PAYMENT SYSTEMS MIGRATION TO THE ISO 20022 ELECTRONIC MESSAGING STANDARD

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Payment systems migration to the ISO 20022 electronic messaging standard

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Abstract: The paper aims to analyse the projects of payment systems migration from the current ISO 15022 to the new ISO 20022 standard globally and in Serbia. One of the main project objectives is to facilitate cross-border payments, still largely characterised by high costs, low speed and insufficient transparency. This objective has been acknowledged globally as testified by the G20 roadmap designed in October 2020. National central banks are implementing their own migration projects based on keeping up with good practices and operating in accordance with the most up-to-date standards. The National Bank of Serbia also aims to achieve the compatibility required for potential connection with other payment systems (e.g. TARGET services of the European Central Bank) and connection to the SEPA geographical scope. New electronic messages are up to three times larger and structured in a way to offer greater flexibility, accommodation to economic conjuncture and complex requirements of AML/CFT, KYC, fraud prevention regulations, and the possibility for an almost one hundred percent straight-through processing rate. The analysis combines descriptive, comparative and case study methods to present in detail the characteristics of payments systems as the fundamental public infrastructure, payment trends, as well as the phenomenon of the electronic messaging standard and the XML pattern as the syntactic basis of the ISO 20022 standard. The paper also looks into the experiences of international payment systems and their operators, migration methods in the SWIFT network, as well as the work of the SWIFT central service for translation of MT and MX messages. Potential characteristics of the future software platform of the National Bank of Serbia for the NBS RTGS and NBS Clearing payment systems are also discussed in the paper. Payment systems migration will be completed in November 2025. As for the SWIFT network, the coexistence period started in March 2023 when messaging was possible under both standards. The NBS, as the operator of the payment systems which will switch to the new messaging format, will enable the coexistence of two messaging formats until the end of 2024 as one of the measures for ensuring the continuity of their work.

Key words: migration, ISO 20022 standard, electronic messages
[JEL Code]: E42, E58, F30, F33, G20

Non-technical summary

In the prior period, most payment systems in the world used the ISO 15022 standard as the basis for electronic messages exchanged by participants: central banks, banks, non-banking payment service providers and other payment system operators. This is the SWIFT MT message format most often modified by payment system operators primarily to adapt to local market needs. Despite various shortcomings of MT messages which became clear during the years of their use, e.g. in cross-border payments, this implies certain fragmentation and impossibility to optimise the exchange of information among financial institutions. Amid expanding, more globalised and connected financial markets, the need of the financial community for improvement of electronic messages is rising.

The focus of efforts made at improving cross-border payments is the switch to the new, ISO 20022 standard of electronic messages in the MX format. These messages can contain several times richer and more structured information, which significantly reduces the potential for misinterpretation, at the same time increasing the success of straight-through data processing. A wealth of information will be used in several financial industries, not only the payment area, implying greater interoperability among diverse market participants. This should additionally enhance the quality of information about financial transactions, financial products and services for which it will be used, as well as help meet ever stricter regulatory requirements as the complexity of the payment services market increases.

The transition to the new standard is a global project headed by the International Organization for Standardization (ISO), Society for Worldwide Interbank Financial Telecommunication (SWIFT*)* and operators of the largest international payment systems, primarily the European Central Bank. The official transition deadline in the SWIFT network is November 2025 while the two message formats coexistence period started in March 2023. This means that as of March 2023 all institutions are required to have the technical capacity to receive the MX format messages, while as of 2025 they will be required to send messages in this format as well. The new message format is currently used in more than 70 countries. In November 2025, SWIFT will decommission MT messages.

The paper aims to present the characteristics of this migration, first in introductory sections on payment systems and trends. The analysis then observes electronic messages, differences between various formats and finally the ISO 20022 standard, as well as its syntactic basis, a standardised XML-based syntax for textual messages. The last section provides an overview of international migration experiences, interoperability of payment systems in the coexistence period, as well as domestic payment systems. Out of eight payment systems in the Republic of Serbia, the National Bank of Serbia (NBS) is the operator of six – NBS RTGS System, NBS Clearing System, NBS Interbank Clearing of FX Payments, International Clearing of FX Payments, DinaCard Clearing System and IPS System. As the last-mentioned system has operated under the ISO 20022 standard since 2018, it is the NBS RTGS System, NBS Clearing System, NBS Interbank Clearing of FX Payments, International Clearing of FX Payments that will migrate to the new standard. The scope of this paper covers the potential characteristics of the software platform which, once the migration is concluded, will be the basis for the operation of the NBS RTGS and Clearing payment systems, as important systems entirely concerning domestic payments in dinars. A comparative overview will be presented of the currently used MT ISO 15022 messages and their potential MX ISO 20022 equivalents. Also, this paper exemplifies the NBS's support to all payment system participants during the migration project.

Contents:

1 Introduction 70

2 Payment systems: the bloodstream of modern-day economy 71

2.1 Classification of payment systems 72
2.2 Significance of payment systems 74
2.3 Trends in payment services and payment systems 76

3 Electronic message standards 78

3.1 XML: Syntax of the new standard 81
3.2 Characteristics and use of ISO 20022 in the area of payments 82

4 Migration to the new standard: opportunities and challenges 86

4.1 Beginnings of migration 86
4.2 Ensuring interoperability in coexistence 87
4.3 International experiences 88
4.4 Payment systems in the Republic of Serbia 90

5 Conclusion 92

Literature 94

1 Introduction

A payment system is a set of systems for transferring monetary assets, which facilitates money circulation. It is an indispensable part of the public infrastructure as well as a precondition for monetary policy implementation and economic activity. Instruments and procedures enabling the above also make a part of payment systems. As this is a structure with a significant economy of scale and a unique natural monopoly, the most frequent model is the one where central banks are payment system founders, owners and operators. Models differ not only in management structure but also in other criteria depending on payment system characteristics. Their heterogeneity concerning various issues – such as ownership of settlement assets, purpose of establishment, the requirements to be satisfied, etc. – conditions the diversity of their operations.

The principal activity of payment systems is to enable payments, as the transfer of funds from a payer to a payee after which mutual obligations of both parties are discharged. It is precisely because of this dynamic evolution of payment, which has moved away from the use of cash in the last twenty or so years, that the significance of payment system operators is growing. Digital payments are continuously developing owing to the constant interaction between payment service providers, ICT development and the needs of end users. These needs are diverse, but they all have in common the constant striving towards acceleration, simplicity and security of the payment process. This refers to both internal and international payment traffic.

Cross-border payments, as payments between two financial entities from different countries and different payment systems, are methods for executing international financial flows. To ensure economic growth, globalisation demands speed from capital. This implies the perfection of payment methods between parties in the same but also in different payment systems. Payments are made by exchanging a great number of different electronic messages between financial institutions, their clients and payment system operators. This takes place through computer networks which can be international (e.g. SWIFT) and local, i.e. tailor-made to individual payment systems. An electronic message is a set of information exchanged in a transaction by financial institutions: information on institutions, client information, information about amounts and types of used payment instruments, etc. These data have a certain structure established by conventions. These conventions are named standards. Formulating, confirming and promoting standards in the area of financial services, and many other standards, falls under the mandate of the International Organization for Standardization (ISO).

The bulk of payment systems worldwide, including those operated by the NBS (except the NBS IPS System, compatible with ISO 20022), have so far used SWIFT MT messages based on the ISO 15022 standard as the principal and most frequently used standard for the exchange of financial messages between financial institutions. National payment system operators, including the NBS, mainly opted for a minor or major modification of the content of this message format, to meet the needs of their local markets. This increases their usefulness in internal use by domestic customers but compromises it in international exchange, particularly when national payment systems are increasingly striving towards integration stimulated by globalisation requirements. As message types are rather diverse, this calls for optimisation, simplification, and acceleration of payments.

The new ISO 20022 electronic messaging standard should be able to satisfy this need. This is an improved system of recording information in electronic messages whose structure, scope and technical rigour have been significantly improved in relation to the ISO 15022 version. Influential international organisations, private sector and operators of globally significant payment systems (the

European Central Bank, the Federal Reserves, etc. as well as the SWIFT network) are the hubs of global migration to the new electronic messaging standard, which should be completed by November 2025. This is a part of the G20 roadmap designed in October 2020 with the objective to facilitate cross-border payments. This should be implemented by solving persistent problems such as high costs, low speed and insufficient transparency of these payments. Central banks and financial institutions which are payment system operators as well as payment system participants must finish the migration by the set deadline, when the SWIFT network will decommission the MT message format. This particularly refers to entities using the SWIFT network as the primary communication channel. As it entails substantial software-hardware adjustments, this is a technically and organisationally demanding process.

The paper is aimed at analysing this migration. A combination of descriptive, comparative and case study methods provides an overview of all relevant aspects of the migration ahead of payment systems in Serbia and their participants. They concern the nature of the payment systems, their technical and organisational features, digital payment trends, electronic message phenomena and syntactic basis of the ISO 20022 standard.

The paper is structured in the following way. Below the readers will be informed about the basic concepts concerning payment systems such as payment, clearing, settlement, etc. Several classification methods for payments systems are presented indicating the basic features of three out of six payments systems operated by the NBS: NBS RTGS System, NBS Clearing System and NBS IPS System. In addition to the mentioned three, the NBS also operates the following systems: NBS Interbank Clearing of FX Payments, International Clearing of FX Payments and DinaCard Clearing System. Payment systems are the key financial infrastructure benefiting all stakeholders – from government through banks to end users of payment services. Hence, it is important to also introduce the future trends of payment service provision – accelerated digitalisation and integration with advanced technologies such as artificial intelligence. The third part of the paper presents the phenomenon of electronic messages and their standardisation, with an overview of the XML pattern as the syntactic basis of the ISO 20022 standard. The fourth part of the paper concerns the migration to the new standard both worldwide and in our country – with a focus on the NBS RTGS System and NBS Clearing System as important payment systems.

As the intention of this paper is to symbolise the onset of payment systems migration in the Republic of Serbia, as the project of first-class importance for both the operator and participants – the paper ends without a conclusion in the narrow sense of the word. This is a result of its somewhat specific role. It is primarily informational. This means providing the main set of information, which is not final, but is useful for all participants in the project and for the success of its implementation. An equally important idea behind this paper was to exemplify the NBS's constant support to all participants in the payment systems of which it is the operator.

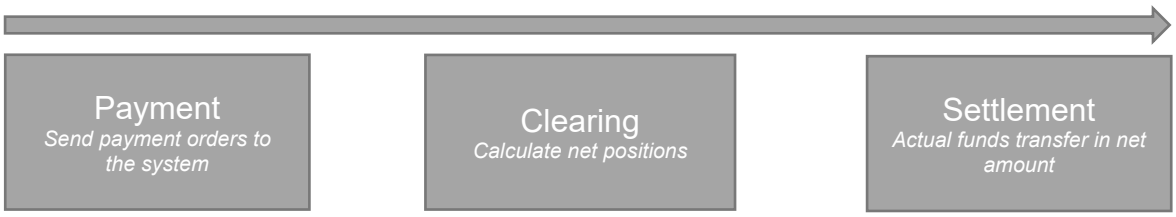
2 Payment systems: the bloodstream of modern-day economy

There are several ways to define payment systems. Most often they are defined as a complete set of instruments, intermediaries, rules, procedures and interbank funds transfer systems which facilitate the circulation of money in a country or currency area (ECB, 2010). It can also be said that the above set guarantees such circulation of money (Banco de México, 2024). Put more concisely, a payment system is an organised arrangement for transferring monetary value between two parties (Nakajima, 2011). According to our Law on Payment Services, a payment system is "a system for

the transfer of funds between its participants with written and standardised procedures and rules for the processing, netting and/or settlement of transfer orders, applied to all participants in the system" (RS Official Gazette, Nos 139/2014 and 44/2018).

Therefore, a transfer of monetary value (payment) is a transfer of funds which discharges an obligation on the part of the payer vis-à-vis a payee (ECB, 2010). The mutual obligations between the two parties are discharged once payment is done. This is referred to as settlement. Settlement is preceded by processing and clearing. Clearing is the process of determining the difference between the sum of all transfers received and the sum of all transfers sent on individual accounts of payment system participants – the calculation of the net position. If the difference is positive, the participant has a net positive (credit) position. If it is negative, it has a net negative (debit) position. During settlement, participants with a negative net position send an amount equal to their net position into the system. This is then summed up and distributed to participants with a positive net position. Though in theory clearing is one of payment system processes, not all payment systems function according to this principle.

Figure 1 **Functioning of payment systems with clearing**



According to: Nakajima, M., "Payment System Technologies and Functions", p. 6.

Payment systems are a vital part of each country's public infrastructure because they affect the speed of economic flows, the results of monetary policy implementation and transmission, and the costs and liquidity of participants. They must therefore stay reliable. In fact, no economic activities are possible without the transfer of money (Nakajima, 2012),1 and no transfers are possible without payment systems.[2]

2.1 Classification of payment systems

In order to get a broader picture of payment systems, we will classify them according to several criteria. The classification criteria differ depending on the information to be provided by a specific classification. Payment systems can therefore be classified by: operator, method and frequency of settlement, value of transactions settled in this system and settlement assets (Figure 2).

According to the operator, there are central bank payment systems and private payment systems. The former are owned and operated by central banks, which means that central banks have the role of payment system operators.[3] In the Republic of Serbia, the NBS is the operator of the following payment systems – NBS RTGS, NBS Clearing System, NBS IPS System, NBS Interbank Clearing of FX Payments, International Clearing of FX Payments and DinaCard Clearing System. Private

[1] A well-known example is the reaction of Alan Greenspan, chairman of the Federal Reserve Board, when he heard of the September 11 attack. As he later said, his immediate concern was not the inflation rate or the unemployment rate, but the "Fedwire" – the largest payment system in the US which transfers more than USD 4 trillion a day.

[2] Except in case of cooperation with correspondent banks.

[3] Such as the American Fedwire, the ECB's TARGET2, Japanese BOJ-NET etc.

payment systems are founded and operated by private market players, most often associations of banks and other financial institutions (Clearing Houses). In professional literature, these payment systems are referred to as "clearing systems". In Serbia, the Association of Serbian Banks is the operator of two systems – ASB Cheque Clearing System and ASB Direct Debit Clearing.

According to the method of settlement, there are net and gross settlement systems. In net settlement systems, system participants' positions are in the net amount. Each participant's net position is calculated either relative to any other participant (bilateral settlement) or relative to all other participants (multilateral settlement). The NBS Clearing System is based on the multilateral settlement principle. In gross settlement, payments are made in the full amount, by order of entry into the system. The classification of payment systems by frequency of settlement is closely related. There is real-time settlement and designated-time settlement. The first group includes Real-time Gross Settlement Systems – RTGS, and the other Designated-Time Net Settlement (DTNS) or Deferred Net Settlement Systems (DNS). The clearing cycles in the NBS Clearing System are initiated four times during the system's working hours, which means that it belongs to the latter group.

According to the criterion of value of transactions processed through the payment system, we differentiate between Large Value Payment Systems (LVPS) and Retail Payment Systems (RPS). These designations – "large-value" and "retail" – should not necessarily be taken literally, but may also be understood as the type of payments for the processing of which these systems were designed. As a type of payment, retail payments are payments between bank clients – payment system participants, and refer to the transfers and purchase of goods and services by natural and legal persons and entrepreneurs. In other words, these are payments between two natural persons (P2P), between one natural and one legal person (P2B) or commercial transactions between legal persons and entrepreneurs (B2B) (Bech & Hancock, 2020). We should also add payments to government accounts – P2G and B2G. Such payments have relatively low value, but are very numerous. In theory, the systems processing retail payments do not need to carry out settlement on the same day when the payment order was received. They are most often doing so, however, in order to minimise operational risks, and this is the practice adopted by the payment systems operated by the NBS. Wholesale payments, on the other hand, are payments between financial institutions – payment system participants: payments to settle securities and foreign exchange trades, and other interbank transactions.#While there are significantly fewer compared with retail payments, their value is much larger. The average daily number of payments in the NBS RTGS System – the system for real time gross settlement of large-value payments[4] – is around 840,000, and the average value of an individual payment is around RSD 936,000.[5] Conversely, the NBS IPS system for retail payments processes around 185,000 payments a day, and their average value is around RSD 11,000.

The final classification is made according to ownership of settlement assets. There we differentiate between payment systems which settle in central bank money – money in payment system participants' accounts with the central bank – and in commercial banks money.[6] The finality

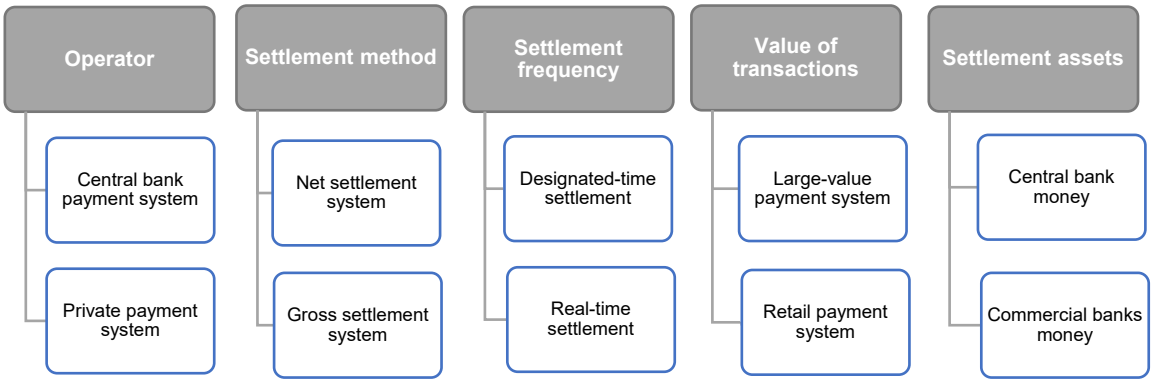
[4] Large-value payments are payments exceeding RSD 300,000. Not all payments in the NBS RTGS system are large-value payments in the wholesale sense, however. Retail payments are also effected in real time in this system. Their individual amounts are lower than RSD 300,000 but they are made in bulk. This is a service which aims to advance retail payments in the country. The NBS IPS system processes payments below RSD 300,000.

[5] "General indicators of RTGS and Clearing system in 2023", available at: https://www.nbs.rs/export/sites/NBS_site/documents-eng/platni-sistem/statistika/rtgs/stat_23.pdf

[6] It is often forgotten that natural persons' balances in banks do not represent their ownership but only, in a strictly theoretical sense, an "obligation" of the banks towards their clients.

of settlement liquidity risk, associated with balances with commercial banks, is minimal in the case of central bank balances. For this reason, the relevant global standards recommend that such systems be settled in central bank money (BIS, 2001).

Figure 2 **Classification of payment systems**



Source: author's analysis.

2.2 Significance of payment systems

The above is reflected in the fact that the ECB's RTGS system settled the equivalent of annual GDP of euro area countries in six days of operation, i.e. around EUR 13 trillion (ECB, 2023). The equivalent payment system in the UK settled an average of over GBP 720 billion each working day, equivalent to the UK's GDP every three days (BOE, 2022). The NBS RTGS system, as the most important payment system in the Republic of Serbia, processes around EUR 6.7 bn daily. The annual value processed through this system is approximately 29 times the country's GDP.

This is not the only reason why payment systems are difficult to overvalue. Each country relying on a stable macroeconomic environment, where the public has confidence in the financial and banking systems as hubs of economic activity, has to make sure that payments can be made at all times.

The functioning of payment systems costs money. The social cost of payment systems includes all costs sustained in order to make payments using all payment instruments[7] less charges on the transactions between system participants. Examples include the costs for the production of banknotes, the time it takes households to obtain cash and make payments or the costs of processing payment orders or cheques at bank tellers (Krüger & Seitz, 2014). Taken together, these are the net costs of payment systems. This concept is useful, but with limited potential. The estimates of net costs of payment systems, both aggregate and by individual transaction, depend on the characteristics of the national economy and, most of all, on the frequency of using specific payment instruments. This is a key factor for the economy of scale, necessary for payment system efficiency. It depends on the scale of the acceptance network for cashless payments, and even on the interest rates used when calculating the opportunity costs of going to an ATM or a bank teller. For all these reasons, the studies were not consistent even when they referred to the same countries, the same methodology

[7] Cash, payment cards, credit transfers, etc.

and similar time periods. Since costs depend on too many factors, different studies are not easily comparable. In spite of efforts, there is only limited knowledge and information available for making valid comparisons across countries (Schmiedel et al., 2012).

Increasing technological complexity and, by extension, efficiency of payment systems (e.g. through the introduction of instant payments systems) delivered the liquidity required for economic activities to take place. The technological development of payment system is hence critically important to the functioning of globalised markets. In other words, an efficient payment system can promote economic growth and deliver long-term productivity improvements which are prerequisites to elevating living standards (CEBR, 2022). The more efficient a payment system is, the fewer costs it involves.

The outbreak of the economic crisis in 2008 spiked interest in the development of macroeconomic forecasting tools, particularly those based on monetary and financial data. This has created scope for the analysis of data on payment instruments which, being associated with economic transactions, represent a unique source of information for the purposes of short-term economic activity forecasts. Though this connection was known more than a century ago, thanks to economist Irving Fischer (1912) who wrote that the "equations [quantitative theories of money] mean that the currency paid for goods is the equivalent of the value of the goods bought", the renewed interest was encouraged by the ideas of the so-called New Monetarists.[8] In this regard, based on earlier research on the relation of GDP, private consumption and the statistics of payment instruments – mostly cards, a close relationship was established between the time series on retail payments and main economic aggregates.

That the relationship between aggregate production and payment system statistics of a country is not only descriptive has been confirmed by a recent Indian study (Rooj, Sangupta, 2020). The researchers concluded that large-value payment systems positively impact economic growth, and that economic growth also leads to an increase in the value and volume of payments within these systems. They also found that an increase in RTGS payments leads to an increase in money supply and price level as indicated by the CPI. In other words, when the economy and incomes are rising (pushing up aggregate demand), people tend to indulge more in cashless[9] payments and thus enhance economic growth.

The main financial system participants are payment systems, central banks and commercial banks. Central banks play a vital role in modern-day payment systems. They operate these systems and carry out settlement for banks and other financial institutions. They also take active part in monetary policy implementation through open market operations. Hence a sound payment system is a prerequisite for successful monetary policy (Bech, 2008). Commercial banks use payment systems for operations in the markets of money, foreign exchange or securities on their own or on their clients' behalf. The impact of payment systems on finances and banking is reflected in the fact that banks are the key players in the payment services market, i.e. key payment system participants. So far, the banks' role was reflected in the performance of transactions at a significant and rising volume and in using the benefits of the economy of scale with a tendency of decline in costs. For banks, payment

[8] For more on this school of thought which, by contrast to traditional monetarism (and Keynesianism), relies more on macroeconomic analysis, see: *https://oxfordre.com/economics/display/10.1093/acrefore/9780190625979.001.0001/acrefore-9780190625979-e-397*.

[9] This can refer to cash payments, but because of the immanent risk of grey economy, cashless payments are a better criterion.

operations are an important source of stable income, and are not subject to capital requirements.[10] They are also an important source of information on clients' conduct and the base for applying the most advanced analytics (Živković, 2019).

Payment systems tend towards so-called natural monopoly. This is a situation where, in an economy of scale, maximum efficiency of production and distribution can only be achieved through a single supplier. The natural monopoly is characterised by enormous fixed costs and negligible marginal costs[11] (Varijan, 2014). Also, similarly to mobile telephony networks, payment systems are characterised by the so-called network externalities – the more participants in a payment system, the greater the value transmitted through the system and the more system participants and end-users it reaches.

In view of the above, central banks and the broader social community are clearly highly interested in ensuring the reliability and efficiency of payment systems.

2.3 Trends in payment services and payment systems

With the robust technological advances powered by the Internet and later also smartphones, the consumer habits, preferences and conduct have shifted in the past fifteen years from using cash to making digital payments. In parallel, the scope of Internet-based payment services widened, including e-banking or e-money payments.[12] The acquiring network is becoming modernised – ever more functional POS and ATM terminals are increasingly available, while the number of ATMs offering only cash withdrawal is dwindling. In addition to digitalised communication, digitalised purchase methods are another requirement of the technologically-mediated society, leading to higher demand for real-time retail payment instruments.

The general shift away from cash, cheques and credit transfers based on a paper order (payment slip), and towards cashless instruments, such as online credit transfers, cards or e-money, is particularly evident in the statistics on payment services provision. The average number of digital payments per person in the group of countries whose statistics are published by the Bank for International Settlements (*Red Book statistics*) increased from 179 to 332 in the 2012–2021 period.[13] Cash lost further popularity in the pandemic over fear of pathogens transmission via paper banknotes.[14] These trends are not universal, however, as the demand for cash, even in the richer countries of the capitalist centre, remains high. According to the last year's report of the Bank for International Settlement, currency in circulation as a share of GDP grew to an all-time high in the first year of the pandemic (2021), and still exceeds its pre-pandemic levels (Glowka et al., 2023). An important reason is that cash became significant as a store of value, which lead to its "hoarding" (Auer et al., 2022).

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[10] The scale of this income is best reflected in the fact that total net income from fees and charges in 2015 measured 65% of operating income of European banks.

[11] The establishing of a payment system involves very high initial costs independent from the number of payment system participants. Once a payment system has been set up, the additional cost of individual participants joining the system is negligible from the viewpoint of the owner of the payment system.

[12] The Serbian Law on Payment Services defines electronic money as electronically and magnetically stored monetary value as represented by a claim on the issuer of such money. It is not a synonym for balances in ordinary payment accounts. Like cash and account balances, electronic money is a means of payment and as such is regulated by the above Law.

[13] The list of countries is available at: *https://stats.bis.org/statx/toc/CPMI.html*.

[14] In the meantime, research revealed that banknotes and coins are no more dangerous than other frequently touched surfaces (Tamele, B., A. et al., 2021).

Regulators are adapting to the above trends. The central banks are upgrading their legal and regulatory framework: the key trend is the lifting of barriers to market entry for new, non-banking payment service providers (non-banking financial institutions – NBFI).[15] It is equally important that, by end-2023, over 60 countries modernised their payment systems by launching instant payment systems.[16] The world leader in the number of instant payments per inhabitant above 15 years of age is Thailand, with 276 payments a year. The most successful European country is Sweden, with 114 such payments (ACI, 2023). In the Republic of Serbia, the NBS IPS system was launched on 22 October 2018. In 2023, the system processed 67 million transactions or 11.25 instant payment transactions per inhabitant above 15 years of age. Though this type of statistics can differ greatly from country to country, depending on the dominant payment instrument and type of transaction (P2P, B2B, P2B or P2G), research shows that the acceptance of instant payments is followed by a general pattern of advancing technological innovation in payments (Bech et al., 2017). This means that instant payments are becoming standard.

An indication of future trends was given by the Global Payments portal (2024), which held in-depth discussions with leaders from financial institutions, businesses and international payment bodies, as well as from financial markets in periphery countries. The prevailing attitude is that, whatever direction global economy may take, market players are taking the initiative to accelerate and remove friction from the payment process, deploy the latest technologies to reduce fraud, and deepen their relationship with consumers of payment and other services. Artificial intelligence clearly takes centre stage: "It's not very often in one's lifetime that a technology like this [AI] comes along with such a wide variety of use cases," says Vanessa Colella, head of innovation and digital partnerships at Visa. Businesses do not have a single answer to how they intend to use it, but a half of SMEs surveyed are enthusiastic about the impact of AI on their business, as are 80% of large and multinational enterprises. Specific changes are emerging – according to the above research, the top three expected applications for AI are customer service (43%), fraud detection (43%) and marketing (40%). According to McKinsey consulting firm (2023), generative AI could add USD 2.6 trillion to USD 4.4 trillion in value to the global economy annually. Another important factor behind payment trends, even more than economic conjuncture, is open finance[17] and the resulting concepts such as banking as a service (BaaS). This is a set of related services provided by non-financial companies to their clients: from merchant m-applications with the internal account and payment functionality, to payment cards issued by the specific company or even microloans from online stores.[18]

Though non-traditional financial institutions have been allowed market access and cross-border payment dynamics are robust – reaching about USD 150 trillion in 2022, a 13 percent increase relative to 2021 – challenges remain (McKinsey & Company, 2023). They persist despite global communication networks which include thousands of financial institutions. Some of these challenges are: high costs due to chains of intermediaries, currency conversion, different working hours of payment systems, security risks, etc.

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[15] According to the World Bank definition, these are financial institutions that do not have a full banking licence and cannot accept deposits from the public, but they do facilitate alternative financial services (World Bank, 2016). Such services, regulated in particular by the revised Directive EU 2015/2366 (PSD2), include payment initiation services and account information services.#

[16] Lipis Advisors. (2023). *Overview of instant payments landscape today*.

[17] Open finance means a market structure where banking and other financial services are provided not only by traditional institutions (e.g. banks), but also by regulated third-party institutions in order for consumers to have greater control of their finances and for the market to be more competitive.

[18] A well-known example is the Buy now, pay later (BNPL) concept, whereby the bill is divided into several equal instalments and no interest is charged.

Payment systems function through the exchange of electronic messages between their operators and participants. An electronic message is a set of structured information exchanged by parties to a financial transaction. In the discharge of their activities, banks and other financial institutions exchange enormous quantities of data between themselves and with their customers. Such exchange is reliant upon both the sender and the receiver of a message having a common understanding of how to interpret the information and data they receive. This has become more and more important as computerisation has advanced and human participation diminished. To overcome this the financial industry has created standards on how to organise the data they want to exchange in structured formats (syntax) and meanings (semantics).

These conventions are known as standards. The structure and content of electronic messages varies greatly from area to area, indicating the importance of standardisation. The hubs of these efforts are the International Organisation for Standardisation and the SWIFT global network, as important levers of global standards acceptance. Standardisation of electronic messages is one of the key methods to improve the functioning of payment systems and facilitate cross-border payments.

Consistent data quality is also important for financial regulators. This is key in a situation where it is necessary to aggregate the data of different financial institutions from different markets. Without some uniformity in the generating and processing of information, conclusions based on their analysis cannot be reliable either. The lack of high-quality and accessible data can be risky, particularly at times of financial crises. Risk management systems and short-term financing mechanism can then face difficulties in identifying key information, terms and elements of the messages (Office for Financial Research, 2012).

3 Electronic message standards

Information is becoming an increasingly important factor in modern-day finance. Its scope, complexity and diversity are expanding hand in hand with the economy, and this is a trend which is expected to last. In other words, the more important information is, the greater the need for it to be high-quality. That is why the standardisation of electronic messages is so important (Powell, 2014).

The history of message standardisation is longer than half a century and it is associated with the banking markets which used to be highly fragmented at that time. The first message formats were created in the USA, where local formats such as BAI (Bank Administration Institute) or its upgraded variant BAI2 appeared. CFONB and other formats were created in France and STD18 in the UK. The first major step towards unification occurred with the MT messages of different generations formulated by the SWIFT global network in the early 1970s. Until these messages appeared, only telex international transfers were possible, and they came with numerous shortcomings. Payment took up to 4 days and the messages were unstructured – to the extent that transfers were described in entire sentences which the recipient was supposed to read. Because of the possibility of human error, this resulted in a low rate of successful processing. Communication multiplied after the introduction of the international MT format. Throughout 1979, the SWIFT network processed around 10 million messages (IR, 2021). It currently processes around 45 million messages daily.

Though technically obsolete, many older formats are still in use. Many countries also use internal, proprietary standards based on the international standard but adapted to the needs of the

local market.[19] This apparently illogical coexistence is illustrated by the famous quip that "the great thing about standards is that there are so many of them". It is illogical because a multitude of standards is a contradiction in itself, but only at first glance, as the potential costs of rapid harmonisation greatly outstrip the benefits.

When it comes to SWIFT MT messages, most payment systems use the ISO 15022 standard, introduced at the beginning of this century to replace the ISO 7775 standard. Once the latter standard was excluded, electronic messages became more informative and easier to structure, with greater automation. This is reflected in the fact that the straight-through processing (STP) rate increased from around 65% to 90% and more, which is the standard today. STP means that all sub-processes relating to payments and the associated information flows are computerised, minimising manual human work.

Almost a half of all messages exchanged every day within the SWIFT network are structured according to the ISO 15022 standard. Message standard ISO 8583 is dominant in the card systems, and the volume of their daily exchange is measured in hundreds of millions. Different financial activities use different standards, and one of the objectives of introducing the ISO 20022 standard was precisely to include them all. Presented below are elements of two messages relating to an ordinary credit transfer from a payer to a payee, but according to different standards: SWIFT ISO 15022 and the internal US standard. In this hypothetical example, ABC bank from Belgrade (BG), Republic of Serbia (RS) wishes to transfer USD 15,000 at the payment order of its payment service consumer DEF, head office in Terazije 25, Belgrade, on 1 March 2024, from his account 123456789.

Figure 3 **Comparison of electronic messages for credit transfer**

MT103	FEDWire Proprietary
:32A: 2410301USD15000 :50F:/123456789 1/DEF 2/Terazije 25 3/RS/Beograd :52A: ABCRSBG	{1520}20240301xxxxxxxyyyyyyyy {2000}0000015000 {5000}D123456789 DEF.*TERAZIJE 25*BEOGRAD* SRBIJA* {5100} BABCRSBG

Source: author's analysis.

From the above, we see that the same data (payer's name, payer's payment service provider, head office, etc.) are structured differently, with different field elements. According to one standard, the bank identification code is specified in field 52A, while according to the other standard, it is entered in field 5100, and the content of the two fields differs. As these are just examples of parts of messages, which in practice may contain as many as twenty fields, the problem of communication becomes even more complex.

This means that communication using different standards can create problems with end-to-end automation. This problem's potential increases with the length of communication chains inside constantly expanding and increasingly interconnected financial markets.

Communication is significantly impeded if different semantics and syntax are used.

1. In this sense, *semantics* means the "vocabulary" used by different areas. Incompatibilities may arise if different words refer to the same thing or, even worse, if the same

[19] This is also the case with the messages used in the payment systems in the Republic of Serbia.

word means two different things. For example, a payer in a transaction may be denoted in English as the Ordering customer, Payer, Payor, Payment Originator, Initiator, etc. Initiator can mean two things, depending on the payment instrument. In a credit transfer, the initiator is at the same time the payer, while in a direct debit the initiator is the payee based on the payer's authorisation.

2. In this sense, *syntax* means the structure of information, that is the "language" of communication. If the message recipient does not understand the syntax used, he will not understand the content of the message either. Standard can be seen as an agreement on the content of electronic messages and the meaning and structure of data within messages. Each business model (e.g. payment) must contain elements (e.g. payer, payee, payment service provider, address) described so as to be intelligible for humans and software, enhancing interoperability and the potential for automation (SWIFT, 2015). Therefore, the standard defines *what* is communicated by the message, and the syntax *how/what with* this is communicated.

The standards are not adopted in order to be a source of competitive advantage for a specific organisation or company, but in order to offer added value to all financial system participants. This is reflected in the more comprehensive and higher-quality content of messages which will meet future market requirements as well, such as more data on cross-border payments (for users), more data on payment service consumers in order to improve the offer (for banks), easier assessment of payment orders' compliance with legal regulations (for regulators), etc.

As a natural solution for state-of-the art instant payment systems, ISO 20022 is a genuine catalogue with more than 800 different messages covering different business areas (Figure 3). Within each area, there is a large number of individual messages denoting different business relations, such as those between end-users and payment service providers, between payment service providers, and between payment service providers and payment system operators.

Figure 4 **Overview of business areas where the new electronic message format is used**

acmt: Account management	**colr:** Collateral management
auth: Authorities communications	**setr:** Securities trade
caaa: Acceptor to acquirer card transactions	**secl:** Securities clearing
catm: Card terminal management	**sese:** Securities settlement
pacs: Payments clearing and settlement	**semt:** Securities management
pain: Payments initiation	**seev:** Securities Events
camt: Cash management	**tsin:** Trade services initiation
remt: Payments remittance advice	**tsmt:** Trade services management
fxtr: Foreign exchange trade	**reda:** Reference data

According to: ISO20022 Business Areas, p. 2.

The use of common rules, within harmonised categories, makes it possible to focus organisational, material and other resources on value drivers, i.e. activities where the greatest value is created, instead of dissipating these resources on formatting, conversion and reinterpretation of data because of different standards. This does not mean that one standard is not translated into another, because it is, but the intention is to make this practice obsolete by transitioning to the ISO 20022 standard. Before we analyse the above standard, it is useful to look at its syntactic basis.

3.1 XML: Syntax of the new standard

The most widely used syntax within the ISO 20022 standard is XML – eXtensible Mark-up Language.[20] Since its design in 1998, this has been the most popular standard for marking up documents and messages online and offline, as it is also used in computer applications,[21] vector graphics, mail exchange, voice mail systems, etc. It defines a generic syntax used to mark up data with simple, human-readable tags (Harold & Means, 2006). This is the most robust, reliable and flexible document syntax ever invented.[22]

An XML document contains text. It is built from text content marked up with text tags between symbols "<" and ">". There are start-tags and end-tags. The use of the document is very flexible, but there are strict rules about where tags are placed and how they are written. This means that all XML documents must be well-formed, i.e. conform to a set of rules, such as:

- Every start-tag must have a matching end-tag;
- Elements may not overlap;
- Attribute values must be (single or double) quoted;
- Comments or processing instructions may not appear in tags.

These rules are unbreakable, which makes parsing XML documents easier and writing them a little harder. Below is an example of the simplest yet complete XML document:

```
<person>
      Petar Petrovic
</person>
```

The element in this document is "person". The element is delimited by the start-tag <person> and the end-tag </person>. This syntax is case-sensitive, so if you open an element with a <person> tag, you cannot close it with a </PERSON> tag. Everything between the start-tag and the end-tag of the element (exclusive) is called the element's content. The content of this element is "Petar Petrović".

Below is a somewhat more complex document which contains one *person* element, but also data on the name, surname and profession:

```
<person>
      <name_and_surname>
            <name>Petar</name>
            <surname>Petrovic</surname>
      </name_and_surname>
      <profession>intern</profession>
</person>
```

Within this syntax, tags give meaning and structure to the information which is exchanged. Data are included as strings of text. In the above example, the string is "Petar", "Petrović", "intern".

[20] The other syntax supported by the ISO 20022 standard is JSON.

[21] For example, MSWord files are saved in the .docx format, where the final "x" denotes XML, or extensible.

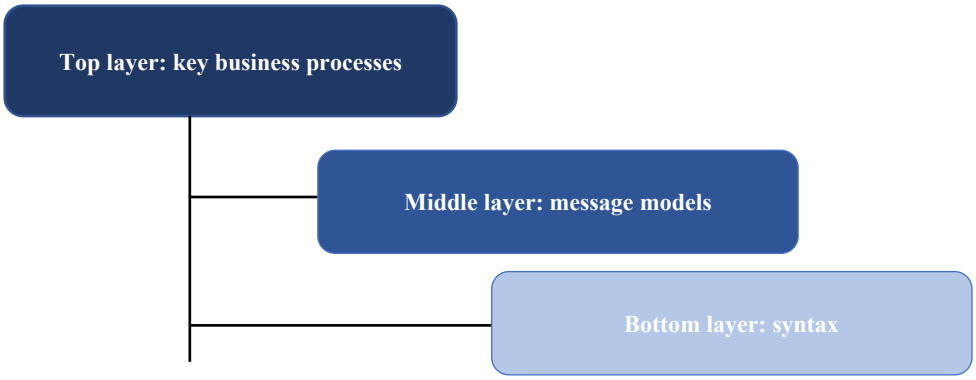
[22] XML is a descendant of SGML, the Standard Generalized Markup Language, invented at IBM in the 1970s and adopted as ISO 8879 standard in 1986. SGML was extremely powerful and was used in the U.S. military and government, strategic industries, and in other domains that needed ways of efficiently managing technical documents that were tens of thousands of pages long. However, SGML was very complicated — its official specification is over 150 very technical pages. It is so complex that almost no software has ever implemented it fully. Its simplification and trimming began in 1996, but so as to retain most of its useful functionalities. The result was XML 1.0. (Ibid, p. 9).

In the area of payments, these documents are much longer and more complex and the names of the elements are officially defined and unique. For example: <FinInstnId> for the identification code (BIC) of the payment service provider; <Nm>, <Adr> for data on parties to a transaction; <CCy> and <Amt> for transaction currency and amount, etc. These and many other elements are included in the three areas covered by the payment systems, shaded in Figure 3: payment clearing and settlement (pacs), payments initiation (pain) and cash management (camt). It is of key importance that element names are unique and unchangeable in all payment systems where the ISO 20022 standard is used, which is optimal for machine parsing of a large number of messages.

3.2 Characteristics and use of ISO 20022 in the area of payments

Business processes are the methodological basis of this standard. Information is needed in order for business processes to take place. It is organised in business components (message models) which, in turn, consist of elements described by syntax. In other words, this is a concept of three separate layers.

Figure 5 **Three layers of the ISO 20022 standard**



Source: author's analysis.

Business processes are relevant activities in the financial industry. They are also referred to as business domains and include operations with bonds, payment systems, trade services, foreign exchange market and card services (ISO, 2024). Message models are segments where specific activities take place (Figure 3), while the bottom layer contains the structure of the specific message model.

There are multiple differences between the MX messages based on the ISO 20022 standard and MT messages based on the ISO 15022 standard. The former have a better defined structure, with dedicated, structured elements for each detail important for the transaction. This facilitates parsing and enhances interoperability of payment systems across regions. Specifically, MX messages have element hierarchy with nested elements for logical grouping of data. For example, if we are interested in information on the payee (<Cdtr>), we will find it the lower branching order under name (<Nm>) and address (<PstlAdr>), then under address you can have further structured elements for street number (<StrNm>), postal code (<PstCd>) etc. This was not possible in the MT message format, as can be seen below.

Figure 6 **Simplified overview of a credit transfer according to the old and the new standard**

MT103	pacs.008
{1:F01ABNANL2AAXXX1234012345} {2:O1031511010606UBSWCHZHGXXX0000013085010549S} {3:{108:UHBMT103001}{121:360f1e65-90e0-44d5-a49a-92b55eb3025f}} {4: :20:494931/DEV :23B:CRED :32A:011521USD10551,50 :33B:USD10551,50 :50K:/122267890 BIODATA GMBH HOCHSTRASSE, 27 8022-ZURICH SWITZERLAND :59:/1234567890 CUBA SPORTS BAR GRILLE 1234 OCEAN DRIVE 90099 LA :71A:SHA	<?xml version="1.0"?> <Document xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="urn:iso:std:iso:20022:tech:xsd:pacs.008.001.08"> FIToFICstmrCdtTrf> <GrpHdr> <MsgId>494931/DEV</MsgId> <CreDtTm>2021-15-01T00:00:00</CreDtTm> <NbOfTxs>1</NbOfTxs> <SttlmInf> <SttlmMtd>INDA</SttlmMtd> </SttlmInf> </GrpHdr> <CdtTrfTxInf> <PmtId> <InstrId>4949431/DEV</InstrId> <TxId>NOTPROVIDED</TxId> <EndToEndId>NOTPROVIDED</EndToEndId> <UETR>360f1e65-90e0-44d5-a49-a92b55eb3025f</UETR> </PmtId> … <CdtTrfTxInf> … <Cdtr> <Nm>Cuba Sports Bar & Grille</Nm> <PstlAdr> <StrtNm>Ocean Drive</StrtNm> <BldgNb>1234</BldgNb> <PstCd>90099</PstCd> <TwnNm>Los Angeles</TwnNm> <CtrySubDvsn>CA</CtrySubDvsn> <Ctry>US</Ctry> </PstlAdr> … </Cdtr>

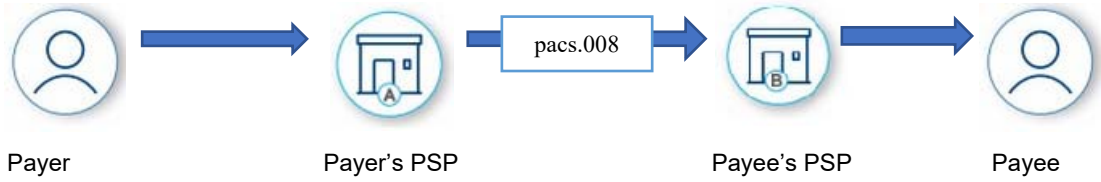
Source: McConnell, S., McAuliffe, R. (2020).

Data on the payee are shaded yellow and green in the two message formats. The difference in the structure of information is visible at first glance. There can be no confusion when interpreting the pacs.008 MX message, as each piece of information has special, dedicated elements. In the example on the left, incompletely structured data on the payee's address may result in "CUBA" being interpreted as the name of the country which is under financial sanctions, and not as a part of the street name. The reference number of the payer's payment service provider is shaded red in the old and the equivalent data is shaded light blue in the new message format. Whereas in the old format 16 characters could be included in field 20, in the new format the payer sends the unique message identifier <MsgId>, payment order identifier <InstrId>, end-to-end processing identifier <EndToEndId> and data on the payment <TxId>. Each of the elements can have 35 characters.

Three message models are used for payments: PACS, PAIN and CAMT. They cover the entire communication chain – customer to bank (pain), bank to bank (pacs) and different notifications for banks, clients and the payment system operator (camt). Different secondary functions are included such as bank account management, managing limits in bank accounts, managing direct debit authorisation, regulatory reporting, etc. The coverage is not final, and is constantly expanding to

respond to market requirements.[23] Given below are the descriptions of some of these models[24] with a simplified[25] illustration of the communication flow. The first message model is exchanged between financial institutions, i.e. payment system participants, to clear the transaction information and settle the related funds. Examples are:

1. **pacs.008** – FI to FI Customer Credit Transfer;
2. **pacs.003** – FI to FI Customer Direct Debit;
3. **pacs.009** – Financial Institution Credit Transfer;
4. **pacs.004** – Payment Return.



The PAIN message group supports the initiation of a payment from the ordering customer to an account-managing financial institution. This model is designed to support the flow of messages exchanged between customers – payers or payees – and their financial institutions – banks or non-banking payment service providers. Examples are:

1. **pain.001 –** Customer Credit Transfer Initiation;
2. **pain.008 –** Customer Direct Debit Initiation.

As the domestic instant payment system (IPS) which functions based on the ISO 20022 standard processes credit transfers and generates associated messages, pacs.003 and pain.008 messages are currently not used.[26] Those that are in use are regulated according to their purpose and type by means of the Guidelines on Messages used in the NBS IPS System.[27]

Finally, CAMT messages are designed for communication between payment system participants and customers of payment service providers in order to inform them on the status of an initiated transaction, on the arrival of incoming transactions, to communicate their accounts statements, etc.

[23] In that sense, perhaps the greatest advocate for ISO 20022 standard adoption, at least in Europe, is the Single Euro Payments Area.

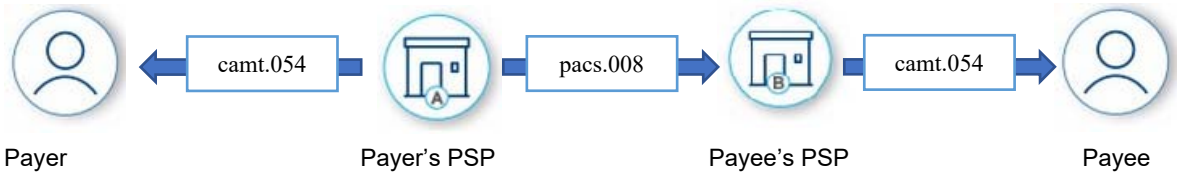
[24] A much greater number of messages are actually used, but their extensive description would be out of scope of this paper.

[25] Simplified primarily because it excludes payment system operators as the central hubs of such diagrams. The operators send instruction to participants and control the validity of the messages which, if inadequate, are returned to senders – participants. Payment in not executed in that case.

[26] These two message models refer to direct debits processed in the Direct Debit Clearing, a payment system operated by the Association of Serbian Banks.

[27] Available at: *https://www.nbs.rs/export/sites/NBS_site/documents/propisi/propisi-ps/Pravila_IPS_2018_prilog7.pdf*.

1. **camt.052** – Bank to Customer Account Report;
2. **camt.053** – Bank to Customer Statement;
3. **camt.054** – Bank to Customer Debit Credit Notification.



Though these messages do not exhaust the list of messages on payments, they are the most frequently used ones. An additional benefit of the ISO 20022 message standard is to reduce the diversity of the messages used by the previous standard. In other words, several MT messages are now functionally merged in fewer[28] MX messages, as can be seen in the table below.

Table 1 **Equivalence of some messages under the old and the new standard**

MT ISO15022	message name	MX ISO20022
	financial[29]	
MT101	Request for Transfer	**pain.001**
MT102	Multiple Customer Credit Transfer	**pacs.008**
MT103	Single Customer Credit Transfer	
MT103/2	Payment Return	**pacs.004**
MT202		
MT104	Direct Debit and Request for Debit Transfer Message	**pacs.003**
MT200	Financial Institution Transfer for its Own Account	**pacs.009**
MT201	Multiple Financial Institution Transfer for its Own Account	
MT202/202COV	General Financial Institution Transfer	
MT203	Multiple General Financial Institution Transfer	
MT205	Financial Institution Transfer Execution	
	non-financial[30]	
MT900	Confirmation of Debit	**camt.054**
MT910	Confirmation of Credit	
MT920	Request Message	**camt.060**
MT940	Customer Statement Message	**camt.053**
MT950	Statement Message	
MT941	Balance Report	**camt.052**
MT942	Interim Transaction Report	

Source: Citibank, N. A. (2021).

Though this is not an exhaustive list of messages, it is noticeable that, out of nine existing categories of MT messages, only the categories used in payment systems – 10xx, 2xx and 9xx – are preparing for migration.

[28] There are changes in the opposite direction as well. For example, different information sent by MT n99 messages is now included in camt.030, camt.031, camt.032, camt.038 etc.

[29] Financial messages are messages followed by a transfer of money.

[30] Their exchange has a communication purpose and does not result in a transfer of money.

4 Migration to the new standard: opportunities and challenges

An important detail about the entire ISO 20022 migration is that it is not a new standard – the International Organization for Standardization published it back in 2004, just as the global transition to ISO 15022 was completed. The fact that it took 21 years from its design to becoming a global solution is explained by the fact that even the best standards do not gain widespread acceptance until the needs of the market reach a sufficient level of complexity. That they have reached that level is evidenced not only by the omnipresent globalisation but also by the growing need for interoperability and, perhaps above all, the digitalisation of payment services. In the last quarter century, it has been marked by the development of internet traffic, smartphones, the emergence of electronic and mobile banking, real-time payments, contactless payment instruments, and similar – as well as the processing power of all necessary hardware components.[31] Therefore, it is not even remotely true to consider that the coronavirus was the key factor in the digitalisation of payment services, though it did highlight its importance, because this diminishes the complexity and duration of digitalisation.

Digitalisation of payment services requires improvement of payment systems and application payment solutions for end users. This, in turn, means the application of modern technologies which will ensure the execution of payments in a simple and efficient way through digital channels and the fulfilment of regulatory and other requirement by banks, especially in the field of preventing money laundering (AML), financing of terrorism (CTF) and fraudulent payments (Fraud Prevention). Also, the emergence of new and the rising complexity of existing business models and payment services will increase the resource and technical requirements for banks, since MX messages have up to three times the capacity for information transfer (Deutsche Bank, 2019).

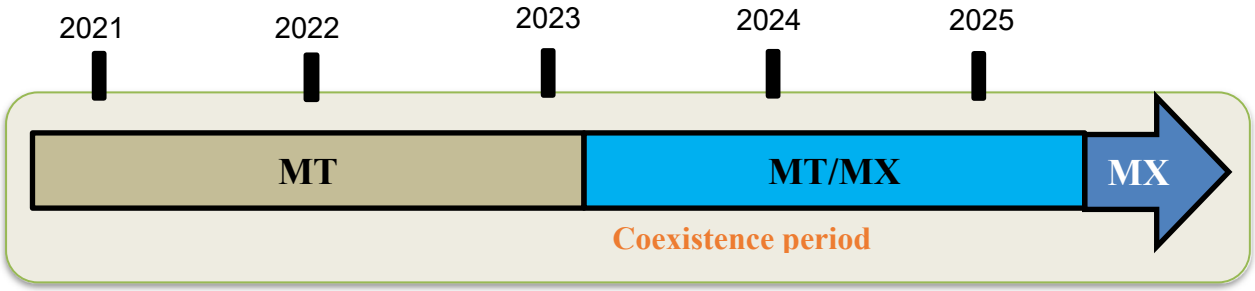
4.1 Beginnings of migration

The first explicit plans for global ISO 20022 transition were formulated in 2016, when SWIFT, together with representatives of the world leading banks and financial infrastructures, established the High Value Payments Systems Plus (HVPS+) workgroup. Its objective is the development of global guidelines for the application of this standard, which would contribute to further automation, greater transparency and content of information flows. In addition, SWIFT also encouraged the formation of a group for cross-border payments and reporting (Cross Border Payments and Reporting Plus, CBPR+) to develop guidelines for the harmonisation of cross-border payments and reporting. Those guidelines became the basis of the central SWIFT message translation service (see next section).

The global transition to the new standard takes place in two ways. On the one hand, the leading market infrastructures are in the midst of transition or have already completed it for internal payments. This particularly applies to retail payment systems and payment areas such as SEPA. On the other hand, SWIFT officially enabled the use of ISO 20022 for cross-border payments and within wholesale payment systems in March 2023. This means that participants who are ready can start exchanging data in this way, while those who are not can still use the old MT format. In other words, March 2023 saw the start of the so-called period of coexistence, i.e. parallel use of both formats. This phase will last until November 2025, when SWIFT will decommission MT messages. Below is a general migration plan.

[31] It is also a prerequisite for the so-called scalability, the ability to increase the volume of transactions without increasing costs.

Figure 7 **ISO 20022 migration plan (*CBPR+*)**



Source: author's analysis.

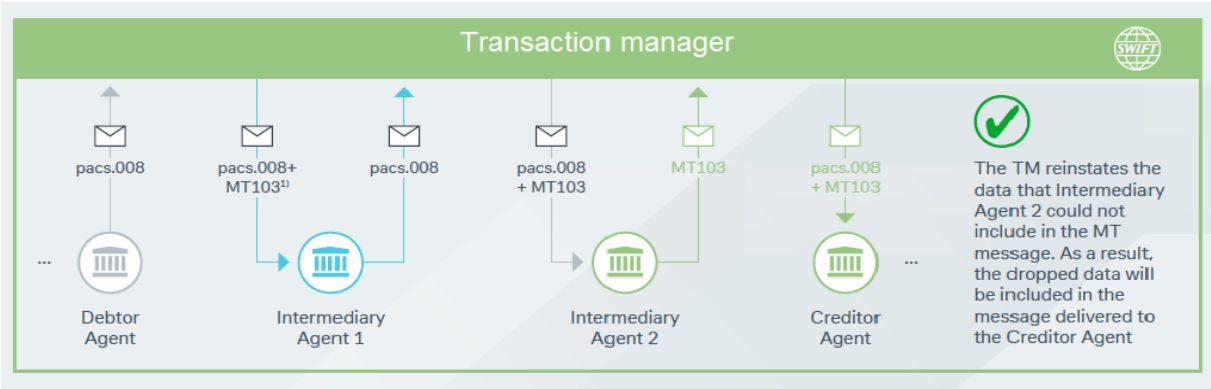
4.2 Ensuring interoperability in coexistence

Perhaps the biggest challenge of the entire migration is the coexistence of two standards. Throughout its duration (2023–2025), banks and other payment system participants have room to adjust their hardware–software solutions. As the new standard is adopted, many old and new format messages will remain in circulation. In order to prevent negative consequences, inconsistencies and data spillage along communication chains, SWIFT provides a mechanism which bridges such differences. In other words, it provides a kind of reinterpretation, i.e. translating messages from the old to the new standard and vice versa. This is crucial in the cases where in one transaction, i.e. in the same chain of communication, there are institutions which transitioned to the MX format and those that still use MT. This mechanism is called "Transaction Manager" (TM) and its objective is to ensure the interoperability of participants. It is a prerequisite that participants adopt the CBPR+ guidelines.

The TM mechanism works by "capturing" the initial MX message and preserving its integrity. In the next step, if the financial institution – intermediary in the chain uses the old MT standard, the mechanism ensures that such a message is delivered to it, but "enriched" as much as possible with the content from the original MX message, which the MT format would not initially recognise. Any subsequent participant using the MX message will receive the same message without reduced quality. This means that, from the beginning to the end of a transaction, the possibility of important data being lost, disintegrated or disappearing under a new record in the same fields is greatly reduced.

Generally, everyone benefits from this mechanism: institutions which have not yet migrated still receive a richer content of messages, and those which have can use the full potential of the new standard without any frictions, bottlenecks or other negative influences from other participants.

Figure 8 **A simplified TM mechanism operation model**



Adjusted according to: Deutsche Bank (2022), p. 16.

4.3 International experiences

Viewed in a wider context, the migration to the new standard is part of the G20 roadmap formulated in October 2020, one of the objectives of which is to facilitate cross-border payments (FSB, 2020). This programme aims to solve persistent problems which are characteristic for cross-border money transfers, such as high costs, low speed and insufficient transparency. The heterogeneity of electronic message standards is recognised as the main factor behind these problems (BIS, 2022). Although the global ISO 15022 standard was already dominant at the time, cross-border payments were made difficult by the fact that countries continued to use their own, internal message formats based on the aforementioned standard, but modified according to the local needs. Though this creates added value for the local market, it takes it away from the global market. The reason is that any cross-border payment in that case requires translation from the internal to the official SWIFT MT format, which can cause partial data loss and slow down the entire procedure.

The complete migration of the European infrastructure to ISO 20022 was perhaps best described by Christian Westerhaus, Head of Cash Products, Cash Management at Deutsche Bank, saying that "this is not just 'another IT project', but the most impactful payments industry undertaking since the introduction of SEPA" (Deutsche Bank, 2019). More specifically, SEPA has resulted in EUR 21.9 bn cost-savings per annum for euro area members (PwC, 2014). Also, liquidity rose by close to EUR 230 bn and over 970 thousand man-years[32] were unlocked by simplifying the netting and settlement processes between hundreds of payment infrastructure hubs within the European Union. Similar effects are expected from this project. The new electronic messaging standard is currently used in more than 70 countries (BOE, 2024).

Roughly speaking, the largest global payment systems and market infrastructures have migrated to the new standard. In the practice of the western financial institutions so far, two approaches to migration have crystallized:

1) in one step, the so-called big-bang approach and

2) gradual, so-called like-for-like approach.

The US Federal Reserve System began the project in 2018, when it officially proposed that the nation's largest payments system, Fedwire, accept the new standard in three phases starting in 2020. The acceleration of cross-border payments and rising competition between banks through the offer of new, more diverse payment services to clients were highlighted as the expected effects. Currently, this RTGS system uses an internal message format which supports different types of communication, so participants can send both financial and non-financial messages. During the migration, payment system participants are expected to develop their own application solutions. The initial plan to end the migration was at end-2023 (Sullivan & Cromwell, 2018). However, this plan was later modified, so the current plan places the final migration in March 2025. As shown below, the decisions of the payment systems were also influenced by the actions of other leading infrastructures. The Federal Reserve had its reasons too – in the summer of 2023, an instant payment service called FedNow was introduced in the States. The complexity of this project in the US is determined by the fact that the two main infrastructures – Fedwire and CHIPS[33] – adopted different

[32] A man-year is a unit of measure which indicates the amount of work done by an individual in the course of one year.

[33] Clearing House Interbank Payments System – This is the second largest system for processing large-value payments in the US. While the Fedwire mainly processes payments between US banks, CHIPS is also used for international payments. In 2021, a record 204.5 million transfers, with an average value of USD 4.9 mn, were processed through Fedwire. Around USD 1.8 bn is processed daily through CHIPS.

timelines, suggesting the so-called like-for-like approach to migration. The latter should complete its migration to the new standard in April this year. Until then, these two payment systems use internal, mutually different but compatible message formats.

As for the European Union, the key payment systems switched to the new standard in March 2023 – these are T2, an RTGS payment system operated by the European Central Bank, and the private payment system EURO1, operated by the European Banking Association (EBA)[34]. Although the original plan envisaged that the migration would take place at end-2022, technical and geopolitical circumstances postponed it. Basically, this was the so-called big-bang migration, where, once the participants tested the messages after a defined period, the migration was carried out in one day. On the other side of the Channel, the Bank of England completed the migration in June last year, also after several delays.

This does not imply that migration is a simple process – on the contrary. The European Central Bank is precisely one of the institutions which are the most responsible for multiple migration delays. The reason is that the European Central Bank should have been the first to make such a significant change, so that it would set an example for other banks and payment system operators. However, the European Central Bank had its own projects in the same period, primarily the consolidation of its TARGET2 large-value payments system and its TARGET2-Securities (T2S) system. This means that each time a European project requiring compliance with ISO 20022 was postponed because participants were not ready, SWIFT also postponed the migration. The biggest delay occurred in October 2022, when the European Central Bank decided to extend the deadline for launching the new consolidated RTGS system[35] to March 2023. The same delay was announced by SWIFT. For its part, the operator of Lynx, Canada's high-value payment system, decided to follow their lead and postponed the migration from November 2022 to March 2023. The initial deadline defined by SWIFT for the migration was November 2021.

While SWIFT and the rest of the western business community are trying to ensure safe migration of most payment systems and banks to the new standard, it is interesting that in PR China the largest RTGS system has been operating according to ISO 20022 since 2013. An important benefit experienced by Chinese banks is that the new standard can transmit information recorded in traditional, Mandarin characters, which was not possible with the MT format.[36] More importantly, China's CIPS cross-border payment system, with more than 1,400 participants from 113 countries, established in 2015, also uses this standard (CIPS, 2024). This is also the case with the Chinese system for instant payments Internet Banking Payments System IBPS[37], with more than 200 banks as participants. The Chinese leadership has expanded the scope of use of this standard beyond the field of payments, thus the Chinese and Japanese central securities registers are jointly based on ISO 20022 (Asianbondsonline). Despite the early adoption of advanced international standards, Chinese payment systems also use internal message formats, i.e. they do not use the SWIFT network for operations (Fintech Futures, 2020).

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[34] Since its establishment in November 2018, the TIPS system for instant payments of the European Central Bank has been based on the ISO 20022 standard.

[35] Its name has now been abbreviated to T2. Until the consolidation, the T2S system was already using the new message standard. For more details, see: *https://www.ecb.europa.eu/paym/target/consolidation/html/index.en.html*.

[36] In the Serbian market, these messages will be able to convey information written in Cyrillic.

[37] For the sake of precision, the Chinese RTGS system and the aforementioned IBPS form the basis of what is called the China National Advanced Payments System, CNAPS (BIS, 2012).

4.4 Payment systems in the Republic of Serbia

In our country, the historical backbone of the payment system consists of the NBS RTGS System and the Clearing System, two important payment systems, which have been operating successfully since 2003. High reliability, both in terms of availability for participants and operational performance, was made possible by the technical upgrades that took place in the meantime, the last in March 2022. In terms of high operational performance of domestic payment systems, the contribution of the NBS IPS system for instant payments is indispensable, with 67 million processed payments last year and with almost 100% availability.

Like numerous financial institutions and operators of payment systems in the world, the NBS prescribed that domestic payment systems use an internal message format based on ISO 15022. As for the communication channel for data exchange between the system and the participants, an internal star-type computer network is used (the operator is in the centre, and the participants are the spokes) based on the IP protocol, whose communication resources are administered by the NBS at the network hub. There is also a connection to the SWIFT network, which may be used as an alternative communication channel. Payment system participants have the possibility to use both networks, so that interoperability within the system is preserved. Currently, all participants use the internal network.

The existence of an internal network made it possible for the messages used to differ to a certain extent from those used in the international network. This kind of independence is sustainable as long as there is technical support from the SWIFT community for the MT message format. In addition to the fact that the NBS follows the best business practices regarding the use of appropriate guidelines and standards in the field of payments[38], an important reason for starting the project of ISO 20022 migration, together with the participants of the payment systems of which it is the operator, is that the MT message format will be decommissioned at the end of the next year.

In addition to the above, it is important to migrate to a new updated set of MX messages which conform to the CBPR+ and HVPS+ guidelines for other reasons as well. First of all, it complies with the upcoming project of Serbia's joining the SEPA geographical scope, where banks communicate according to ISO 20022. Also, it is expected that a new participant will access the NBS RTGS System – Euroclear bank. As it uses the SWIFT network as the primary communication channel in its operation, there will be no other option but to use the MX message format after 2025. The importance of this project goes beyond payment systems, as the financial settlement of transactions related to the securities issued by the Republic of Serbia will be executed through the Euroclear bank account in the NBS RTGS System.

The project of migration to the new standard will be implemented by November 2025. By the end of 2024, the NBS, as an operator, will start the migration process of its own application platform which supports the operation of the NBS RTGS and Clearing System, and provide an appropriate test environment in which participants will test the new message format. Although the project is at an early stage, it is possible to sketch some of the likely features of the future application platform.

Since the so-called period of coexistence is ongoing, the implemented system will support parallel operations with both MT and MX messages, but in such a way that one participant (both in the NBS RTGS and in the Clearing System) may use only one format until it is able to fully transition

[38] As evidenced by the NBS IPS system for instant payments, based on the ISO 20022 standard from 2018.

to the newer one. Different message formats used by payment system participants will be harmonised thanks to the converter, which will perform conversion from one to another message format. This will be provided by the NBS as an operator in due time and it will be available to participants in the transition period. The platform itself will, as is the case now, support the operation of both payment systems through a single application. Technically, this means that it will enable real-time gross settlement, but also batch clearing. As such, it will imply the necessary scalability, that is, the capacity to support growing volumes of payments in the future, the possibility of operating in multiple currencies, as well as connectivity with direct and indirect participants of payment systems. As is the case now, the participants will be able to choose to operate either in the NBS internal network or in the SWIFT network at any time.

Given that the NBS RTGS System will be fully compliant with the HVPS+ guidelines, it will provide the basis for interoperability with other payment systems which operate under same principles, including the T2 payment system of the European Central Bank.

Below is the range of potential MX messages which will be used in domestic payment systems after a successful migration, as well as their MT equivalents. As mentioned, the messages which are currently in use at home are modified in relation to the MT messages prescribed by SWIFT, which means that the use of a certain number of fields is mandatory according to domestic regulations[39]. Those fields which are also in the official SWIFT specification, the use of which is not mandatory, may be used by payment system participants, but their content is not controlled and does not affect the execution of transactions. Since parallel operation with two message formats will be provided as an important measure to ensure the continuity of the payment system operation, of which the MT format contains a smaller volume of information – the use of the MX format will have certain limitations. It will be eliminated when all participants completely transition to the newer message format.

Table 2 **Potential MX messages in domestic payment systems and their MT equivalents**

MX ISO20022	Message description	MT ISO15022
pacs.004	Payment return (revocation of a previously received payment order)	**MT103 | MT202**
pacs.008	Individual credit transfer for the account of end users of payment services	**MT103**
pacs.008	Group credit transfer for the account of end users of payment services	**MT102**
pacs.029	Batch message for settlement of external payment systems within RTGS	**MT971**
pacs.009	Transfer of funds between participants in the payment system (wholesale). Tracks the transfer of funds from account to account in RTGS.	**MT202**
pacs.010	Direct debit between participants in the payment system	**MT204**
camt.050	Credit transfer between participants in the payment system	**MT202**
camt.051	Debt transfer between participants in the payment system	**MT202**
pacs.028	Request for information on payment status	**MTn95**
camt.007 | camt.087	Request to change the priority of an incomplete transfer message	**MTn95**
camt.008 | camt.056	Request for revocation of an incomplete transfer message previously sent to the system	**MTn92**
camt.018	Download business day notifications	**MT999**
camt.019	Return business day information	**MT999**
camt.025	Response to request or error notification	**MTn96**
admi.002	Message rejection notice	**MT996**

[39] Guidelines on the Format and Purpose of Electronic Messages Exchanged in Payment Operations. Available at: *Microsoft Word - Uputstvo o formatu i nameni 2009 _2_.doc (nbs.rs).*

MX ISO20022	Message description	MT ISO15022
admi.004	Password change notification	**MT996**
pacs.002	Payment status notification (MT196 or MT296)	**MTn96**
camt.052	Answer to the inquiry about the account status	**MT986**
camt.052	Account status	**MT941**
camt.053	The final statement with all the details related to the specific account during the current business day. It concerns a payment that has been settled.	**MT940 | MT950**
camt.054 CR	Account credit confirmation. It is used after the related transactions have been completed within the RTGS.	**MT910**
camt.054 DR	Account debit confirmation. It is used after the related transactions have been completed within the RTGS.	**MT900**
camt.060	Request for account balance information or account statement. With one message, it is possible to request several reports related to several accounts.	**MT920**
camt.060	Account status inquiry	**MT985**
camt.998	Free format message	**MTx99**

5 Conclusion

A fast and smooth flow of capital is needed for national and international financial markets to work successfully. One of the most important prerequisites for that is the optimisation of information exchange between financial institutions and the operators of the payment systems in which they participate. This primarily concerns electronic messages which are exchanged between different participants in large volumes and on a daily basis, following each transaction. An electronic message is a set of structured information providing necessary knowledge about elements of the transaction – parties, transaction amount, end users of payment services, etc. The exchange of electronic messages has always been a part of automation trend, which means that the share of human work is decreasing, and the importance of computer data processing is increasing.

To make this processing as successful as possible, especially in the light of globalised markets and rising volume of financial transactions, it is crucial that financial institutions produce and exchange harmonised information. The information must also be of higher quality. That is why the financial industry is constantly formulating conventions – standards about the structure and meaning of this information. Financial markets are currently transitioning to using the latest ISO 20022 standard of electronic messages in the MX format, which replaces the previously used MT format messages, based on ISO 15022.

The objective of this paper is to analyse these migrations. There are several reasons why payment systems decide to transition – more content and better structured messages, greater flexibility and adaptability of data to regulatory requirements, but also better automation of their processing. The analysis began with an introduction on payment systems and trends, followed by an overview of electronic messages as the basic method of interbank communication in modern payment systems, the difference between various message formats and, finally, the messages according to the mentioned new standard and its syntactic basis. The final part concerns the payment systems operated by the NBS – primarily the NBS RTGS System and the NBS Clearing System, as important payment systems – which are also expected to migrate to the use of MX messages according to ISO 20022 by end-2025.

Although uncertain at the moment due to the early stage of the migration project, the architecture of the future application platform which will support the operation of domestic payment systems has several probable characteristics. In addition to technical support for the parallel use of both MT and MX message formats – whereby an individual participant can use only one of them in production

work – the system will enable the conversion of messages through a centralised or indirect mechanism. Both the RTGS System for the real-time settlement of large-value payments and the Clearing System for the settlement of group payments at a certain time will operate, as before, on a single platform – while International and Interbank Clearing of FX Payments will be located on a separate platform. Considering the current projects of the NBS, and thus the payment systems it operates and their participants, that platform should be as compatible as possible with the technical requirements of potential participation in the TARGET systems of the European Central Bank, and the SEPA geographical scope – including working with messages based on the ISO 20022 standard, in accordance with the HVPS+ and CBPR+ guidelines.

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