAccount/BankAccountName:   Bank A - EU

Output Scenario 2:
-- no tags are created --

```

Fig. 7.12: Conditions using the ‘if’ operator

Another critical functionality that needs to be evaluated is the possibility of grouping records and looping within the records of that group. The scenario depicted in Figure 7.13 refers to the creation of multiple instances of unstructured remittance messages, one per payable document contained in the payment. The ‘for-each’ element is created to loop the content of every individual payment, storing the concatenated values of the document payable number, original and paid amounts, in a variable. Two instances of payable documents are presented as an example, generating as many lines of the unstructured remittance details as the number of payable documents. For simplification purposes, other elements have been removed.

```

XML Transformation Template:
<xsl:for-each select="./PayableDocuments">
  <xsl:variable name="remittanceismgmt">
    <xsl:value-of select="./DocNumber"/>
    <xsl:value-of select="concat(';-',./DocAmount/Value,'-',./PaymentA-
mount/Value, ';')"/>
  </xsl:variable>
  <Ustrd>
    <xsl:value-of select="substring($remittanceismgmt,1,140)"/>
  </Ustrd>
</xsl:for-each>

XML Master File:
/DocNumber[1]: 238746334/22 /DocAmount/Value[1]: 300.00 /PaymentAmount/Value: 300.00
/DocNumber[2]: 238746335/22 /DocAmount/Value[2]: 600.00 /PaymentAmount/Value: 600.00

Output:
<RmtInf>
  <Ustrd>238746334/22;300.00;300.00;</Ustrd>
  <Ustrd>238746335/22;600.00;600.00;</Ustrd>
</RmtInf>

```

Fig. 7.13: Use of the ‘for-each’ element to loop through the contents of tags

This functionality becomes particularly useful when creating instructions when using the batch booking functionality (for SEPA, according to the organization’s requirements). Several payments are grouped under the ‘CdtTrfTxInf’ tag, for each value of ‘GroupingTag’. Sample output of a SEPA instruction can be observed in [Appendix VII](#) with such grouping in place (scenarios 1 and 2).

The transformations can be achieved offline with the use of desktop tools such as Notepad++ (with the ‘XML Tools’ plugin) or Microsoft XML Notepad 2007. The latter offers a visual interface and simplifies the task of modifying the data in the XML Master File, for instance, for the creation of new test or demonstration scenarios. Verification of the structure against the official schema published by SWIFT can also be performed through any of these tools.

7.2 Statistics

To evaluate how efficient the new solution is in effectively processing the payments, addressing the pain points, and meeting the requirements, a series of statistics have been collected, enabling a better view of the impact of the changes that have been promoted.

The source of data is the organization’s service ticketing system, which is used by users to record requests for support from the IT Helpdesk team or support agents from

other departments of the organization. Data has been collected for the current year and the three years before the undertaking of the ISO 2022 adoption project. It includes all the requests related to the execution of electronic payments and filters out any reported issue that is perceived as not a “true issue” (for instance, originating from a user error). The quality of data collected depends significantly on the discipline of both users and support agents in recording and updating the requests for assistance, and it is acknowledged that the real number of issues that occurred during the period of analysis for the legacy formats is significantly higher than the number reported. After the deployment of the 5th ISO 2022 product release, better attention was paid to logging issues in the system related to the newly developed ISO 2022 format, so that a more accurate image of the status of the implementation could be achieved.

Data are summarized by year and week, the volume of new/closed issues is presented, and a measure of the number of issues with an open status at the end of each week is calculated. An indication of the moment the 5th ISO 2022 product release was implemented can be observed, initiating the ‘coexistence’ period. The same happens for the 6th release, the ‘Go-Live’ event.

This data is visible in Figure 7.14 for data pertaining to the legacy formats.

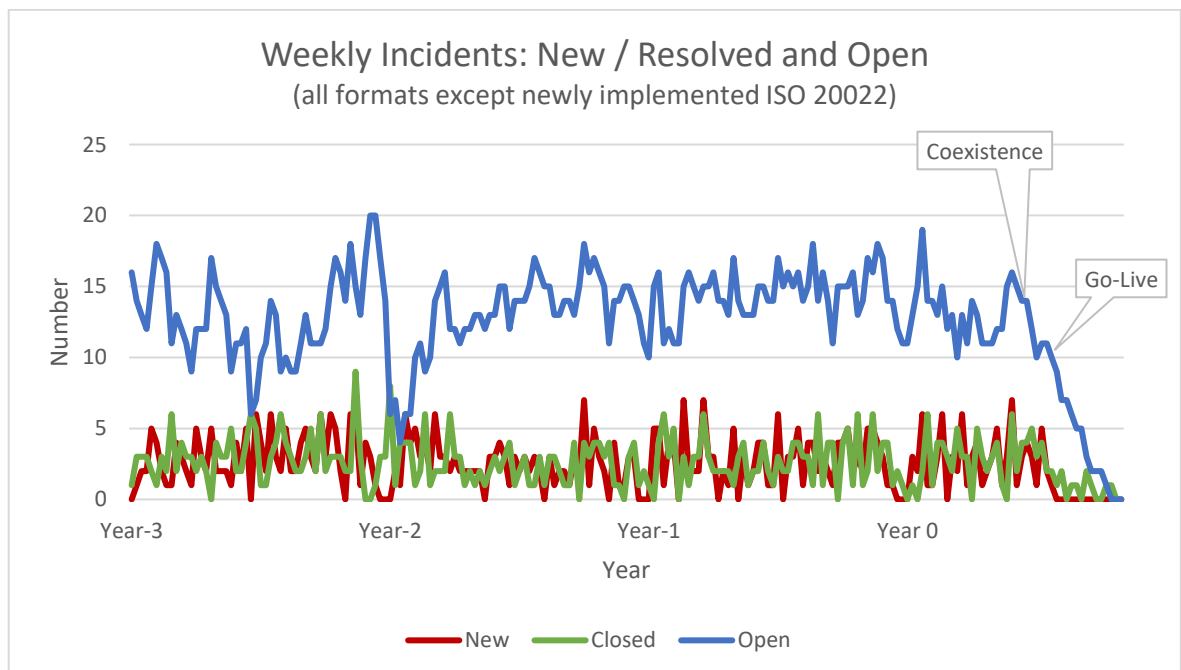


Fig. 7.14: Statistics on reported issues for legacy formats

Taking into consideration the period between the start of the series and the beginning of the 'coexistence' period, an average number of 2.7 issues per week was reported, and roughly the same figure was calculated for the average number of resolved issues (2.716).

The average number of open issues at the end of each week for the same series has been calculated as 13.4. If calculated every year, it is observed that no significant variations occur: 13.04 for Year-3, 12.88 for Year-2, 14.4 for Year-1 and 12.9 for Year 0. The calculation of the average number of calendar days necessary to resolve one issue (from the moment of creation until the moment of resolution) had to be split into two scenarios, depending on whether a technical intervention is required or not. For the latter, the average time is 3 days, while for the first, the calculated average is 42 days.

Shifting the focus to the coexistence period and after, it is observable from Figure 7.15 that a steady and significant drop in the number of open issues related to the legacy formats starts to take shape. This is explained by the fact that several problematic scenarios were successfully tested in a live environment using the new ISO 20022 payment format, making no sense to keep the assistance request open.

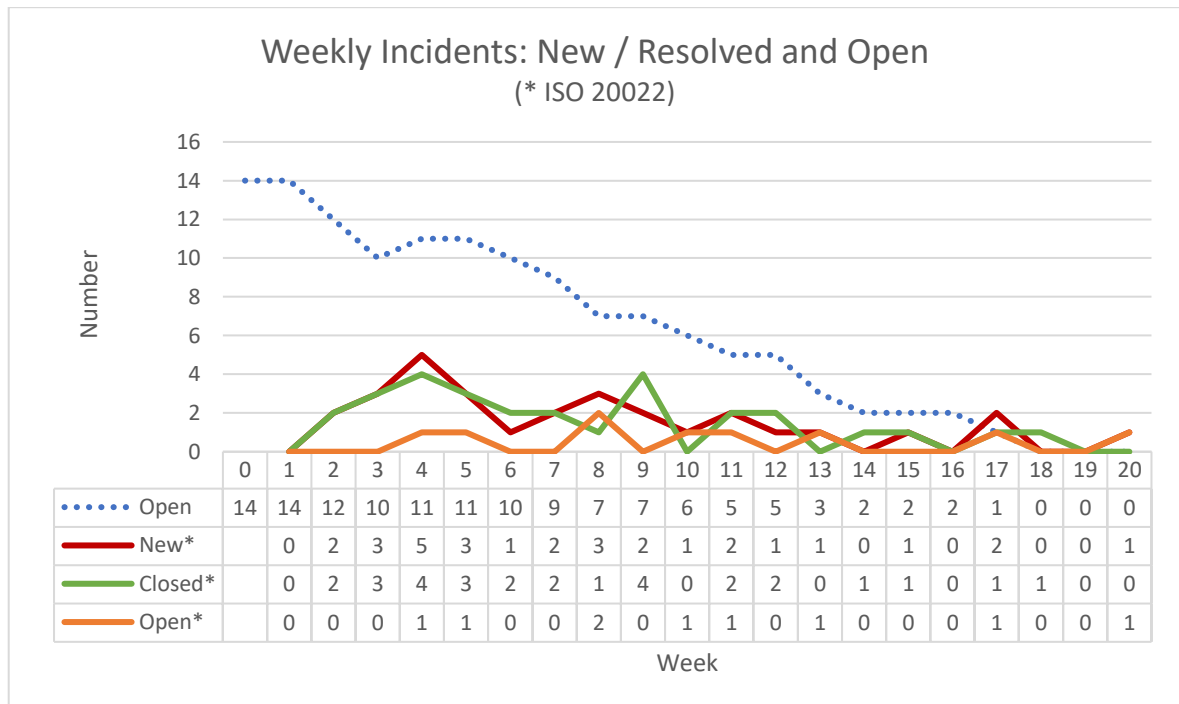


Fig. 7.15: Statistics on reported issues since the coexistence period

With the gradual increase of the load of payments processed using ISO 20022, and as expectable, new issues arose. Such issues were, however, promptly addressed, as the number of open issues for the new ISO 20022 format rapidly decreased after peaking on the 4th week of coexistence.

During the remainder of the series, it is possible to observe the evolution of both legacy and ISO 20022 formats. After the Go-Live event (6th product release), the number of open issues for the legacy formats dropped steeply, through the 18th week after the start of the coexistence period, when all the issues had been closed. Regarding the new ISO 20022 formats, the number of new issues, which was never as expressive as the number of issues related to the legacy formats, followed a decreasing trend and stabilized at a very low level. Its open issues at the end of every week stayed low throughout the entire series, recording a maximum figure of 2 on the 8th week following the adoption, and recording 0 for 12 of the 20 weeks included in the series.

7.3 Expert Evaluation

Surveys can be an efficient way to collect relevant information to assist in the evaluation of artefacts in the context of DSRM (Venable et al., 2012). Surveys typically collect information from a sample, but for the case being analysed, it was possible to survey the entire population.

Two focus groups were targeted by this survey:

- Treasury Specialists (3 individuals) – the group of users responsible for executing the fund’s disbursement process for the entire organization, including all the communication with financial institutions (rejections, fees and inquiries) or the bank statement reconciliation process. In addition, its composition has been stable throughout the years and, as such, this focus group is deeply aware of how successful the execution of this business flow might be when comparing different solutions;

- IT Developer and Support Specialists (5 individuals) – the group responsible for implementing and supporting the technical solutions related to the finance functional domain (including the payment execution process). Similarly to the Treasury Specialists, its composition has not suffered any recent change, which enables them to compare implemented solutions throughout time. The profiles are mixed as 4 individuals are purely technical resources, and one individual is a functional IT resource acting as a bridge between the end users and the IT Helpdesk service.

Surveys were only sent to the population on the 18th week following the beginning of the coexistence period, and the 12th week from the official go-live date (and deployment of the 6th version of the product). This is to allow enough time for the solution to stabilize and for the involved parties to form an opinion about the success of the implementation.

The surveys were built differently for each focus group but had much in common. Both include a set of 6 questions to be evaluated according to a 5-point Likert scale²³, combined with the possibility of adding comments. A set of questions allowing free text was also included, similar in both groups except for one question centred around the adequate choice of technology (made available only to the IT Developers and Support Specialists). The goal of the survey was to evaluate the overall success of the adoption in several dimensions. Not only the overall success was queried, but also the feeling related to sustainability, complexity and effort required to maintain the solution, its scalability, and the room for improvements.

The survey forms and the obtained results are made available in [Appendix VIII](#). The outcome revealed that, in general, satisfaction with the ISO 20022 solution is very high in comparison to the legacy formats. All the respondents from both focus groups, except for one person, manifested clear satisfaction with all the above-mentioned dimensions of analysis. The analysis on the first set of 6 questions (through a Likert scale) shows just that, considering that the range of possible values goes from 1 (much worse) to 5 (much better):

²³ https://en.wikipedia.org/wiki/Likert_scale

Table 7.1: Survey results from the focus groups – Question 1

Respondent / Question	Q1.1	Q1.2	Q1.3	Q1.4	Q1.5	Q1.6
IT Dev/Supp 1	5	5	5	5	5	5
IT Dev/Supp 2	4	4	5	4	4	5
IT Dev/Supp 3	4	5	4	4	5	5
IT Dev/Supp 4	5	5	5	4	5	5
IT Dev/Supp 5	1	1	1	N/A	1	1
Treasury 1	N/A	4	5	3	5	5
Treasury 2	N/A	5	5	N/A	5	5
Treasury 3	5	5	5	5	5	5

On the comments that were requested, the response was enthusiastic. Comments such as “The ISO pain.001.001.03 is much easier to modify” or “Significant improvement! (the ISO 20022 format) has many differences and exceptions, but that is manageable” were received by the IT Developer and Support staff. Encouraging comments were also received from the Treasury staff, such as “overall, the solution is much better compared to the previous. (...) We don't use workarounds anymore” and “the process is now much smoother and I can clearly say that we are having less rejections (maybe 80% less), and the amount of inquiries and the time we spend on them decreased to less than 10% of what it used to be.”

Most IT Developer and Support staff also replied positively concerning the choice of technology, accounting for 4 out of 5 positive evaluations. One respondent added, “it makes the transformation very simple and we can test immediately”. Equally positive was the perception related to the sustainability and scalability of the solution, with one respondent answering “It is definitely sustainable. (...) we have significantly less incidents now. (...) the introduction to new bank accounts must be simplified.”

One IT Developer / Support staff was, however, not satisfied with the outcome of the adoption, responding very negatively to almost every question. This responder argued that “the new solution is more complex to manage. There is no need to have an intermediate step between the extraction of data and its transformation” and that the choice of XSLT as the technology “(...) is inadequate. (...) It is overkill”. It also questions the sustainability of the solution and its ability to scale, manifesting the desire to “go back to the old (but much more effective) solution”. Given the clear contrast between the responses of

this particular person and the remaining people that participated in the survey, this result may be considered as an outlier.

Regarding the perception of items that could be improved, a clear pattern was identified. The IT Developer and Support group highlighted the need to improve the XML Schema, being described as “confusing”, and stated that “the rules are not clear. (validation fails) but according to the solution architect that is acceptable.”. The Treasury focus group, however, listed a set of possible improvements that cannot be linked in any way to ISO 20022 (define payment approval workflows, for instance), or are impossible to address, like the impossibility of performing end-to-end testing with banks.

7.4 Analysis

Taking into consideration all the dimensions of analysis that were part of this master’s thesis, we conclude that the proposed model for the adoption of ISO 20022 for payments can be considered a success. It was verified that it is possible, in practice, to achieve the goal of successfully adopting the standard, while at the same time, not only addressing a set of issues but also laying the foundation for a flexible and possible to sustain functionality, that will be in use for an unforeseeable period.

A diverse set of criteria were evaluated, ranging from more conceptual and theoretical objects, like the criteria related to results of the evaluation through simulations, to the more “hard-facts”, such as the criteria related to the evaluation from users and experts, or the statistical indicators collected throughout an extended period. The latter showed an extremely positive picture of the success of the adoption, quickly overcoming all the issues accumulated since the inception of the legacy formats. The opinion of the experts only reinforced what could have been perceived from the analysis of the statistics.

It was equally important to verify that the model is sustainable and scalable, and that it is possible to engage business experts in the solution definition phase of an implementation or remediation activity. For these purposes, the choice of technologies needs to be adequate, flexible, transparent and accessible. However, full engagement of business

users is limited to those with a somewhat hybrid profile, able to grasp basic concepts of software development.

In general, from the outputs produced during the evaluation phase, it is possible to attest to the efficacy of the artefact in achieving its goal. It is also important to highlight the human dimension and its alignment with the technology and the organization mainly identified through the surveys (despite one possible outlier). There is, however, room for improvement in terms of the completeness, clarity and detail of the artefact, especially related to the XML Master File Schema technical object. The sustainability of the solution and its capacity to adapt to changes in the environment were also put to the test, and the response was remarkably positive. Scaling up the solution, despite not having been put to the test, still left the majority of the surveyed people confident about its easiness and success.

8 Conclusion

Two research methodologies were used in this research: Design Science Research and Systematic Literature Review. Following the identification of the research problem, which can be summarized in the difficulty felt by organizations in adopting the standard, the latter stages of the research process resulted in the acknowledgement of a research gap: the lack of guidelines that could assist corporates in the process of adopting ISO 20022. To address this issue, an adoption model was developed and put into place in a professional environment: an organization with a complex profile in terms of its payments landscape, which constituted an optimal candidate to implement ISO 20022 following such a model.

Before initiating the development of the artefact, an SLR was conducted with the objective of better understanding the research problem, through the identification of the opportunities, challenges and critical success factors to observe during the adoption of the standard. Once conclusions were drawn, enough detail had been collected to assist in the process of choosing the approach used for the development and evaluation of the required objects.

The development of the model was performed in a professional environment, with exposure to “real-life” problems and issues, in an organization wishing to optimize its processes and technical infrastructure, and better prepare itself for the future, by adopting ISO 20022 as the only standard to create payment instructions. The findings reveal that the design process can benefit from careful preparation, analysis and planning in the early stages of the design process.

All the required technical objects were developed following a methodology based on the Agile manifesto, and additional critical activities, such as the master data clean-up exercise, were carried out in parallel.

To evaluate the produced artefact, three different approaches were used. Firstly, the components were put through the test through simulation of scenarios, which provided, given the limitations available in performing fully reliable test exercises, a measure of success related to the choice of technologies and components developed. Two focus groups were consulted through the form of structured surveys, 18 weeks past the

deployment of the 5th product release, allowing time for the solution to mature and for the experts to develop their feelings and opinions. Lastly, the collection and compilation of statistics created a picture of the evolution of the effectiveness of the artefact, by consolidating years of data related to the use of the legacy solution and providing side-by-side comparisons for the first 20 weeks following the adoption of the standard by the organization.

The results are, in general, very positive. One can conclude that not only the adoption carried out by the organization was successful, but it also addressed a series of pain points, allows quick remediation of issues, and laid the foundation for facilitated rollouts and the addition of new functionality. The fact that the artefact was deployed in a “real-life” environment, in a complex payments landscape and with a successful outcome, grants it validity and utility from the perspective of DSRM.

8.1 Contributions

The main contribution of this research is bridging the identified research gap: the lack of literature on solutions or guidelines to address the challenges faced by organizations when adopting ISO 20022.

Not every organization faces the same challenges, but it is our understanding that this research has not only contributed to the implementation of a flexible, sustainable and scalable model, but also that the model can serve as a reference to any other organization in the process of adoption. By illustrating the methodology with the adoption of ISO 20022 by an organization, this research makes it possible for potential other candidates to replicate the processes herein.

It is also our objective to trigger further research in this specific field, by allowing other researchers to take on the outcome of this master’s thesis and extend the knowledge base on this topic.

Ultimately, since it is possible that the community of corporates does not have its voice properly heard within the governing body of the standard, this document could, in theory, provide the perspective of a corporate to the same governing body and, possibly,

influence future decisions, especially those related to efforts of further harmonising the instructions.

8.2 Limitations

Several challenges were felt during the different phases of the work, the most remarkable one, being the impossibility of performing end-to-end testing without being in a “live” environment. In addition, given the extremely high number of possible combinations of data elements, it is virtually impossible to test every possible scenario. These facts contribute to both an increase in the perceived risk related to the adoption, as financial data of this type is sensitive, and any potential errors are not easily recoverable. Nevertheless, risk needs to be mitigated, in this case, for instance, by gradually increasing the amount and volume of payments to be processed and thoroughly verifying the outcome of the cash flows.

It was also observed that following the-go-live, several changes had to be performed on the XSLT transformation template as the financial institutions failed to provide accurate instructions for the creation of messages. In addition, exceptions had to be considered, which were also not documented and were only verified once payments were being executed in a live environment.

During the Evaluation stage of the DSR, it was, unfortunately, impossible to collect reliable statistics on rejected payments for the legacy formats. Such details were not being consistently recorded by the organization, therefore it was not possible to compare the figures between legacy formats and ISO 20022. This was mitigated by surveying the involved user community and inviting it to provide feedback.

Despite the organization’s strong investment, very positive attitude and the availability of resources to undertake the ISO 20022 adoption project, it was baselined for an extremely ambitious schedule. For that reason, it was not possible to invest as much effort in certain objects as they deserved, and their outcomes cannot be considered optimal. Some of these limitations were only observed in the later stages of the development cycles, when dependencies were already observable, and remediation would mean significant

additional effort. None of these limitations had, however, any significant negative impact on the main output, the creation of the payment instruction, therefore no intervention was considered as required. This can be done at a later stage when resources are available for object remediation and integrated testing.

Such cases are:

- The XML Master file schema has room for improvement in terms of the validations it can perform – more tags can have validations built for them, and even make use of ‘and’/‘or’ logical operators which was not explored;
- The structure of the XML Master can also be improved – it was noted that address structures were shared between several elements, which compromises the ability to create more granular validations for its sub-tags in its corresponding schema;
- Certain elements about the structure of the XML Master were not mapped through business rules, and were simply left as part of the structure, but as placeholders, and reserved for future use.

8.3 Future Work

Margin for improvement exists for the developed artefact. Due to several constraints, and as mentioned in the [Limitations](#) section, the technical objects that were developed can still be improved. The best example is the structure of the XML Master File and the validation rules specified in its schema file. The survey also revealed that the clarity of the artefact was compromised by these limitations, therefore, as important as addressing the technical issues, is the need to dedicate time and effort to better training and transfer of knowledge to the technical and functional teams.

The standard is not frozen. The need for innovation drives its evolution, and a good example of that is the initiative of real-time payments. Whilst real-time payments initiatives have initially centred around domestic payments, these are expected to evolve into the cross-border space, with ISO 20022 as the means to facilitate and harmonise the

adoption²⁴. Other initiatives are ongoing, and it is fundamental to keep oneself up to date with the market demands and trends, which will directly or indirectly impact the evolution of the standard.

Adopting ISO 20022 for payments opens doors to organizations aiming to automate their business processes and promote efficiencies. Its data-rich formats and structured nature allows data to be more easily consumed by other services, opening a realm of possibilities in the execution of the related business process.

Two of these possibilities are now being evaluated to be worked on in a near future:

- Automating the confirmation of payments by integrating the ISO 20022 pain.002 format and:
 - For successfully executed payments, automatically issue payment confirmation documents to the beneficiaries;
 - For rejected payments, automatically initiate workflows for the resolution of issues (for instance, if the reason for rejection is a closed beneficiary bank account, the workflow should be initiated and the master data management team needs to be assigned an issue resolution task);
- Enable the automatic creation and reconciliation of payments from customers, through the use of customer or transaction references made available in the camt.053 bank statement format;

All the above-mentioned topics are already being researched, which reinforces the possibility to enrich the knowledge base on the topic of ISO 20022 and its adoption model for corporates.

The final stage of DSRM, the 'Communication' phase, requires the knowledge acquired during the previous stages to be presented effectively both to technology-oriented as well as management-oriented audiences (Hevner et al., 2004) . Researchers and other relevant audiences should have the problem and importance to be shared with them, in addition to the artefact, its utility and novelty, the rigour of the design, and its effectiveness (Peffer et al., 2007).

²⁴ <https://www.iso20022.org/catalogue-messages/additional-content-messages/iso-20022-real-time-payments-group-rtpg>

The project that served as the foundation for the development of the artefact was concluded approximately two weeks before the writing of this section, limiting the possibility of timely initiating the activity of disseminating knowledge. A paper is being prepared for future submission to the scientific community, addressing the development, demonstration and evaluation of the ISO 20022 adoption model artefact.

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Appendixes

Appendix I: Access to the repository

All data and files pertaining to Appendix II through Appendix VII is available from the [repository](#).

URL: <https://github.com/jcsconstantino/iso20022>

Ct. Co.	Country Name	IBAN		Length	BBAN / Bank Account Structure		Branch Code	Branch Code	Branch Code	BankA		Bank B		Bank C		NOTE
		Code	Len		Structure	Structure				IBAN Status	IBAN Usage	IBAN Status	IBAN Usage	IBAN Status	IBAN Usage	
EE	Estonia	EUR	Yes	20	EE 00	10	10	10	10	NA	Yes	NA	Yes	NA	Yes	Free bank
EG	Egypt	EGP	No	29	EG 00	17	17	17	17	NA	No	NA	No	NA	No	Free bank
ER	Eritrea	ERN	No	29	ER 00	17	17	17	17	NA	No	NA	No	NA	No	Free bank
ES	Spain	EUR	Yes	24	ES 00	10	10	10	10	NA	Yes	NA	Yes	NA	Yes	Free bank
ET	Ethiopia	ETB	No	18	ET 00	11	11	11	11	NA	No	NA	No	NA	No	Free bank
FI	Finland	EUR	Yes	18	FI 00	11	11	11	11	NA	Yes	NA	Yes	NA	Yes	Free bank
FJ	Fiji	FJD	No	18	FJ 00	11	11	11	11	NA	No	NA	No	NA	No	Free bank
FR	France	EUR	Yes	27	FR 00	11	11	11	11	NA	Yes	NA	Yes	NA	Yes	Free bank
GA	Gabon	XAF	No	27	GA 00	11	11	11	11	NA	No	NA	No	NA	No	Free bank
GB	United Kingdom	GBP	Yes	22	GB 00	10	10	10	10	NA	Yes	NA	Yes	NA	Yes	Free bank
GD	Grenada	XCD	No	22	GD 00	10	10	10	10	NA	No	NA	No	NA	No	Free bank
GE	Georgia	GEL	No	22	GE 00	10	10	10	10	NA	No	NA	No	NA	No	Free bank
GF	French Guyana	EUR	Yes	27	GF 00	11	11	11	11	NA	Yes	NA	Yes	NA	Yes	Free bank
GG	Guernsey	GBP	Yes	22	GG 00	10	10	10	10	NA	Yes	NA	Yes	NA	Yes	Free bank
GH	Ghana	GHS	No	22	GH 00	10	10	10	10	NA	No	NA	No	NA	No	Free bank
GI	Gibraltar	GBP	Yes	23	GI 00	10	10	10	10	NA	Yes	NA	Yes	NA	Yes	Free bank
GL	Greenland	DKK	Yes	18	GL 00	10	10	10	10	NA	Yes	NA	Yes	NA	Yes	Free bank
GM	Gambia	GMD	No	18	GM 00	10	10	10	10	NA	No	NA	No	NA	No	Free bank
GN	Guinea	GNF	No	27	GN 00	11	11	11	11	NA	No	NA	No	NA	No	Free bank
GP	Guadeloupe	EUR	Yes	27	GP 00	11	11	11	11	NA	Yes	NA	Yes	NA	Yes	Free bank
GR	Greece	EUR	Yes	27	GR 00	11	11	11	11	NA	Yes	NA	Yes	NA	Yes	Free bank
GT	Guatemala	GTQ	Yes	29	GT 00	12	12	12	12	NA	Yes	NA	Yes	NA	Yes	Free bank
GW	Guinea-Bissau	XBP	No	25	GW 00	10	10	10	10	NA	No	NA	No	NA	No	Free bank
GY	Guyana	GYD	No	26	GY 00	11	11	11	11	NA	No	NA	No	NA	No	Free bank
HK	Hong Kong	HKD	No	25	HK 00	10	10	10	10	NA	No	NA	No	NA	No	Free bank
HN	Honduras	HNL	No	28	HN 00	11	11	11	11	NA	No	NA	No	NA	No	Free bank
HR	Croatia	HRK	Yes	21	HR 00	10	10	10	10	NA	Yes	NA	Yes	NA	Yes	Free bank
HT	Haiti	HTG	No	28	HT 00	11	11	11	11	NA	No	NA	No	NA	No	Free bank
HU	Hungary	HUF	Yes	28	HU 00	10	10	10	10	NA	Yes	NA	Yes	NA	Yes	Free bank
ID	Indonesia	IDR	No	22	ID 00	10	10	10	10	NA	No	NA	No	NA	No	Free bank
IE	Ireland	EUR	Yes	22	IE 00	10	10	10	10	NA	Yes	NA	Yes	NA	Yes	Free bank
IL	Israel	ILS	No	23	IL 00	10	10	10	10	NA	No	NA	No	NA	No	Free bank
IM	Isle of Man	GBP	Yes	22	IM 00	10	10	10	10	NA	Yes	NA	Yes	NA	Yes	Free bank
IN	India	INR	No	23	IN 00	10	10	10	10	NA	No	NA	No	NA	No	Free bank
IQ	Iraq	IQD	Yes	20	IQ 00	10	10	10	10	NA	No	NA	No	NA	No	Free bank
IS	Iceland	ISK	Yes	26	IS 00	10	10	10	10	NA	Yes	NA	Yes	NA	Yes	Free bank
IT	Italy	EUR	Yes	27	IT 00	11	11	11	11	NA	Yes	NA	Yes	NA	Yes	Free bank
JF	Jersey	GBP	Yes	22	JF 00	10	10	10	10	NA	Yes	NA	Yes	NA	Yes	Free bank
JM	Jamaica	JMD	No	26	JM 00	11	11	11	11	NA	No	NA	No	NA	No	Free bank
JO	Jordan	JOD	Yes	30	JO 00	10	10	10	10	NA	No	NA	No	NA	No	Free bank
JP	Japan	JPY	No	30	JP 00	10	10	10	10	NA	No	NA	No	NA	No	Free bank
KE	Kenya	KES	No	27	KE 00	10	10	10	10	NA	No	NA	No	NA	No	Free bank
KG	Kyrgyzstan	KGS	No	16	KG 00	10	10	10	10	NA	No	NA	No	NA	No	Free bank
KH	Cambodia	KHR	No	24	KH 00	10	10	10	10	NA	No	NA	No	NA	No	Free bank
KI	Solomon Islands	SBD	No	27	KI 00	10	10	10	10	NA	No	NA	No	NA	No	Free bank
KM	Comoros	KMF	No	27	KM 00	10	10	10	10	NA	No	NA	No	NA	No	Free bank
KW	Kuwait	KWD	Yes	30	KW 00	10	10	10	10	NA	Yes	NA	Yes	NA	Yes	Free bank
KY	Cayman Islands	KYD	No	27	KY 00	10	10	10	10	NA	No	NA	No	NA	No	Free bank

Appendix IV: Specifications of Custom Forms

IBAN Usage Rules

Form layout:

Bank Name		Bank Account			
Bank A		EU			
Country Code	Country	IBAN Status	SEPA Country	IBAN Usage	
				Domestic	Cross Border
AF	Afghanistan	No IBAN			
AL	Albania	Active	No	Yes	Yes
DZ	Algeria	Transitioning	No	No	Recommended
AD	Andorra	Active	Yes	Yes	Yes
AO	Angola	Transitioning	No	No	No
AI	Anguilla	No IBAN			
AG	Antigua and Barbuda	No IBAN			
AR	Argentina	No IBAN			
AM	Armenia	No IBAN			
AU	Australia	No IBAN			
AT	Austria	Active	Yes	Yes	Yes

Ref.	Field	Type	Source	Additional Detail
Master Record				
1	Bank Name	List of Values	All Banks	Only list banks having at least one internal bank account
2	Bank Account	List of Values	Internal Bank Accounts	Internal bank accounts belonging to Bank specified in field 1
Child Records				
3	Country Code	List of Values	All Countries	
4	Country	Not Updatable	All Countries	Displays de country name selected in field 3
5	IBAN Status	List of Values	Lookup	Possible values: Active / No IBAN / Transitioning
6	SEPA Country	List of Values	Lookup	Possible values: Yes / No Only Enterable if IBAN Status = Active
7	Domestic	List of Values	Lookup	Possible values: Yes / No / Recommended
8	Cross Border	List of Values	Lookup	Possible values: Yes / No / Recommended

Rules:

- Do not allow more than one entry per country (for each master record).

- Whenever “Recommended” is selected for Domestic or Cross Border, if both IBAN and Bank Account exist in the database, IBAN gets selected.

Purpose of Payment

Form layout:

Bank Name						Purpose of Payment		
Bank A								
Country Code	Country	Payee Type	Transaction Source	Transaction Type	Payment Group	Code	Text	Print
<Any>	<Any>	<Any>	Travel	<Any>	<Any>		Travel Related Expenses	Description
<Any>	<Any>	Employee	Payroll	<Any>	<Any>		Salary, Wages or Staff Welfare	Description
<Any>	<Any>	Supplier	Accounts Payable	<Any>	<Any>		Payment for Goods and Services	Description
AE	United Arab Emirates	<Any>	Travel	<Any>	<Any>	TKT	Tickets	Code
AE	United Arab Emirates	<Any>	<Any>	<Any>	AMEX	TKT	Tickets	Code
AE	United Arab Emirates	Employee	<Any>	Staff Welfare	<Any>	FAM	Family Support	Code
AE	United Arab Emirates	Employee	Payroll	<Any>	<Any>	COP	Compensation	Code
IN	India	<Any>	Travel	<Any>	<Any>	P0302	Business Travel	Both
IN	India	Employee	Payroll	<Any>	<Any>	P1401	Compensation of Employees	Both
IN	India	Supplier	Accounts Payable	<Any>	<Any>	P1002	Trade Related Services	Both

Ref.	Field	Type	Source	Additional Detail
Master Record				
1	Bank Name	List of Values	All Banks	Only list banks having at least one internal bank account
Child Records				
2	Country Code	List of Values	All Countries	
3	Country	Not Updatable	All Countries	Displays de country name selected in field 2
4	Payee Type	List of Values	All Payee Type	Allow “<Any>” for all payee types
5	Transaction Source	List of Values	All Sources	Allow “<Any>” for all payee types
6	Transaction Type	List of Values	All Transaction Types	Allow “<Any>” for all payee types
7	Payment Group	List of Values	All Payment Groups	Allow “<Any>” for all payee types
8	Code	Free Text		Payment of Purpose code (if exists)
9	Text	Free Text		Payment of Purpose description (if exists)
10	Print	List of Values	Lookup	Possible options: Code / Description / Both

Rules:

- The same combination of Country, Payee Type, Transaction Source, Transaction Type and Payment Group should not be repeated under the same master record.
- When committing the record, a validation should check that at least one of the Code / Text has been entered.

Note: The rules engine takes as input data that is specific to the back-office system. This specification of the form will necessarily have to be updated to work with other systems and business solutions.

Intermediary Banks

Form layout:

Bank Name	Bank Account	Branch
Bank B	NY	NY Branch

Currency	Beneficiary			Intermediary			
	Country	Bank	Branch ID	Bank	Bank ID	Branch ID	Account ID
USD	Australia	Bank of America - Australia	BOFAAUSX / CUID 280482	Bank of America	CHIPS 0959	N/A	N/A
USD	Australia	Bank of China - Australia	BKCHAU2A / CUID 433886	Bank of China	CHIPS 0326	N/A	N/A
USD	Australia	Bank of Communications	COMMAU2S / CUID 437213	Bank of America	CHIPS 0959	N/A	N/A
USD	Australia	Bank of Queensland	QBANAU4B / CUID 059479	Bank of America	CHIPS 0959	N/A	N/A
USD	Australia	Bank of Western Australia	BKWAAU6P / CUID 003864	Citibank	CHIPS 0008	N/A	N/A
USD	Australia	BNP Paribas Securities	PARBAU2S / CUID 438802	BNP Paribas NY	CHIPS 0768	N/A	N/A
USD	Australia	BNP Paribas Sydney	BNPAAU2S / CUID 011702	BNP Paribas NY	CHIPS 0768	N/A	N/A
USD	Australia	Citibank Limited Sydney	CITIAU2X / CUID 230911	Citibank	CHIPS 0008	N/A	N/A
USD	Australia	Credit Suisse 230911	CRSAU2S / CUID 341975	Bank of NY Mellon	CHIPS 0001	N/A	N/A
USD	Australia	Deutsche Bank Australia	DEUTAU2S / CUID 246051	Deutsche Bank	CHIPS 0378	N/A	N/A

Ref.	Field	Type	Source	Additional Detail
Master Record				
1	Bank Name	List of Values	All Banks	Only list banks having at least one internal bank account
2	Bank Branch	List of Values	All Bank Branches	Bank branches belonging to the bank specified in field 1
3	Bank Account	List of Values	Internal Bank Accounts	Internal bank accounts belonging to Bank and Branch specified in fields 1 and 2
Child Records				
4	Currency	List of Values	All Currencies	
5	Ben. Country	List of Values	All Countries	Country of the beneficiary bank
6	Ben. Bank	List of Values	All Banks	All banks in the country indicated in field 5

				Do not allow the same bank as in field 1
7	Ben. Branch ID	List of Values	All Branches	Branch ID for all branches belonging to the bank indicated in field 6
8	Int. Bank	List of Values	All Banks	All banks except for the ones specified in fields 1 and 6
9	Int. Bank ID	List of Values	All Banks	Bank Identifier of the bank selected in field 8
10	Int. Branch ID	List of Values	All Branches	All branches belonging to the bank are specified in field 8. Allow value "N/A" for the case when no mapping is required for the intermediary branch
11	Int. Account ID	Free Text		Free Text Allow value "N/A" for the case when no mapping is required

Rules:

- Fields 10 and 11 are not mandatory. These are only required whenever the beneficiary states the intermediary branch and account number. For the relationships between CHIPS participants, such information is not required.

Appendix V: XML Master File Schema

Access the [repository](#) for access to the documentation pertaining to this Appendix.

URL: <https://github.com/jcsconstantino/iso20022>

Included:

- Appendix V - XML Master File Schema.xsd – The XML Schema file (without annotations)
- Appendix V - XML Master File Schema Documentation.docx – The entire documentation with annotations and the indication of the business rules

Appendix VI: XSLT Transformation Template

Access the [repository](#) for access to the documentation pertaining to this Appendix.

URL: <https://github.com/jcsconstantino/iso20022>

Included:

- Appendix VI - XSLT Transformation Template – The XSLT template (with annotations)

Appendix VII: Demonstration Scenarios

Access the [repository](#) for access to the documentation pertaining to this Appendix.

URL: <https://github.com/jcsconstantino/iso20022>

Included scenarios:

Scn	Bank Acct.	Profile	Re-mit.	Total	Breakdown	To Observe
1	Bank A - EU	SEPA	Unstr.	550 EUR	Pmt. 1: 300.00 (100.00 + 200.00) Pmt. 2: 250.00 (300.00 - 50.00)	-Compliance with SEPA rules -Unstructured remittance message (multiple payments and documents) -Batch Booking (grouping rules)
2	Bank B - UK	SEPA	Struct.	550 EUR	Pmt. 1: 300.00 (100.00 + 200.00) Pmt. 2: 250.00 (300.00 - 50.00)	-Compliance with SEPA rules -Structured remittance message (multiple payments and documents) -Batch Booking (grouping rules)
3	Bank C - CA	Global	Unstr.	7000.00 CAD	Pmt. 1: 5000.00 (3000.00 + 2000.00) Pmt. 2: 2000.00	-Proprietary local instrument code -Routing details
4	Bank C - JP	Global	Unstr.	9000 JPY	Pmt. 1: 7000 JPY Pmt. 2: 2000 JPY	-Proprietary local instrument code -Routing details -Inclusion of alternate bank account name (in Katakana) -Bank branch address removal -Bank account type
5	Bank A - EU	Global	Unstr.	6000.00	Pmt. 1: 2000.00 AUD Pmt. 2: 2000.00 GBP Pmt. 3: 1000.00 EUR Pmt. 4: 1000.00 EUR	-Concatenation of beneficiary bank name and address -Concatenation of routing numbers with bank account numbers for Australia -Rules for populating the Bank Account tag for countries like Côte D'Ivoire -IBAN usage rules for Azerbaijan (an IBAN country) -Purpose of Payment
6	Bank B - NY	Global	Unstr.	4000.00 USD	Pmt. 1: 1000.00 Pmt. 2: 1000.00 Pmt. 3: 2000.00	-Domestic ACH payment (ABA routing code) -Cross-border with an intermediary (CHIPS Participant) -Cross-border without an intermediary (urgent payment) -Payee contact details -Purpose of payment

Appendix VIII: Survey

Survey for the IT Developer and Support focus group

ISO 20022 Implementation - Technical

The goal of this survey is to evaluate the success of the ISO 20022 adoption initiative. Your feedback is highly appreciated!

Q1. In comparison to the maintenance of legacy formats, and on a scale of 1 (much worse) to 5 (much better), how do you evaluate the ISO 20022 solution in the following aspects:

	1	2	3	4	5	N/A
Q1.1. Easyness to perform any change to the templates	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q1.2. Effort involved in testing and deploying a change	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q1.3. Involvement of business users in the definition of rules and in testing the solution	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q1.4. Perception of complexity associated to performing rollouts to other banks?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q1.5. Overall, in terms of value added and success, how do you compare the new against the legacy solution?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q1.6. In terms of overall effort in supporting the solution, how do you compare against legacy?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q2 Please provide any comments you may have in regards to the previous set of questions.

Q3. Did you find the choice of technologies adequate?

Yes No

Why?

Q4. How do you see the implemented ISO 20022 solution as being scalable and sustainable? Why?

Q5. Do you see any room for improvement to the ISO 20022 solution? On what?

Survey for the Treasury focus group

ISO 20022 Implementation - Treasury

The goal of this survey is to evaluate the success of the ISO 20022 adoption initiative. Your feedback is highly appreciated!

Q1. In comparison to the maintenance of legacy formats, and on a scale of 1 (much worse) to 5 (much better), how do you evaluate the ISO 20022 solution in the following aspects:

	1	2	3	4	5	N/A
Q1.1. Easyness to perform any change to the templates	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q1.2. Effort involved in testing and deploying a change	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q1.3. Involvement of business users in the definition of rules and in testing the solution	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q1.4. Perception of complexity associated to performing rollouts to other banks?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q1.5. Overall, in terms of value added and success, how do you compare the new against the legacy solution?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q1.6. In terms of overall effort in supporting the solution, how do you compare against legacy?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q2. Please provide any comments you may have in regards to the previous set of questions.

Q3. How do you see the implemented ISO 20022 solution as being scalable and sustainable? Why?

Q4. Do you see any room for improvement to the ISO 20022 solution? On what?

Survey Results

IT Developer and Support Staff						
Q1.1	Q1.2	Q1.3	Q1.4	Q1.5	Q1.6	Q2
Q3						
Q4						
Q5						
						The ISO pain.001.001.03 is much easier to modify. We solved the SEPA issue with the batch booking (that was open for 4 years) by simply adding two lines of code in the xsdt. We also close many old tickets and very few new tickets have been opened since the go live.
5	5	5	5	5	5	1 and 2 - I feel it is easier to do any change and see the impact immediately 3 - users are now much more involved, they now understand the rules that are applied. They connect with the banks (which are coming up changes) and communication improved 4 - I have no doubts that the two planned rollouts will be much easier to perform 5 - Significant improvement! Not only the legacy formats were dropped we chose one single format. It has many differences and exceptions but that is manageable
						I have a very positive first impression about this solution. We have been struggling for years with multiple issues, from managing multiple (and very diverse) formats. Limitations with character sets, changes that are required urgently, updates to master data with the only purpose of working around issues, etc. Now everything seems to be in place, there was a clear strategy defined and elements like the quality of master data were not forgotten about. The number of open incidents has dropped dramatically and I am dedicating much less time in supporting the payments process. Users are now aware of the rules we apply, and they can even create test cases and try the solution. This is major shift as it brought THD and users closer. The definition of rules for purpose of payment and the selection of IBAN/BBAN is also very helpful.
4	5	4	4	5	5	The iso2022 adoption initiative has provided us with a significant improvement. It is inevitable to adopt the pain001 format in the next few years, but it is better to start by having a template that can be reused, we don't have to start from scratch. I am also happy with the definition of the steps that should be executed and the instructions for getting details from the banks. It is also important to act quickly when we have issues and this customization enables that, and we normally had a lot of issues (but very few new issues now). The colleagues from treasury can also be involved in the definition of requirements because they are now able to understand and perform tests themselves
5	5	5	4	5	5	The new solution is more complex to manage. There is no need to have an intermediate step between the extraction of data and its transformation, this can be handled directly with SQL
1	1	1	N/A	1	1	
						The user configuration forms really helps us because we don't have to hard code all those rules. They seem flexible enough. The xsdt is a very good idea, it is very easy and it does everything that we need. It is very easy to test.
						XSL is very easy to learn and I have the flexibility to define all types of rules. The only problem is that we don't have all the functions we need (should be available in XSL v2 or v3 only).
						Yes
						Huge improvement - it was unthinkable to continue managing the 'old' formats. Using one single format means less effort and more quality
						NA
						It is definitely sustainable. As I mentioned before we have significantly less incidents now. It should also be scalable as the introduction to new bank accounts must be simplified.
						Maybe the XSD needs some improvement as the rules are not clear. Some addresses fail validation but according to the solution architect that is acceptable.
						We did not participate in a rollout yet so I cannot judge the scalability. It should be simpler at least in theory as we can implement the same template and manage the exceptions. It is completely sustainable because only after a few weeks we managed to close almost all the tickets we had open for years and very few new issues are coming up
						It will be difficult to sustain because there are now more components to manage while the available resources are the same. We didn't have the possibility of testing a rollout but I can anticipate many issues during the process
						The XML schema is a bit confusing - sometimes it gives an error message but I am not totally sure when I need to act and correct
						going back to the old (but much more effective) solution

Treasury Staff						
Q1.1	Q1.2	Q1.3	Q1.4	Q1.5	Q1.6	Q2
						<p>I was skeptical when we started the project, but I am now optimistic. Even though the project required significant attention from us, it seems to be paying off. It used to be a nightmare to manage all the several formats, especially when dealing with IT (they fix one thing and break another).</p> <p>We are getting significantly less rejections (and repair fees).</p> <p>- treasury is now a lot more involved and we (finally) have visibility on what is happening. We are involved in the definition of the mappings and the conditions to insert data in the fields of the xml file. We can also test some other scenarios</p> <p>- overall the solution is much better compared to the previous. We had so many problems and ITHD was not responsive. We always had to request master data team to temporarily modify data and now everything is in the right place and we don't use workarounds</p> <p>Abandoning the MT101, UN and US ACH formats is something we should have done earlier, all of them were giving us trouble. The process is now much smoother and I can clearly say that we are having less rejections (maybe 80% less) and the amount of inquiries and the time we spend on them decreased to less than 10% of what it used to be. The exception was the first few weeks when we still had some problems. But all the problems we had were resolved promptly.</p> <p>We had no more issues with invalid characters and the bank reconciliation of SEPA payment batches is improved</p>
N/A	4	5	3	5	5	<p>- treasury is now a lot more involved and we (finally) have visibility on what is happening. We are involved in the definition of the mappings and the conditions to insert data in the fields of the xml file. We can also test some other scenarios</p> <p>- overall the solution is much better compared to the previous. We had so many problems and ITHD was not responsive. We always had to request master data team to temporarily modify data and now everything is in the right place and we don't use workarounds</p> <p>Abandoning the MT101, UN and US ACH formats is something we should have done earlier, all of them were giving us trouble. The process is now much smoother and I can clearly say that we are having less rejections (maybe 80% less) and the amount of inquiries and the time we spend on them decreased to less than 10% of what it used to be. The exception was the first few weeks when we still had some problems. But all the problems we had were resolved promptly.</p> <p>We had no more issues with invalid characters and the bank reconciliation of SEPA payment batches is improved</p>
						<p>I see potential improvements in correcting the issues related to the approval workflow. This project is also a good opportunity to improve the master data SOPs. The cleanup exercise was successful but after that we had issues with new suppliers.</p>
						<p>From what I understand, we are now using a sheet that can be reused for other banks. There are general rules and then there are exceptions, and only the exceptions need to be coded. It should be scalable but I am not a programmer.</p>
						<p>- I believe it is sustainable: so far all the corrections have been applied within 1-2 days of the ticket being logged</p>
						<p>- The solution should allow tests with the beneficiary banks. If we test with our banks only we will never know if the payments will go through.</p>
						<p>I would like to have a dashboard to give me an overview of the daily payment runs. I would also like to have more validations to the master data (bank account formats for example) and better controls and policies to be implemented for master data management</p>
5	5	5	5	5	5	<p>I am not a technical person but I believe that IT is able to rollout new banks quickly, or at least, be able to work with the business units (treasury especially).</p>